Crown-Indigenous Relations and Northern Affairs Canada
Relations Couronne-Autochtones et Affaires du Nord Canada

NORTHERN CONTAMINANTS PROGRAM

Call for Proposals 2023-2024

The Northern Contaminants Program (NCP) engages Northerners and scientists in research and monitoring of long-range contaminants in the Canadian Arctic, that is, contaminants that are transported to the Arctic through atmospheric and oceanic processes from other parts of the world and which remain in the Arctic environment and build up in the food chain.

The data generated by the NCP is used to assess ecosystem and human health, and the findings of these assessments are used to address the safety and security of traditional country foods that are important to the health and traditional lifestyles of Northerners and northern communities. The findings also inform policy, resulting in action to eliminate contaminants from long-range sources.

The NCP is committed to scientific excellence and northern engagement on the issue of long-range contaminants in the Arctic. Through this Call for Proposals, the NCP is seeking proposals for new activities across all subprograms, including for the monitoring and research of plastic pollution in Northern and Arctic environments and wildlife.

NCP is now accepting proposals for projects beginning in 2023, for up to 3 years of funding.

Table of Contents

List of Tables

Appendices

1 – GENERAL INFORMATION

1.1 Timelines for the Northern Contaminants Program Call for Proposals

The Northern Contaminants Program (NCP) issues an annual Call for Proposals. The NCP is now accepting funding proposals for 2023-2024. **The deadline for proposal submissions is 11:59 PM Eastern Standard Time, March 8, 2023.**

Table 1.1 Timelines for the NCP 2023-2024 Call for Proposals

MILESTONES / TASKS	DATE
Call for Proposals issued	January 18, 2023
Proposal co-development by, and in consultation with, communities, researchers, Regional Contaminants Committees, Inuit Research Advisors, etc.	January-March 2023
NCP Proposal Seminar #1: Introduction and essential requirements of a NCP proposal and budget Note: This will include practical examples of how to fill in the proposal and budget templates	January 24, 2023
NCP Proposal Seminar #2: Best practices for completing a Community-Based Monitoring and Research and Communications, Capacity and Outreach Proposal Note: This will include practical examples of how to fill in the proposal and budget templates	January 31, 2023
NCP Proposal Seminar #3: Best practices for completing a Human Health or Environmental Monitoring and Research Proposal: Note: This will include practical examples of how to fill in the proposal and budget templates	February 7, 2023
Deadline for submission of proposals	March 8, 2023
Deadline for submission of *Community Engagement* forms	March 22, 2023
Applicants apply for research licences and ethics review, as applicable	Spring 2023
Proposal Review Period - proposals are reviewed by peer reviewers, technical review teams and Regional Contaminants Committees	March-April 2023
NCP Management Committee meets to make final funding decisions	May 2023
Notification sent to applicants on the status of their proposal(s)	Late May-June 2023
Funding Agreements prepared and signed	beginning June 2023

1.2 Available Funds

The current focus of the Northern Contaminants Program (NCP) is on the high priority issues in communities where people are exposed to contaminants at levels of concern to health authorities and on better understanding the issue of plastic pollution in the North and Arctic. See Appendix A for the NCP's contaminants of concern.

Projects funded by the NCP fall under five subprograms each with its own funding envelope. See Table 1.2 for the funding available in 2023-2024 to 2025-2026 under this Call for Proposals by subprogram. Funding envelope amounts are approximate and may be subject to change. Starting in 2020-2021, the NCP began supporting multi-year projects under each of the 5 funding envelopes. As a consequence, a portion of NCP funding is already committed to projects extending to 2024-2025. NCP will continue to support the coordinated generation, collection and management of scientific and environmental data and Indigenous knowledge pertaining to plastic and microplastic pollution in the environment and wildlife by allocating approximately $875,000 annually to 2026-2027. Please consult Table 1.2 when considering new project submissions.

Applicants should consult the NCP Blueprints (see Sections 6-10) for a description of the subprograms and their priorities for funding, when preparing a proposal. Applicants may request funding for up to 3 consecutive years.

Leaders of ongoing multi-year projects must submit a proposal update to report on progress and identify any potential adjustments. Templates and instructions will be supplied separately by the NCP Secretariat.

Table 1.2 NCP Funding available by subprogram for projects beginning in 2023-2024.

NCP Subprograms & Annual Funding Envelopes	Funding Available through this Call for Proposals		
	2023-2024	2024-2025	2025-2026
Human Health (HH) (Total **$1,075,000 Annually)** **Human biomonitoring and research projects:** Support for ongoing biomonitoring and research priorities identified in the HH Blueprint	$425,000	$600,000 See Note B	$600,000 See Note B
Community-Based Monitoring & Research (CBMR) (Total **$430,000 Annually)** Support for projects that address priorities identified in the CBMR Blueprint ($230,000 per annum)	$230,000	$230,000	$230,000
Plastic pollution: Support for projects and activities that address plastic pollution ($200,000 per annum)	$130,000 See Note A	$170,000 See Note A	$200,000

NCP Subprograms & Annual Funding Envelopes	Funding Available through this Call for Proposals		
	2023-2024	2024-2025	2025-2026
Environmental Monitoring & Research (EMR) (Total **$1,550,000 Annually)**			
Core monitoring projects: Support for ongoing core monitoring projects (project leaders identified in the EMR Blueprint) ($850,000 per annum)	$630,000 See Note A	$850,000 See Note A	$850,000 See Note A
Research projects: Support for research projects that address priorities identified in the EMR Blueprint ($225,000 per annum)	$150,000 See Note A	$200,000 See Note B	$200,000 See Note B
Plastic pollution: Support for projects and activities that address plastic pollution priorities identified in the EMR Blueprint ($475,000 per annum)	$400,000 See Note A	$475,000	$475,000
Communications, Capacity & Outreach (CCO) (Total **$700,000 Annually)**			
Core projects: Support for Regional Contaminants Committees and Inuit Research Advisors (project leaders identified in the CCO Blueprint) ($500,000 per annum, includes $50,000 per annum plastics funding)	$500,000 Includes plastic funding See Note A	$500,000 Includes plastic funding See Note A	$500,000 Includes plastic funding See Note A
Other/new projects (General): Support for projects and activities that address priorities identified in the CCO Blueprint ($200,000 per annum, includes $50,000 per annum plastics funding)	$200,000	$175,000 See Note B	$175,000 See Note B
Program Coordination & Indigenous Partnerships (Total **$1,240,000 Annually**)			
Core projects: Support for projects and activities as identified in the Program Coordination & Indigenous Partnerships Blueprint (Includes $100,000 per annum plastic funding)	See Note A	See Note A	See Note A
SUBTOTAL - NCP Funding (General)	**$2,035,000**	**$2,235,000**	**$2,235,000**

NCP Subprograms & Annual Funding Envelopes	Funding Available through this Call for Proposals		
	2023-2024	2024-2025	2025-2026
SUBTOTAL - NCP Funding (Plastics)	**$630,000**	**$745,000**	**$775,000**
TOTAL	**$2,665,000**	**$2,975,000**	**$3,005,000**

[A] funds already committed through multi-year projects and/or directed funding
[B] additional funding to be available through 2024-2025 and/or 2025-2026 Call for Proposals

1.3 Geographic focus of the NCP

The geographic focus of the NCP is Yukon, Northwest Territories, Nunavut, Nunavik and Nunatsiavut. This includes the traditional territories of Yukon First Nations and of the Dene and Metis of the Northwest Territories, and all of Inuit Nunangat (including Inuvialuit Settlement Region). Proposals for work to be conducted outside these regions will be considered on a case-by-case basis according to their relevance to the various NCP Blueprints.

1.4 Changes to the 2023-2024 NCP Call for Proposals

Please note the following important changes and updates in this year's Call for Proposals:

- **Research and Monitoring of Plastic Pollution:** Dedicated funds for plastic pollution monitoring and research under the Northern Contaminants Program, and related communications and outreach activities, has been secured until 2026-2027. Priorities for plastics pollution monitoring and research are outlined under the following subprograms: Environmental Monitoring and Research, Community-Based Monitoring and Research, and Communications, Capacity, and Outreach. Plastics-focused projects beginning in 2023-2024 are also eligible for multi-year funding (up to 3 years).
- **Contaminants of Concern:** Candidate persistent organic pollutants (POPs) nominated for addition to the *Stockholm Convention on Persistent Organic Pollutants* for which data are being sought include long-chain perfluorinated carboxylic acids (C9-C20), their salts and precursors; medium-chain chlorinated paraffins (MCCPs; also called medium-chain chlorinated alkanes) and chlorpyrifos. Please see Appendix A for NCP's Contaminants of Concern.
- **Environmental Monitoring and Research:** Research and monitoring priorities have been updated, including those related to plastic pollution. Note that these priorities are also applicable to applicants to the Community-Based Monitoring and Research subprogram.
- **Quality Assurance/Quality Control (QA/QC) Information**: Applicants are asked to provide additional details to the "Laboratory Analysis" section of the proposal if the proposal involves chemical analysis. This information will ensure that new laboratories can be easily integrated, and so that existing laboratories can be confirmed, for participation in the NCP QA/QC Interlaboratory study. Participation in this study is a requirement for most projects performing chemical analyses funded by the NCP.

1.5 Proposal Requirements

Proposals must demonstrate that the proposed work will comply with the requirements outlined below.

1.5.0 COVID-19 Considerations

COVID-19 and other public health pressures may continue to impact northern and Arctic research in 2023-2024. All work carried out with the support of the Northern Contaminants Program will be expected to comply with any and all relevant public health requirements. COVID-19 related information is available from the Government of Canada (www.canada.ca/en/public-health/services/diseases/coronavirus-disease-covid-19.html) and territorial/ region specific information is available through Polar Knowledge Canada (www.canada.ca/en/polar-knowledge/online-portal-for-researchers.html#region-specific-information).

1.5.1 Partnerships

The NCP requires that all funded projects be carried out in partnership with Northerners. Scientists are encouraged to work with community leaders, Elders, hunters, and other knowledgeable individuals to engage Indigenous Knowledge in the design and conduct of the study. Community input to the research is important, as are sensitive and sound researcher–community relations; all must be clearly demonstrated in project proposals. The Regional Contaminants Committees and the Inuit Research Advisors play a particularly important role in this respect and are to be involved in any steps taken to work with the communities. See (Appendix B) for contact information.

The NCP supports interdisciplinary studies that advance general knowledge related to contaminants, including projects that address the interactions between climate change and contaminants. Applicants are encouraged to seek opportunities to combine NCP activities with those funded by other programs such as ArcticNet and the Indigenous Community-Based Climate Monitoring Program to explore interdisciplinary questions. Project leaders may also wish to consider applying for an Alliance grant through the Natural Sciences and Engineering Research Council of Canada (NSERC). Alliance grants encourage researchers to collaborate with partner organizations, which can be from the public or not-for-profit sectors. Please consult NSERC's eligibility requirements for more information.

Project leaders are encouraged to seek co-funding from other programs that support community-based research and monitoring in the North and the Arctic. Two such programs that operate in the Northwest Territories and Nunavut, respectively, are the Northwest Territories Cumulative Impact Monitoring Program (NWT CIMP) and the Nunavut General Monitoring Plan (NGMP). For more information, please contact NWT CIMP by e-mail at nwtcimp@gov.nt.ca or call 1-867-767-9233 ext. 53084, and for NGMP, please e-mail ngmp-psgn@rcaanc-cirnac.gc.ca or call 1-855-897-6988.

1.5.2 Training the next generation of Arctic and northern scientists

The NCP recognizes the importance of training the next generation of Arctic and northern scientists, which includes training researchers from the North. Research funded by the NCP is often well suited for graduate level research projects. The involvement of students of all academic levels in NCP projects is strongly encouraged. Project leaders are encouraged to develop links with Northern and Arctic Colleges and other educational institutions to enhance the training and education of Northern students by including them in the project work.

1.5.3 Northern engagement and informed consent

All applicants are asked to review the *Community Engagement Requirements for Northern Contaminants Program Projects* carefully; this specifies engagement requirements for **all** project proposals, see section 3. Applicants must demonstrate, in writing, appropriate engagement as per the above-mentioned requirements, ensure that they allow enough time to complete this process, and are strongly encouraged to discuss their engagement plans with the appropriate Regional Contaminant Committee(s) and/or Inuit Research Advisor(s), see Appendix B – Contact Information.

For projects involving the collection of personal information and/or samples from people, informed consent must be obtained prior to final approval of the project. Additionally, agreements must be established with First Nations, Métis, and Inuit governments or organizations with respect to ownership, control, access, and possession of data and information collected from individuals, as described by OCAP® and the National Inuit Strategy on Research.

1.5.4 Licensing, ethics review and health and safety

All research taking place in the North and Arctic requires a scientific research licence. Please consult the websites of the licensing authorities or research institute in the region of study, and/or contact the Regional Contaminants Committee coordinators or Inuit Research Advisor for guidance, see Appendix B – Contact Information.

- Yukon: Government of Yukon Department of Tourism and Culture
- Northwest Territories: Aurora Research Institute
- Nunavut: Nunavut Research Institute
- Nunavik: Nunavik Research Centre
- Nunatsiavut: Nunatsiavut Research Centre

Every project involving the collection of personal information and/or samples from people will be required to provide proof to the NCP Secretariat of approval from all relevant ethics review boards/committees, before the project is given final approval.

The health and safety of NCP project teams, including northern community members who assist/participate in the research in any way, is of paramount importance. NCP Project Leaders should be aware of their responsibilities with respect to ensuring the health and safety of their teams, particularly when carrying out project activities in remote northern locations.

NCP researchers must familiarise themselves with requirements relating to health, safety, insurance, training, licensing, and other aspects of working in the North and Arctic; share relevant information with members of the project team; and incorporate appropriate measures into project plans. For useful information, see Conducting Research in Canada's North.

For research involving students in Nunavut, the Research in Nunavut Schools Policy aims to establish clear procedures and guidelines for researchers who request to conduct research in Nunavut schools; and ensure that research is relevant, respectful, transparent and fair to students and school staff and that appropriate ethical standards of research are upheld. Researchers wishing to engage Nunavut schools for research or research-related activities (including outreach, etc.) need to contact the Government of Nunavut, Department of Education, Partner Relations Division at info.edu@gov.nu.ca.

1.5.5 Project communications

The NCP places an emphasis on the importance of clear and appropriate communications during all phases of a project's lifecycle, from planning and development, to the dissemination of results, and all of the stages in-between. Proposals must present a communications plan/strategy that is acceptable to the relevant Regional Contaminants Committee, First Nations, Métis, Inuit governments and organizations and regional health authorities (where applicable).

The NCP **requires** that successful applicants work in partnership with relevant local/regional organizations and the NCP Secretariat to develop any messaging related to contaminants exposure to human populations. Regional health authorities and Indigenous governments in areas with settled land claims bear the ultimate authority to approve and release public health messages.

Communication initiatives in the North need to be appropriate to how knowledge is normally shared in a particular region or community. Applicants are strongly advised to contact the appropriate Regional Contaminants Committee and Inuit Research Advisor for advice and guidance on communications planning during the development of their proposal, and throughout all stages of project implementation.

1.5.6 Data management

The integrity and long-term stability of sample archive and data management is very important for meeting the long-term science and policy objectives of the NCP. Therefore, the NCP, in collaboration with other partners, has developed the Data Management Principles and Guidelines for Polar Research and Monitoring in Canada, which outlines the expectations and responsibilities of the NCP and of project teams regarding data, metadata, and other information generated from NCP-funded research and monitoring projects. To meet the objectives laid out in the document, the NCP has partnered with the Canadian Polar Data Network - Polar Data Catalogue to ensure long-term access and availability of data, and to promote collaboration among researchers.

- All NCP project leaders **must use the Polar Data Catalogue to create a full set of metadata that completely document and describe the data collected as part of their NCP projects**. In 2023-2024, training and technical support will be offered to project leaders on how to create meta data and upload associated data files through webinar presentations.
- Applicants must describe their data management plans in their proposals.
- Upon approval of funding each project leader will be required to complete and sign the NCP Data Deposit Agreement.
- Where possible, Global Positioning System (GPS) coordinates should be recorded at sample locations.

The NCP Secretariat will review entries in the Polar Data Catalogue to ensure that NCP projects are reporting their metadata. Since metadata can be created before analysis is complete, the deadline for completion is March 31, 2024. Any holdback or further installment of funds including funding for the subsequent year will be contingent upon the creation of a new metadata record or update to an existing record.

1.5.7 Sample archiving

It is important that all tissue samples collected during NCP studies be properly archived for future use, as appropriate. For example, the collection and archiving of tissues from important traditional/country foods is of particular importance. Archived tissues can be used in future studies to assess dietary exposure of Northerners to contaminants. Special considerations are necessary for archiving samples from human biomonitoring. If the project will be using archived samples from previous research or samples from another project, the communities involved in the original collections may need to be re-engaged and confirm their participation in the new proposal and the analyses.

1.5.8 Quality assurance and quality control

A quality assurance and quality control (QA/QC) program has been established to assess the performance of all laboratories carrying out contaminant analyses under the NCP and to ensure inter-comparability of data. The QA/QC program is also designed to meet the diverse QA/QC needs of the researchers and analysts by providing them with appropriate diagnostic tools for their analyses and by offering guidance and support in taking corrective measures if needed. Further information on the NCP QA/QC program can be found in a detailed QA/QC report available upon request by e-mail to the NCP Secretariat. To ensure the continued success of the QA/QC program, **all laboratories performing analyses for NCP research are required to participate in the program**. Applicants are required to report on laboratory QA/QC performance in their

proposals, including their performance in past NCP QA/QC Interlaboratory studies if applicable (see "The Proposal" in Section 2).

1.5.9 Reporting

Funding recipients are responsible for submitting the following project reports to the NCP Secretariat, in accordance with the deadlines outlined in Table 1.3. Please incorporate these reporting requirements into work plans.

Table 1.3 NCP Reporting Requirements

Type of Reporting Requirement	Federal Government funding recipients	All other funding recipients
Mid-year report and Data Deposit Agreement	September 16, 2023	
Final financial report	March 16, 2024	July 31, 2024
Project metadata input in the Polar Data Catalogue	March 31, 2024	
End of year synopsis of research report	April 30, 2024	
NCP Results Workshop	Fall 2023 (location/format TBD)	

NCP funded project leaders are expected to attend the NCP Results Workshop in years when they occur. The last NCP Results Workshop was held as a virtual event in October 2021. The next NCP Results Workshop will be held in person in the fall of 2023 (location TBD). Applicants should budget a maximum of $3,000 for travel to attend the workshop in 2023 and 2025.

The end of year synopsis of research report enables the NCP Secretariat to make research results and other project information available to the public, including Northerners and the scientific community, in a timely manner. Short versions of the reports are posted on the NCP website. The complete Synopsis Report of NCP research is published in electronic format in September of each year. The contents of the Synopsis Report are also widely accessible to the public through the NCP Publications Database.

1.5.10 Publications, Products and Acknowledgments

Project leaders are expected to publish their results in peer-reviewed literature in a timely manner. Project leaders are **required** to provide the NCP Secretariat with an advance copy of any materials being developed for communication with the public that is related to or resulting from work carried out with the support of the NCP.

Project leaders and all team members are **required to acknowledge funding from the NCP in any publications, presentations, print, and electronic communications** related to and/or resulting from work carried out with the support of the NCP. Subject to requirements for confidentiality, publications should give appropriate credit to all individuals and organizations, particularly Indigenous and northern organizations, that contribute to the research.

For guidance and/or instructions on the proper acknowledgment of the NCP funding, and/or logos to use, please contact the NCP Secretariat at plcn-ncp@rcaanc-cirnac.gc.ca.

2 – PREPARING A PROPOSAL SUBMISSION

A complete proposal submission to the Northern Contaminants Program (NCP) includes: a detailed proposal (see section 2.1); detailed budget tables (see section 2.2); and, as applicable, signed Community Engagement forms and/or letters of support (see section 3.1).

The NCP is now accepting multi-year proposals for consideration under all subprograms. If applying for multi-year funding, the proposal, budget tables and community Engagement forms/letters of support should reflect the full duration of funding support being requested (maximum up to 3 years). A request for multi-year funding does not guarantee that funding will be approved for the full duration requested, i.e. the NCP Management Committee reserves the right to approve single year funding.

If your proposal was previously submitted and approved for multi-year funding, you will receive a personalized proposal update template.

2.1 The Proposal

All proposals submitted to the NCP must include a detailed proposal following the general format outlined below. To request a sample proposal, please contact the NCP Secretariat. A fillable template isavailable that should be used for the proposal. A template specific to the Communication, Capacity and Outreach and Indigenous Partner proposals that do not involve data collection or chemical analysis will be provided directly from the NCP Secretariat.

Note: For ongoing multi-year projects, please emphasize any project modifications from the original/previous year's approved proposal.

Multi-Year Funding Requests: Details provided in the proposal must reflect the full funding period proposed.

YEARS OF FUNDING REQUEST: (*check all that apply*)

□ 2023-2024 □ 2024-2025 □ 2025-2026

REGION(S) OF PROPOSED ACTIVITIES: (*check all that apply*)

□ NORTHWEST TERRITORIES (MACKENZIE VALLEY) □ NORTHWEST TERRITORIES (INUVIALUIT SETTLEMENT REGION)

□ YUKON □ NUNAVUT □ NUNAVIK □ NUNATSIAVUT □ OTHER (Please specify) _____

1. PROJECT TITLE:

The project title should provide an indication of the nature and location of the work being proposed. Please also provide an alternate short title for use in plain language communications.

2. PROGRAM CATEGORY:

A project under one subprogram can be linked to priorities under other subprograms or can be a standalone project. A project that links two or more subprograms are encouraged. Indicate which of the following five subprograms the project falls under as its primary subprogram:

- *Human Health* (***new submissions invited***)
- *Community-Based Monitoring and Research* (***new submissions invited***)

- *Environmental Monitoring and Research (**new submissions invited**)*
- *Communications, Capacity and Outreach (**new submissions invited**)*
- *Program Coordination and Indigenous Partnerships (no new submissions; directed projects only)*

3. PROGRAM PRIORITY:

Indicate the key priority/priorities addressed by the proposed work, as per the relevant subprogram Blueprint(s).

4. PROJECT LEADER, AFFILIATION, AND CONTACT INFORMATION:

Include name, title, affiliation, mailing address, telephone #, and e-mail address. No more than three individuals should be identified as Project Leaders. The Project Leader(s) will be the main contact(s) on the project and will be responsible for the overall project implementation and for meeting all NCP reporting requirements.

5. PROJECT TEAM MEMBERS AND THEIR AFFILIATIONS:

List names of all the project team members, their affiliations, and their role in the project. All team members listed must be actively involved in the project. For ongoing/multi-year projects please ensure that the list of project team members is still valid. By listing members of the project team, the applicant (or Project Leader) is confirming that these individuals have agreed to be included as members of the project team in 2023-2024 and have been granted an opportunity to review and/or provide input on this project proposal.

6. PLAIN LANGUAGE SUMMARY:

In a maximum of 200 words (narrative or bullet-form), provide **a clear and concise summary** of the project and its proposed activities using non-technical plain-language so that it can be understood by a non-scientific audience. The summary will be used in the review process, particularly by the Regional Contaminants Committees during their social/cultural review of proposals, as well as by the NCP Management Committee. These plain language summaries will also be used on the NCP website and the NCP Project Discovery Portal to provide a brief description of NCP-funded projects.

The summary should provide an overview of the proposed work by addressing the following:

- What is the proposed work?
- What questions does the project attempt to answer and why?
- Where and when will the work be done?
- How will the project involve/help Indigenous peoples and other Northerners?
- What are the expected results and the results to date, and how will results be communicated back to the community?

7. PROJECT DESCRIPTION

a) Objectives:

Provide well-defined short-term and long-term objectives for the overall project in relation to the applicable NCP Blueprint.

b) Rationale:

Describe the rationale for the project in relation to the applicable NCP Blueprint. This should be a detailed section that clearly lays out the scientific basis for the proposed project. It is this section that will convince reviewers that the proposed project addresses the needs described in the Blueprint in a way that is scientifically defensible.

c) Progress to Date:

Describe the results of any work completed to date so that the project can be properly and fully evaluated. This should include any work carried out in related NCP projects as well as non-NCP funded projects whose results are specifically relevant to the proposed work. This section should also include information on any progress in the areas of capacity building, communications, and/or the use of Indigenous Knowledge.

d) Proposed Work:

Provide a brief description of activities, including project design and methodology, where and when the work will be carried out over the lifetime of the project. Include a more detailed description of planned activities in the year(s) for which funds are being requested.

e) Deliverables:

Specify the deliverables to be submitted to the NCP Secretariat over the lifetime of the project, as well as for the year(s) for which funding is requested. Include data reports, open literature publications, reports, workshops, and items for communications initiatives, etc.; please refer to Table 1.3 for reporting requirements.

8. CLIENTS/PARTNERS:

List the departments, agencies, Indigenous organizations, communities, and other countries, along with the corresponding contact persons, involved in the project and/or who could make use of the results (**for the requested funding year(s) only**). List any other projects that are related to the proposed work and indicate any shared costs and/or sample archival possibilities.

9. COMMUNICATIONS, CAPACITY BUILDING, AND INDIGENOUS KNOWLEDGE:

Under sections (a) Communications, (b) Northern Capacity Building and Training, and (c) Indigenous Knowledge, below, please indicate any activities that have shared responsibilities (presentations, reports, workshops, etc.) with other NCP-funded projects. For these, please specify which proposal and project leaders are directly responsible for the activities and related deliverables.

a) Communications

Describe in detail (**for the requested funding year(s) only**) any communications activities planned as part of the proposed project, including the names of people and organizations that have been or will be contacted. Note that it is a requirement of all NCP-funded projects to provide the relevant Regional Contaminants Committee(s) with draft communications materials for review, prior to translation and/or communication activities in northern communities.

b) Northern Capacity Building and Training:

Capacity building is defined, for the purposes of the NCP, as activities that improve an individual's, organization's, or community's ability to engage in contaminants issues. Describe the capacity building efforts planned for the year(s) for which funding is requested. Some examples of capacity building include (but are not limited to):

- Formal training programs (one-on-one or small group training with the researcher)
- Community or target-group workshops
- Presentations to, and engagement of, science classes (promoting student involvement)
- Hiring and engagement of local individuals in research projects

c) Indigenous Knowledge:

Explain how the proposed project will engage with local knowledge and/or Indigenous Knowledge and create bridges between Indigenous Knowledge and Western knowledge, unless not applicable (**for the requested funding year(s) only**). The NCP promotes the engagement of Indigenous Knowledge holders throughout all

project stages, including project development, sample collection, data analysis, conclusions, and communication of results. This informs, for example, appropriate sample collection timing, improves understanding of changes in migration patterns, changes in populations, and changes in habitat. Indigenous engagement aids in overall results interpretation, formulating new research questions, identifying knowledge gaps, and improving communication with local communities. Please contact the appropriate Inuit Research Advisor and/or Regional Contaminants Committee members to discuss the potential for collaborative application of Indigenous Knowledge in your project. See Contacts in Appendix B.

10. COMMUNITY ENGAGEMENT:

This section must be completed for all projects, including ongoing multi-year projects for which any part of the project in any year of the study was conducted in the North or made use of samples from the North. For projects that have no northern component at any stage, a brief statement explaining why there has been no northern community engagement may be sufficient; project leaders should confirm that engagement is not required with the appropriate Regional Contaminants Committee(s). If the project will be using archived samples from previous research or samples from another project, the communities involved in the original collections may need to be re-engaged and confirm their participation in the new proposal and the analyses. Please consult the appropriate Regional Contaminants Committee or Inuit Research Advisor for advice on appropriate engagement in these circumstances.

Describe the specific details of the community engagement that has occurred thus far, including efforts and successes from the previous year's project (if applicable) and specific plans for future community engagement (e.g. what was discussed, with whom and when).

Signed *Community Engagement* form(s) and/or letters of community consent must be submitted with project proposals. The community engagement forms are considered, along with the proposal, as part of the social/cultural review of proposals carried out by the five Regional Contaminants Committees and are requirements for funding approval from the NCP. Applicants should be considerate of the challenges and potential delays in Northern communities due to COVID-19 or other factors in their engagement plans.

Please include a list of the expected engagement forms that includes the organization, the signing representative of that organization (if possible), and whether it has been submitted with the proposal or is expected at a later date.

a) Ethics review:

Proposals for human health research and social science research (i.e. Indigenous Knowledge) must include information about the relevant ethics review, which ethical review board has or will review the proposal and the status of the review. A copy of the relevant consent form should also be included. It should be noted that NCP access to project data should be recognized in this documentation, where appropriate.

11. LABORATORY ANALYSIS:

Please provide the following:

- The necessary information for the laboratories that will be used to conduct contaminant and related analyses, including:
    - Laboratory name and whether this is your laboratory, a contract laboratory, or a paid or in-kind contribution from a team member
    - The ISO/IEC 17025 Accrediting Body & Client ID (if applicable)
    - The NCP laboratory ID number If the laboratory has previously participated in the NCP QA/QC program, as well as a report on the performance of the laboratories in the most recent NCP QA/QC interlaboratory tests

    - The contact information for the manager of the laboratory performing the processing/analyses
- List the contaminants being analyzed and matrices (e.g. environmental media or tissue), the type of processing, extraction and analyses being conducted, and the cost of analysis per sample for each class of contaminant
- The quality assurance/quality control (QA/QC) methods and recent results. If a project will use a laboratory new to the NCP that has yet to participate in the NCP QA/QC program, performance in other QA/QC programs should be reported that demonstrate a high quality of analytical performance.
- If the laboratory does not currently participate in the NCP QA/QC program, state if they are willing to do so (**for the requested funding year(s) only**). If you indicate that the laboratory is not planning to participate in the program, an explanation is required
- For laboratories that analyze air extracts or human tissues, a report on the performance in QA/QC programs specifically developed for those matrices

12. DATA MANAGEMENT PLAN:

Describe the project data management plan. Detail where and when data will be captured and when the metadata records will be created in the Polar Data Catalogue. Provide the link to the project metafile(s) and data file(s) if they already exist. Note that project leaders are still required to create metafiles in the Polar Data Catalogue even if data are housed in a separate repository. If the data are housed in another data repository such as Environment and Climate Change Canada's Data Portal, provide the link to that as well. Project leaders will be requested to complete and sign the NCP *Data Deposit Agreement Form* upon approval of funding.

13. RELEVANT PUBLICATIONS / PRESENTATIONS:

Include publications and presentations by project team members relevant to the proposed project (2 pages maximum). Include a list of the references cited in the text of the proposal.

14. SUPPORTIVE INFORMATION ON EXPERTISE:

Attach résumés/CVs to demonstrate the scientific excellence, experience and/or expertise of the project leader(s) (maximum two pages per individual).

2.2 Budget Tables

Proposals submitted to the NCP for funding must include budget tables prepared using templates available from the NCP Secretariat:

- Use Budget Table 1 to identify the budget request for 2023-2024, 2024-2025, and 2025-2026, as needed, i.e. depending on whether funding request is for a single year or multi-year
- Budget Table 2 automatically summarizes the monetary requests by category
- Use Budget Table 3 to identify any other anticipated and/or confirmed sources of funds that are/ may be available for the project, including in-kind support as well as cash contributions.

For any questions or issues pertaining to the budget table templates, please contact the NCP Secretariat.

BUDGET TABLE 1: DETAILED BUDGET INFORMATION FOR NCP SUPPORT

Please follow the instructions outlined within the Call for Proposals 2023-2024 budget template. Please note that some columns are auto-calculated and thus are locked for editing (i.e. you will not be able to delete or enter information directly into these cells). Applicants are asked to indicate what expenses are plastics-related using the appropriate columns and pull-down menus in the budget tables.

BUDGET TABLE 2: BUDGET SUMMARY INFORMATION

If your project received funds in 2022-2023, please enter those amounts in the cells provided. The remainder of Budget Table 2 is auto-filled from the inputs in Budget Table 1 and Budget Table 3.

BUDGET TABLE 3: OTHER SOURCES OF FUNDS

Please indicate other funding sources in Budget Table 3. Other funding sources include in-kind contributions such as staff salaries, services, facilities, and operating funds as well as the estimated value, status, and source of other known or potential contributions to the project (e.g. Natural Sciences and Engineering Research Council of Canada (NSERC), ArcticNet, other government departments (OGDs), Canada Foundation for Innovation, etc.).

CLASSES OF EXPENDITURES

The following provides further detail on the Classes of Expenditures that are to be used in the budget tables.

1. Professional Fees and Services:

This category includes wages of people hired specifically for the project (i.e., non-federal employees including students, Indigenous and/or local employees), honoraria, and contracted services (e.g. translation).

- Indicate the total estimated value of each contract to be let under the project, the contractor name (if known) and purpose of the contract. Contractors must provide justification of their fees.
- Caution should be exercised to ensure that double counting of contracted employees does not occur.
- If funding is requested for student stipends, it must be used for tasks directly related to the project.
- In the case of contracted laboratory services, indicate the cost of analysis per sample, as well as the type of analysis and number of samples. If a student is to conduct any of the analyses or sample preparation, the analysis costs should be reduced as appropriate.
- This category should not include the salaries of full-time indeterminate or term federal employees participating in the proposed project. The latter salaries are government A-base and are to be covered by the particular department. Such salaries should be reported in Budget Table 3 “Other sources of funds”.

2. Equipment and Facilities:

This category includes equipment and supplies that are specifically purchased, leased or developed for the particular project, rentals, and other analytical costs.

- Specify the type of equipment, equipment costs (purchase, lease or maintenance) and the extent to which the equipment will be used in NCP contaminants projects. Only equipment that is specifically purchased, leased or developed for the particular project should be reported in this category. General purpose personal gear and items that are required as basic necessities for Northern work and that are purchased for individuals (parkas, boots, etc.) are generally not eligible for NCP funding. Other personal expenses that are generally considered personal expenses such as personal computers, phones and tablets are also generally not eligible for NCP funding, though there can be exceptions if they relate to specific objectives of a project and are not general equipment for an employee or graduate student, for example.
- The maintenance cost of equipment already owned by the federal government and used as part of the project should be reported in Budget Table 3 "Other sources of funds".
- Indicate the cost of any laboratory analysis per sample, the type of analysis and the number of samples to be analyzed. Only the cost of the sample analysis and/or the development of specific analytical techniques for an NCP project are appropriate.
- Identify any costs of shipping equipment.

3. Travel:

This category includes a variety of travel-associated expenses.

- Include costs for travel, accommodation and meals (research-related, workshops, consultations, meetings, and NCP Results Workshop*)
- The cost of establishing and operating field camps, aircraft rental and shipping (i.e., freight)
- Ship time should be reported under this category only when the use of the ship will be charged directly to the project or when smaller vessels are rented for the express purpose of conducting the project. If ship time is considered government A-base (i.e., the project manager is not charged for time on board) then such costs should be reported in Budget Table 3 "Other sources of funds".

*Budget requests can include a maximum of $3,000 in fiscal year 2023-2024 for the NCP Results Workshop to be held in fall 2023.

4. Other Costs:

Other costs include miscellaneous costs such as office supplies and operating expenses (e.g. office space, rental, phone, printing, computer time, fax, photocopying and postage). Costs that do not fit in any of the above categories are included here.

5. Administration Fee:

All administrative expenses associated with the project activity may be included in this category. This may include, for example, payroll or accounting services. Administrative expenses shall not exceed 15% of the total project budget. Organizations that are eligible to include administrative expenses in their budget include, but are not limited to, Indigenous organizations and governments, universities, private companies, and other non-government organizations. Federal departments are ineligible to request these funds.

3 – COMMUNITY ENGAGEMENT REQUIREMENTS FOR NCP PROJECTS

3.1 Guidelines for Working with Northern Communities

GUIDELINE 1

All recipients of NCP project funding are expected to meet the Northern Contaminants Program (NCP) standards for carrying out research in the North, as outlined in the NCP's *Guidelines for Responsible Research*. These *Guidelines* provide direction to project leaders and scientists for planning communications, and in developing research agreements with communities (see Appendix C).

GUIDELINE 2

All project applicants must contact the relevant Regional Contaminants Committee (RCC) or Inuit Research Advisor (IRA) during the proposal development stage to discuss consultation requirements.

Applicants should then include in the "Community Engagement" section of the proposal a summary of their discussions with the RCC/IRA. During these discussions, RCCs/IRAs may advise the applicant to undertake specific actions before the NCP Management Committee makes its funding decisions in April.

GUIDELINE 3

The Regional Contaminants Committees will determine the appropriate engagement needed for projects in their regions, but there is recognition that not all projects require the same level of engagement (e.g. human health projects vs. computer modelling projects). With this difference in mind, the following is a guideline for minimum levels of engagement required. The RCCs may recommend further engagement in addition to the minimum.

a) Human Health projects (active or archived samples): engagement needed with the regional health authority and/or the appropriate health centre, and Inuit organization/government for work within Inuit Nunangat

b) Biotic/Wildlife projects (active sampling): engagement needed with the community and the Hunters and Trappers Organization/Committee at the appropriate level (regional and/or local), and Inuit organization/government for work within Inuit Nunangat

c) Biotic/Wildlife projects (archived samples): engagement not necessarily needed if the original sampling agreement covered further analysis

d) Abiotic projects (active sampling): engagement needed with communities close to the sampling sites. If there is no nearby community, engagement should only be with the RCC

e) Abiotic projects (archived samples): engagement not necessarily needed

f) Laboratory-based/Modelling projects: engagement not necessarily needed, except where specified by RCCs

GUIDELINE 4

For every project involving community engagement (as directed by the RCCs), project applicants must ensure that signed C*ommunity Engagement* forms or equivalent letters of support are submitted to the Secretariat by the appropriate bodies with whom community engagement has taken place. This assures the NCP that the community engagement for any particular proposed project is satisfactory.

GUIDELINE 5

Due to the different nature of NCP projects, the "appropriate" Indigenous organization or regional/community body to engage with will vary, and applicants will be guided by the relevant RCC. For instance, a project that intends to sample at a remote location may require engagement with the appropriate Indigenous organization(s) represented on the NCP Management Committee (Council of Yukon First Nations, Dene Nation, Inuit Tapiriit Kanatami) and with the relevant land claim rights-holder organization. A project to be conducted within or near a community will require community engagement with a community-level organization. Even if project members stop only briefly in a community on route to a sampling site, community engagement may still be required. In addition, projects involving the use of archived samples may also require community engagement since the proposed use may differ from that which had been originally approved. Such cases will be advised by the appropriate RCC on an individual basis.

Note that the Regional Contaminants Committees and Indigenous partners that help govern the Northern Contaminants Program do not complete engagement forms, but can help guide applicants to the appropriate organizations and communities where they are required.

4 - PROPOSAL REVIEW PROCESS

The steps involved in the Northern Contaminants Program (NCP) proposal review process are described in the following subsections.

4.1 Relevance Review

Submitted proposals are distributed to one of five review teams. The review teams are comprised of representatives from northern organizations, other government departments, academia, and other areas of expertise. These teams are:

- *Human Health* review team
- *Environmental Monitoring* review team
- *Environmental Research* review team
- *Community-Based Monitoring and Research* review team
- *Communications, Capacity and Outreach* review team

The review team's role is to assess the merit of the project and its relevance to the NCP. They assess relevance by reviewing how the proposal addresses the priority areas identified in the relevant NCP Blueprint and other NCP strategic priorities, using the criteria in Table 4.1.

Table 4.1 Review Criteria – NCP Relevance

Weighting	Criteria
Y/N	Does the research proposal address one of the key research needs outlined in the Blueprint? If so, which one(s)?
Y/N	Does the proposed work have relevance and applicability in addressing other issues of importance to Northerners (e.g. climate change, food security)?
Y/N	Does the team have the necessary capacity and/or track record to conduct described research, and the potential to deliver results that reflect scientific excellence?
Y/N	Where appropriate (e.g. community-based monitoring and research proposals), is co-production of knowledge/Indigenous Knowledge included in the proposal and does the project use participatory research methods?
Y/N	Does the proposal include educational/training elements?
Y/N	If this research project directly impacts northern communities or Indigenous groups, have they been engaged and do they support this research? Have the applicants addressed the NCP *Guidelines for Responsible Research* and obtained written consent (where applicable)?

4.2 Technical and External Peer Review

All proposals undergo a technical review. This review covers the scientific expertise of the project team, the clarity and scope of objectives, the adequacy of methodology, suitability of project design, and

appropriateness of time frame and budget. Proposals are rated and ranked and operational and funding recommendations are made to the NCP Management Committee. Proposals for new projects submitted under the Environmental Monitoring and Research, and Human Health subprograms will undergo an external peer review. Other review teams may request an additional external peer review, for example if more technical expertise is required. Upon receipt of the external peer reviews, the teams are reconvened to take the reviews into account and finalize their recommendations to the NCP Management Committee.

Table 4.2 Review Criteria – Technical and External Peer Review

Weighting	Criteria
20	Scientific excellence/expertise of principal investigator and team (including consideration of relevant publications)
15	Clarity and scope of objectives
15	Clarity, adequacy and inter-comparability of methodology
15	Suitability of proposal design for meeting the objectives (e.g. sample size, etc.)
10	Appropriateness of time frame (e.g. can the project results be delivered within the time frame specified in the proposal and within a time frame appropriate to the NCP?)
10	Appropriateness of budget (e.g. charges for sample analysis)
15	Overall clarity and organization of proposal
Written Assessment	Peer reviewers are asked to provide a brief written assessment of the proposal, including an assessment of the importance of the proposed project with respect to the priority areas identified in the relevant NCP Blueprint.

4.3 Social/Cultural Review

Regional Contaminants Committees (RCCs) conduct a social/cultural review of the proposals. This review assesses aspects in the proposal such as communications, northern priorities, capacity building and training, Indigenous Knowledge, and northern consultation. Each proposal is rated, and recommendations are made to the NCP Management Committee on funding and how the proposals could be improved in these areas.

Table 4.3 Review Criteria – Social/Cultural Review

Criteria	Attributes
Communications	How complete are the planned communications activities: - prior to project implementation? - during project execution? - after project results are received? Are there plans to communicate results to the RCCs and regional health authorities? Are communications activities budgeted in their proposal?
Northern Priority	Does the project address a question that is important to Northerners? *(Note: Proposal must also meet a priority outlined in the Blueprints.)* Has similar work been done already? Recently? Does the proposal build on existing data?
Capacity Building/Training	Does the proposal provide local or northern training opportunities? Does the proposal promote capacity building in the North?
Indigenous Knowledge	Does the proposal make use of appropriate Indigenous Knowledge? Have the relevant communities been consulted on how Indigenous Knowledge could be incorporated into the project? Are there plans to communicate Indigenous Knowledge and incorporate it into project results?
Past Experience in the Region	Has the project team established and/or previously demonstrated good working relationships with the relevant communities? Does the project team have a satisfactory track record of delivering on social/cultural aspects of project plans?
Other	Additional comments on technical and logistical aspects, budget and other considerations.

Regional Contaminants Committees will provide a review of each proposal that is relevant to their region, using the above criteria as guidance.

The review will also include:

(a) an overall rating of the proposal (High, Medium-High, Medium, Medium-Low, Low) for its social/cultural aspects;

(b) a recommendation (Support, Do Not Support, Conditional Support); and

(c) specific conditions of funding recommended by the Regional Contaminants Committees, if applicable.

4.4 NCP Management Committee

The NCP Management Committee meets in May to review and consider all the recommendations from the review teams and Regional Contaminants Committees. The NCP Management Committee makes the final funding decisions for the year. In some cases, funding approval may be conditional on specific follow-up.

5 - PROPOSAL SUBMISSION CHECKLISTS

5.1 Before Submitting the Proposal

Completion of this checklist ensures that the applicant has read and understood the NCP proposal requirements.

- ☐ Timeline for the NCP Call for Proposals and Review Process (Section 1.1)
- ☐ Proposal Requirements (Section 1.5)
- ☐ Proposal and Budget Formats (Section 2)
- ☐ The objectives identified in the relevant Blueprint(s) for the current funding year.
- ☐ *Guidelines for Working with Northern Communities* (Section 3.1) *and Guidelines for Responsible Research* (Appendix C)

5.2 Submitting the Proposal

- ☐ Complete proposal packages must be submitted by email (maximum size: 10 MB) to the NCP Secretariat at plcn-ncp@rcaanc-cirnac.gc.ca using the following text as the Subject: NCP Proposal 2023-2024 – [*insert name of Project Leader*]. The proposal is consistent with the current proposal format as an MS-Word file, while Budget Tables are prepared and submitted using the Excel-based templates. Please note, compressed files cannot be submitted.
- ☐ All project team members identified in the proposal are to be copied on the email submission. Proposal submissions that do not copy project team members on the submission will be requested to re-submit.
- ☐ The Signed C*ommunity Engagement* form(s) and/or letters of community support are submitted by the applicant or directly by the northern community organization(s) by email to the NCP Secretariat at plcn-ncp@rcaanc-cirnac.gc.ca. Signed Community Engagement forms are due by March 22, 2023.
- ☐ The budget information is appropriate, realistic, complete and correct for all funding years.
- ☐ The deadline for proposal submission is **March 8, 2023 at 11:59 PM Eastern Standard Time.**

6 – BLUEPRINT FOR HUMAN HEALTH

6.1 Purpose

The purpose of the Human Health subprogram of the Northern Contaminants Program (NCP) is to:

- Monitor contaminant levels and trends in Arctic and northern Indigenous populations.
- Conduct research into factors influencing levels and trends of contaminants in Arctic and northern Indigenous populations.
- Conduct research into the effects of contaminants on the health of Arctic and northern Indigenous populations.
- Support the assessment of human health risks using information on levels and trends of contaminants in traditional/country foods and in Arctic and northern Indigenous populations.
- Support, through collaboration, projects that are funded under other NCP subprograms.
- Produce scientific information supporting domestic and international chemical management initiatives.
- Produce scientific information to support actions to manage health risks posed by exposure to contaminants in Arctic and northern Indigenous populations.

The annual funding for Human Health projects under the Northern Contaminants Program is currently set at $1,075,000. The total amounts of funding available in the Human Health subprogram through this call for proposals in the 2023-2024, 2024-2025, and 2025-2026 fiscal years, after considering multi-year funding commitments, are shown in Table 1.2. At this time, the NCP is not considering funding human health studies on plastics. Instead, the NCP invites proposals for research under the Environmental Monitoring and Research subprogram and the Community-Based Monitoring and Research subprogram on the sources, presence and abundance of plastics in the environment, characterization of plastic type, as well as research on the potential of plastics to sorb other environmental contaminants and/or release chemicals used in the manufacture of the plastics.

6.2 Introduction

This Blueprint outlines the research issues and questions to be addressed by the Human Health subprogram of the Northern Contaminants Program (NCP) so that Northerners can assess, understand and better manage the health risks in Northern Canada related to the long-range transport of contaminants and their presence in people and traditional/country foods. This is closely aligned with the goals of Inuit, Métis and First Nations organizations that have a shared objective to improve health and wellness among their populations across the North. Priorities also align with the goal of reducing/eliminating contaminants in traditional/country foods, by supporting national and international chemicals management initiatives, international working groups (e.g. Arctic Monitoring and Assessment Programme), and providing critical information to support international conventions, such as the United Nations Stockholm Convention on Persistent Organic Pollutants, and Minamata Convention on Mercury.

The scope of this Blueprint provides a continuing opportunity for northern health authorities and/or First Nations, Métis and Inuit governments and organizations to take the lead on projects within their own regions, enabling Northerners to control and increase their own research capacity more directly. The Blueprint identifies priorities and activities in the areas of human biomonitoring, health effects and benefit/risk evaluation.

6.3 Background

Northern Contaminants Program-funded research and monitoring has shown elevated concentrations of persistent organic pollutants (POPs) and metals, particularly mercury, in human samples (i.e., blood, milk) in certain northern and Arctic regions. This research shows that the primary source of exposure for many of these contaminants is the consumption of country foods. Epidemiological and toxicological studies in Canada and elsewhere have found that at certain concentrations these contaminants are toxic to humans.

National and international assessments of contaminants and human health in the Canadian Arctic (CACAR 2017) and circumpolar Arctic (AMAP 2016; AMAP 2021) have summarized key conclusions from research supported by the NCP and externally funded research, as well as identified a number of knowledge gaps. Some of the key conclusions and knowledge gaps from these reports are:

- Time trends data among Inuit pregnant women from Nunavik suggest that many contaminants (legacy POPs and some metals) are decreasing, however other contaminants including some PFAS are increasing. Additional studies are required to ascertain contaminant trends for women of childbearing age and pregnant women from additional Inuit regions.
- New POPs are continually being added to the Stockholm Convention and these contaminants are found in the Arctic environment and biota. More biomonitoring data is needed, along with data on sources of exposure to and potential health outcomes related to these contaminants. There is a need to establish time trends datasets for chemicals of emerging Arctic concern (CEACs).
- There is increasing evidence showing beneficial interactions between some nutrients and contaminants. The contaminant concentration and nutrient composition of many traditional/country food items need to be identified (or updated), and additional studies on the potential beneficial effects of available foods in the North are warranted.
- Regionally specific dietary advice is important, and the impact to contaminant body burdens due to changes in traditional/country food intake will be contaminant specific (i.e., due to factors such as elimination half-life).
- Novel methods should be developed and applied to complement dietary recall and food frequency questionnaires to determine reliable rates or types of traditional/country food consumption during human biomonitoring studies. Biomonitoring studies should also consider the effects of seasonality when determining the timing of sampling.
- Co-location of biomonitoring studies in people and wildlife is encouraged, to create direct links between current exposure and measured body burdens.
- Development of innovative tools can support public health authorities for interpretation of biomonitoring results and management of exposure risk.

Studies that provide information on food choice, dietary intake, and contaminant levels in traditional/country foods are extremely valuable and provide a clearer understanding of how diet affects contaminant concentrations in Northerners. Future dietary work and biomonitoring studies should continue to focus on moderate-to-highly exposed populations, including pregnant women and women of childbearing age and should include both legacy and emerging contaminants of potential concern where there is the potential for exposure from traditional/country foods.

The assessment of contaminant concentrations in traditional/country foods along with traditional or innovative dietary assessments methods will be essential to assess sources and levels of dietary exposure. These elements should be developed such that future assessments will be carried out with the cooperation and/or collaboration of project leads responsible for biotic monitoring under the *Environmental Monitoring and Research* subprogram as well as the *Community-Based Monitoring and Research* subprogram. Subprogram collaboration would be particularly beneficial for regional health and environmental authorities and/or First Nations, Métis and Inuit governments and organizations evaluating these projects. In particular, northern health authorities may be interested in having studies under the *Human Health* and *Environmental Monitoring and Research* and/or Community-Based Monitoring and Research subprograms co-located. Doing so will strengthen the links between these subprograms and ensure that knowledge gained on contaminants in the ecosystem is transferred to the assessment of human health risks.

Further information is also needed on the potential impact of climate change and how it may influence access and availability of traditional/country food sources, and changes in contaminant levels.

In order to place human chemical concentrations in a health risk assessment context, there is a need for tools to interpret biomonitoring data. For example, there are only a few substances for which direct relationships between human chemical concentrations and health effects have been established. For lead and mercury, intervention guidelines were established on the basis of studies that directly related blood levels with health effects.

Prospective biomonitoring programs should be designed to build on pre-existing biomonitoring data and provide for periodic re-sampling from a similar location and population (approximately 4 to 6-year sampling period). By focusing on continuation of pre-existing datasets in a comprehensive and recurrent manner, a robust biomonitoring program will be established to create comparable datasets and allow for planned continuity, resulting in more meaningful trend analyses covering all regions of Canada's Arctic.

6.4 Human Biomonitoring

Biomonitoring studies that have measured POPs and metals in maternal blood over the last nearly three decades suggest declines for certain POPs and metals in the Canadian Arctic (NWT, Nunavut, and Nunavik) amongst different population groups including Inuit, Dene/Métis, and non-Indigenous Northerners. These biomonitoring studies have informed where and how human exposures to contaminants are changing and have also allowed an assessment of the effectiveness of international agreements.

The coincident collection of information on dietary choice and food frequency during biomonitoring studies will permit researchers to further elucidate contaminant exposures from traditional/country foods and better understand modern dietary transitions in the North.

Role of Northern Health Authorities and First Nations, Métis and Inuit Governments/ Organizations

Canada's northern and Arctic regions can be considered for human biomonitoring studies. It is important that the northern health authorities and First Nations, Métis and Inuit governments and organizations are involved in the development of these human biomonitoring projects. Understanding that there are many demands placed on their limited resources, northern health authorities can gauge their level of involvement based on internal capacity and interest. Their participation aligns with the desire of Northerners to conduct their own research in the North and allows project leaders to more easily encourage community engagement in the projects. Having the northern health authorities involved in the biomonitoring component will ensure that any important health, dietary or contaminant issues that may arise will be addressed for the communities in the most appropriate

health context. Project leaders must include First Nations, Métis and Inuit governments and organizations to ensure that the cultural context of issues will be considered before publication/dissemination of results.

The objective of NCP human biomonitoring is to provide as complete coverage of each northern region as possible to fill regional gaps in data and develop time trends to allow ongoing insight on the changing relationship between contaminant exposures and human health outcomes. Ultimately, these studies, in conjunction with monitoring results from the *Environmental Monitoring and Research* subprogram, provide crucial information for the NCP that will help with the implementation of international agreements such as the Stockholm Convention and the Minamata Convention. In addition, data from these biomonitoring studies using this standardized approach can be used to inform local health authorities of the general health status of northern populations from a contaminants perspective.

The overarching goal of NCP human biomonitoring is to characterize exposures of Arctic and northern Indigenous populations to contaminants, and to create time trends and fill regional gaps; however, this does not preclude the NCP from adjusting the schedule to address targeted biomonitoring if the need arises. For example, a rapid dietary shift in traditional/country food consumption or increased levels of contaminants in traditional/country food species regularly monitored through the *Environmental Monitoring and Research* subprogram would be valid reasons for establishing a biomonitoring program in the affected region.

Funding Parameters

A biomonitoring project will usually extend from three to five years and include the following key elements: regional consultation and engagement, project design/feasibility assessment, project implementation/ execution, and reporting of results to the communities. The planning process should not be underestimated and usually requires at least one year to prepare a comprehensive proposal. The proposal should set the general requirements for the project, including recruitment strategy, sample size and frequency (a position paper on these components was prepared by Health Canada [1]), dietary assessment, collection of demographic information through questionnaires, contaminants to be measured, laboratory capacity, data analysis, and reporting of results. The participation and collaboration of the northern health authorities and First Nations, Métis and Inuit governments/organizations will ensure that regional communications on contaminants will be balanced and incorporated into ongoing health messages.

The importance of risk/benefit communication messaging cannot be underestimated. Risk/benefit communication requires ongoing engagement with the appropriate regional health authorities, and their approval before risk messaging is disseminated. The resources required to develop appropriate tools and documents to disseminate the results of human health studies should be included in project proposals.

Seed Funding

In order for biomonitoring studies to commence in regions not currently part of long-term NCP funded biomonitoring work, interested parties may apply to the Call for Proposals for seed funding to establish partnerships with regional health authorities, First Nations, Métis and Inuit governments or organizations, academia/federal scientists and local community organisations. Seed funding may be used to support travel and facilitate meetings in northern communities with all of these key potential partners. Seed funding may also be used for preparatory work on research design, survey development or other pertinent preliminary work. Seed funding will be of a limited amount and will be scaled according to the scope of the proposed biomonitoring work. In addition, seed funding will be provided for one year only. Applicants who receive seed

[1] NCP Maternal Blood Biomonitoring Studies: Sampling and Sample Size Considerations.

funding are not guaranteed to receive long-term funding for future biomonitoring work and must submit proposals for subsequent years of funding.

Biomonitoring Priorities

The NCP has identified key target populations for human biomonitoring. Early biomonitoring studies focused on pregnant women in order to obtain information on potential health impacts for the fetus, and this target population remains a priority. Cross-sectional studies have included both sexes and all adult age groups to obtain a better understanding of human exposures across the Canadian Arctic. Therefore, the priority populations for biomonitoring studies under the NCP are presented as follows, in order of importance:

1. Pregnant women and women of child-bearing age
2. Children
3. Adults, and in particular, older adults who typically consume more traditional/country foods

Pregnant women and women of child-bearing age are the highest priority due to the sensitivity of the developing fetus to contaminant exposure. Maternal trends that are not confounded by the sampling medium or differing study design can be determined through the continued sampling of maternal blood using prior protocols. Children are the next priority for biomonitoring studies due to their status as a vulnerable population to potential contaminant effects, and they have been found to have relatively high concentrations of some contaminants in the past. Biomonitoring of older adult populations of both sexes is important because contaminant concentrations have, in general, been shown to be higher in this adult population than in children and pregnant women or women of child-bearing age due in part to higher historical and current consumption of traditional/country foods. Due to the persistent, bioaccumulative nature of legacy POPs, older adults may also have higher concentrations in fluids and tissues due to cumulative lifetime exposure, especially from exposure prior to the phase-out of these legacy POPs.

Due to the effort, cost and value associated with the collection of samples from participants in biomonitoring studies (e.g. blood, hair, milk and/or urine sample), applicants are encouraged to develop and maintain these samples in a biobank for future analysis, after ensuring that appropriate informed consent has been received, privacy and confidentiality is maintained, and the necessary reporting protocols are followed. This will allow for the opportunity to conduct additional analyses (including future contaminants of emerging Arctic concern), as per the policies associated with any given biobank.

The chemicals of interest for the core biomonitoring program have been prioritized into three general groups: Schedule A and Schedule B POPs, and Schedule C CEACs (see sections below and Appendix A). Effort should be made to coordinate the biomonitoring of these chemicals of interest under the *Human Health* subprogram with those monitored within the *Environmental Monitoring and Research* subprogram.

PRIORITY 1: SCHEDULE A CONTAMINANTS

The core biomonitoring program would continue to measure Schedule A contaminants (contaminants such as "legacy" POPs (e.g. PCBs, organochlorine pesticides) and heavy metals including mercury, lead and cadmium) in human samples and traditional/ country foods to ensure comparability with earlier datasets to be used in trend assessments and to fulfill Canada's commitment to monitoring these contaminants under international agreements. Contaminants proposed for analysis should be delivered to the North primarily through long range transport and not from local sources. Northerners continue to be exposed to legacy contaminants through the consumption of traditional/country foods. See Schedule A (Appendix A) for a list of legacy POPs for continued monitoring.

Full speciation of metals is important for interpreting the result of biomonitoring data and assessing the risk associated with these exposures. For some data poor contaminants (e.g. dioxins) newer methods have been

developed. These advances in methodology make it more feasible to analyse a broader suite of chemicals in biomonitoring studies.

PRIORITY 2: SCHEDULE B AND C CONTAMINANTS

Monitoring by the NCP also includes Schedule B POPs ("new" POPs) and Schedule C CEACs that need assessment and monitoring to determine if they are present in the Arctic environment and in human tissues given their persistent and bioaccumulative properties and their ability to be transported long distances into the Arctic. It is expected that a number of chemicals measured under the Chemicals Management Program (CMP) will meet these criteria and thus should be monitored under the NCP.

Schedule B and C (Appendix A) contains a list of "new" POPs and CEACs that are known to fall within the NCP's mandate and are therefore a priority for future biomonitoring studies. Several new contaminants have already been included or nominated as potential candidates for regulation under UNEP's *Stockholm Convention* and the UNECE *1998 Aarhus Protocol on Persistent Organic Pollutants (POPs)*. There is a strong need for generating data on these contaminants in human populations, and efforts should be made to include these contaminants in biomonitoring studies where possible if methods are available. This data is critical to informing the nomination, review and addition of contaminants to the Stockholm Convention.

OTHER RELEVANT CONTAMINANTS AND NUTRIENTS

It is recommended that biomonitoring studies should also investigate chemicals that northern populations are exposed to through local use and exposure (e.g. store-bought foods, the preparation and preservation of traditional/country foods, drinking water and consumer products) to fully understand the exposure profile of northern populations. However, applicants are expected to seek alternate funding sources for these analyses.

Nutrients should be included in these biomonitoring studies. While selenium is not listed as a chemical of concern under Appendix A, dietary intake of selenium is relevant to the health of northern populations and to understanding contaminant interactions, and should, therefore, continue to be measured as part of NCP funded Health Research.

Biomonitoring studies should include other contaminants/nutrients that are relevant to understanding potential health effects associated with consuming traditional/country foods.

6.5 Dietary Exposure Assessment

The purpose of conducting dietary exposure assessments is to provide an up-to-date estimate of the amount of contaminants consumed in the diet of Northerners, and to gain information about dietary habits through traditional (e.g. 24h recalls and Food Frequency Questionnaires) or new/innovative methods. These estimates of dietary exposure can then be compared with guidelines for safe levels of contaminant exposure (i.e., tolerable daily intake (TDI), predictive modeling, etc.).

A number of dietary surveys have been undertaken by NCP researchers in Yukon, NWT, Nunavut and Nunavik. Dietary transitions need to be taken into consideration when reviewing these results. It may be necessary to conduct additional dietary exposure studies to take into account current exposure patterns. Comparing dietary exposure assessments provides valuable information on changes in contaminant concentrations in traditional/country foods, changes in dietary habits, and ultimately on changes in exposure to dietary contaminants.

Dietary exposure assessments, particularly the food choice and dietary surveys, should be carried out in parallel with human biomonitoring studies. This will allow valuable comparisons of dietary exposure assessments to

measured contaminant concentrations in human samples and will facilitate the development of effective dietary intervention strategies.

When dietary assessment data is paired with wildlife monitoring data, information is obtained on which traditional/country foods may be important sources of contaminants for people and thus should be given the highest priority for monitoring of contaminants. Samples of traditional/country foods should also be collected to allow the measurement of contaminant concentrations, including some of the contaminants of concern. Measurement of contaminant concentrations in traditional/country foods should be carried out in cooperation with project leaders from the *Environmental Monitoring and Research* subprogram.

The assessment of contaminant exposure needs to be coupled with an assessment of nutrient intake, which is essential for evaluating dietary risks and benefits. Food choice studies will also provide information about the factors affecting the dietary choices of Northerners and the perception of contaminants in making those choices.

Dietary Exposure Assessment Priorities

The following outlines the priority themes for dietary exposure studies under the NCP:

- Dietary assessments should be updated in regions where currently available data does not match current dietary habits
- Studies are strongest when dietary exposure assessments and human biomonitoring are conducted simultaneously.
- Dietary assessments should be paired with environmental monitoring, where possible
- Dietary contaminant exposure assessment should be coupled with an assessment of nutrient intake.

The NCP recognizes that plastic and microplastic pollution is an emerging issue that requires further research in order to fully assess potential risks to human health. While human exposure to microplastics may occur through air, water and food, determining the impact on human health first requires more quantitative information about the occurrence of microplastics in potential sources of human exposure. As such, the NCP is taking a stepwise research approach that focuses first on expanding knowledge on the occurrence of microplastics in the environment, including where they may be relevant to human exposure. For example, research is needed on the occurrence of microplastics in animals traditionally consumed by Northerners.

6.6 Human Health Effects Research

The focus of the health effects element is the study of the interactions and effects of contaminants on human biological systems through investigations based on measurable determinants of health. The desired outcome is to reduce the current burden of environmentally-related disease, and to minimize environmental health risk across all life stages by addressing single and multiple chemical exposures. Investigative techniques could include epidemiological, laboratory-based toxicological and relevant toxicogenomic studies. The importance of support for these studies and engagement from regional health authorities, communities and Indigenous organizations is critical, especially for disseminating the results of these types of studies.

Biomarkers have the potential to provide an early detection system for health conditions that may develop later in life or can help address epidemiological issues that cannot be investigated directly because of low sample numbers. Research that focuses on biomarker development, however, is beyond the scope of the NCP. Any work with biomarkers funded through the NCP should be integrated within an epidemiological (or toxicological) study and should demonstrate that a gap in NCP work will be filled by the research. Convincing arguments need to be made by project applicants regarding the relevance of these biomarker studies to the Arctic and northern human context. In order for a project to be considered for funding, the chosen biomarkers should be developed and scientifically validated prior to inclusion in NCP studies, and demonstrate a link to clinical health effects or

health outcomes currently or potentially afflicting Arctic and northern Indigenous peoples. Similarly, a relationship needs to be established between such health effects and contaminants.

Human genomics has received much attention in recent years and has been raised as a potentially beneficial area of research related to the effects of contaminants. Identifying the molecular mechanisms behind the contaminant effects observed in Arctic and northern Indigenous peoples could be a useful approach to clarifying how contaminants affect the human body. Genomics research has the ability to identify the molecular mechanisms associated with certain chemically related exposures at a very early stage and possibly uncover new biomarkers of toxicity. Any NCP-funded genomic work should emphasize applied outcomes relevant to Canadian Arctic and northern Indigenous populations and will need to be clearly linked to known biomarkers of contaminant toxicity and/or to the elucidation of the mechanisms of action for high priority northern contaminants. Proposed projects must use existing, well-validated genomic methods. Projects must ensure relevant and specific informed consent and ethical approvals regarding the use of samples for genomic analysis and that First Nations, Métis and Inuit community or individual approval processes have clearly been obtained.

6.6.1 Health Effects Research and Relevance to Arctic and Northern Indigenous Populations

The population is exposed to a mixture of contaminants rather than individual chemicals. NCP-funded toxicological studies have investigated not only the health effects of individual contaminants but also the effects of mixtures that mimic the exposure profile of highly exposed Northerners. Early results demonstrate that the effects of the mixtures are not necessarily the same as those expected from studies of the effects of individual chemicals and that interactions occur among contaminants. There are different approaches to the study of the effects of contaminant mixtures, and the approach used should be justified with appropriate references. The Organization for Economic Cooperation and Development (OECD) summarizes several of these approaches in the linked document (www.oecd.org/chemicalsafety/risk-assessment/considerations-for-assessing-the-risks-of-combined-exposure-to-multiple-chemicals.pdf).

Arctic epidemiological research is revealing that nutrients found in certain traditional/country marine foods may offer some partial protection from the detrimental health effects of contaminants found in those same foods (e.g. methyl mercury and selenium). Lifestyle factors may also influence the health effects of contaminants. For example, a high percentage of pregnant women report smoking during pregnancy in northern Indigenous communities. In such cases, a host of other chemical contaminants may contribute to (or mitigate) the effects of prenatal exposure to environmental contaminant mixtures.

There are a number of factors that applicants must consider to ensure that studies of effects funded by the NCP are relevant in the Arctic and northern human context. Researchers are required to provide a brief but strong rationale justifying their choices with respect to each of the points below and especially their relevance in the Arctic and northern human context:

- The mixtures of contaminants and nutrients to be used should typify those found in traditional/country food diets or (human) maternal/cord blood, as appropriate.
- While mixture studies are a priority, studies of the effects of individual contaminants will be considered if a strong rationale is provided.
- If the study is *in vitro* or based on laboratory animals, the specific exposures, including nutrients, should take into consideration the actual range of exposure levels (e.g. frequency distributions of exposure) experienced by Arctic and northern residents.
- Residual tissue concentrations of contaminants in laboratory animals should be measured to assess whether they are consistent with those of exposed Arctic and northern human populations.

- Study endpoints need to be able to be interpreted in an Arctic and northern human context (e.g. appropriate neurobehavioural and sensory endpoints).

6.6.2 Health Effects Priorities

The following outlines the priority themes for health effects studies under the NCP:

- Child and maternal health effects including pregnancy complications, endocrine disruption, duration of gestation and fetal growth;
- Physical, motor, cognitive, behavioural, and emotional development from infancy to childhood, adolescence, and adulthood;
- Research into interactions between nutrients and contaminants (e.g. methyl mercury and selenium), particularly in the area of lifestyle, nutritional status and contaminant-related health effects;
- Diabetes, metabolic syndrome, and cardiovascular disease;
- Subclinical effects observed as DNA damage, enzymatic activity variations and other measured changes in studied human biomarkers;
- Other chronic diseases likely to be associated with early-life or multi-exposure scenarios (such as allergy and asthma); and
- Immune system function, especially mild immune system malfunction leading to increased risk of infections.

Health effects studies should take into account co-exposure to mixture of chemicals and factors likely to modulate vulnerability of exposed individuals. Special interest should be devoted to characteristics of the diet of First Nations, Métis and Inuit groups where evidence exists for potential protective strategies such as specific micronutrient intake (e.g. selenium, polyunsaturated fatty acids, vitamins, and antioxidants). For example, interactions between methyl mercury and selenium should be investigated, as well as whether health effects are resulting from high concentrations of contaminants (e.g. selenosis from high selenium concentrations).

It is expected that results from current and previous biomonitoring studies such as the *Inuit Health Survey* and the *Nunavik Child Development Study* will be used to guide future pathways and effects research. The following sections provide further guidance on pathways and effects research priorities for the NCP.

6.7 Benefit/Risk Evaluation

The ability to determine and compare benefits and risks is a key component of the NCP and a current focus of the *Human Health* subprogram. Standard risk assessment methodologies used to assess the potential risks to human health of various contaminants are, in general, well known and have been used for many years. However, their application to populations dependent on the use of traditional/country foods can be problematic because there is little consideration given to benefits, and there are no common metrics to compare multiple risk/benefit scenarios. For example, comparison to a TDI should be considered only a preliminary stage of assessing the overall risk because it does not account for the many health benefits that can be attributed to the consumption of traditional/country foods.

The development of methodologies for assessing the benefits of traditional/country foods is a relatively new area of research, and some of the benefits are only described in subjective terms. These benefits pertain to overall well-being and can be nutritional, physical, social, spiritual and economic, whereas the risks focus on the narrower questions of toxicity and potential health effects. It is, therefore, very difficult to evaluate the benefits against the risks, or vice versa, and considerably more research is required in this area. This requires the input

and participation of regional health authorities who are responsible for any subsequent risk management decisions and/or communication regarding the consumption of traditional/country food. Input from these groups is also important to put the risk of contaminants traditional/country foods in context to other risks they face from other sources (e.g. food security, malnutrition, smoking and substance use).

When developing management strategies to balance the benefits of the traditional/country food diet and the risks from contaminants in that diet, it is crucial to look at the benefits and risks of dietary alternatives (e.g. a typical (affordable) store-bought diet). The benefits and risks associated with store-bought foods are very different from those associated with traditional/country foods, and many of the benefits of the latter would be lost by switching to a store-bought food diet. Techniques to "balance" the benefits and risks of store-bought foods with the traditional/country food diet and the development of management strategies that consider the complete diet require further study. Additionally, increased knowledge of local risk perception and how people make dietary choices is necessary to determine an effective way to decrease barriers to message comprehension.

More research is needed in determining best practices for risk communication (such as the use of social media) and their effectiveness in an Arctic context. Studies that include risk communication activities with affected communities should include follow-up work that evaluates the effectiveness of those risk communication activities. The complexity of evaluation study should not be underestimated. It may be a component of a study, or a stand-alone study on its own, with input and participation from regional health authorities, communities and Indigenous organizations.

Projects that intend to study the evaluation of benefits and risks should focus on those communities considered to be at higher risk, as determined in consultation with public health authorities and First Nations, Métis and Inuit governments/organizations, from contaminants (e.g. communities characterized by high and moderate exposure to contaminants and dependent on a primarily marine mammal diet). Because the fetus, infants and children are often most at risk from contaminants, benefit/risk evaluations and communication should focus on their particular situations. This may require special communication efforts to pregnant women and women of child-bearing age.

6.7.1 Benefit/Risk Evaluation Priorities

The following are the priority areas of NCP *Human Health* research on benefit/risk evaluations:

- Evaluate the effectiveness of risk communication messaging.
- Improve our understanding of the factors influencing Northerners' choice of food and the extent to which contaminants factor into these choices, with particular emphasis on mothers, pregnant women and other women of child-bearing age.
- Evaluate food substitution and other management programs that aim to reduce contaminant exposure in high risk regions but still encourage consumption of highly valued traditional/country foods and other nutritional food sources.
- Carry out benefit/risk evaluations and comparisons with special emphasis on the most highly exposed communities and vulnerable groups (e.g. the fetus, infants and children).

7 – BLUEPRINT FOR ENVIRONMENTAL MONITORING AND RESEARCH

7.1 Purpose

The purpose of the Environmental Monitoring and Research subprogram of the Northern Contaminants Program (NCP) is to:

- Monitor NCP priority contaminant levels and trends in multiple compartments of the Arctic environment.
- Conduct research into the influence of environmental change on concentrations and trends of contaminants in the Arctic environment.
- Conduct research into the effects of contaminants on the health of Arctic ecosystems.
- Support the assessment of human health risks using information on levels and trends of contaminants in traditional/country foods and in Arctic ecosystems.
- Through collaboration and mentorship, support projects that are funded under Community-Based Monitoring and Research, and other NCP subprograms.
- Produce scientific information in support of domestic and international chemical management initiatives.

The annual funding for Environmental Monitoring and Research projects under the Northern Contaminants Program is set at $1,075,000 with $850,000 committed to ongoing core monitoring projects and $225,000 for research projects. In 2023-2024, there is an additional $400,000 available annually for studies or components of studies that focus on plastic pollution and related contaminants. The total amounts of funding available in the 2023-2024, 2024-2025, and 2025-2026 fiscal years, after considering multi-year funding commitments, are shown in Table 1.2.

7.2 Introduction

This Blueprint outlines Environmental Monitoring and Research priorities for the Northern Contaminants Program (NCP). Priorities for monitoring and research are described separately for the Atmosphere and three major ecosystem types: Terrestrial, Freshwater, and Marine. The majority of ecosystem monitoring and research is to be carried out in a limited number of defined "focal ecosystems" so that the activities are closely related and complementary. By concentrating monitoring and research on focal ecosystems, the NCP hopes to develop detailed conceptual models of contaminant dynamics in these ecosystems. Monitoring plans have been designed for optimal detection of temporal trends and to build on ongoing monitoring projects, with robust time series datasets and sample archives. Research priorities are designed to improve our understanding of contaminant-related ecological risks, including: how contaminants enter Arctic ecosystems and cycle within them, how contaminant cycling is influenced by environmental change and the resulting effects on biological exposure, and the combined biological effects of contaminants and climate change on Arctic wildlife.

Additional monitoring activity is being planned in cooperation with the Human Health subprogram and regional health authorities. That cooperation will involve the measurement of contaminant levels in traditional/country foods to assess the dietary exposure of Northerners. Under the Human Health subprogram, the NCP is developing a long-term human biomonitoring plan that includes the collection and analysis of traditional/country food items to conduct these dietary exposure assessments. It is intended that dietary exposure assessments will

be carried out cooperatively by the Environmental Monitoring and Research, Community-Based Monitoring and Research, and Human Health NCP subprograms. Doing so will strengthen the links between the three subprograms and ensure that knowledge about contaminants in Arctic ecosystems will be transferred to the assessment of human health risks. It is important that researchers recognize the link between contaminants in wildlife and human health, especially when monitoring and research is being carried out on species that are frequently harvested by Indigenous communities. The link to human health should be reflected in proposals, and especially in sections related to engagement and communications where regional health authorities have an important role.

Currently, Schedule A POPs (formerly known as "legacy" POPs, see Appendix A) will continue to be measured on a biennial basis as part of wildlife core monitoring program (i.e. every other year), however, Schedule B POPs (i.e. new POPs), and other select Schedule C chemicals of emerging Arctic concern (CEACs) (see Appendix A) will be analyzed annually to ensure the rapid detection of trends. Annual analysis of Schedule B POPs and Schedule C CEACs, i.e. new POPs and those not yet considered POPs by the Stockholm Convention, is important for demonstrating their presence in the Arctic in the least number of years possible.

Found in even the most remote environments, plastic pollution of various size ranges, including microplastic pollution continues to establish itself as a global concern. The NCP has identified the need to improve the detection, sampling and analysis of plastic pollution types and sizes, with a focus on macro and microplastics (fragments less than 5 mm), in Arctic and Northern atmospheric, terrestrial, freshwater, and marine environments and associated wildlife. These research and monitoring activities will contribute to Canada's Plastics Science Agenda (CaPSA), furthering our understanding of the fate and transport of plastic pollution in Arctic ecosystems. International initiatives such as the Arctic Council have also recently focused more attention on litter and microplastics in the marine and terrestrial environments including through the development of the AMAP Litter and Microplastics Monitoring Plan and Monitoring Guidelines. Compared to known and monitored POPs, plastic pollution, and specifically microplastics appear to exhibit similar characteristics of persistence and bioaccumulation in some species. Given that plastic pollution is comprised of dozens of polymers and additives, studies to date indicate that microplastics can act as delivery vectors for chemical contaminant exposure, making them a potential exposure risk to Arctic ecosystems and possibly people. The NCP is taking a stepwise approach to assessing microplastics in the Canadian Arctic as outlined in section 7.3.

The Environmental Monitoring and Research Blueprint specifies some regional priorities for contaminants measurements in certain wildlife species that represent important traditional/country foods but for which there is little recent data on contaminant residues. These regional priorities are specified under Section 7.5 Ecosystem Research and Monitoring and are also highlighted in the Blueprint for Community-Based Monitoring and Research.

7.3 Background

The Arctic is a remote environment, far from major emission sources, with environmental characteristics that make it particularly sensitive to long-range contamination by POPs and heavy metals. Furthermore, some Indigenous peoples in the Arctic who rely on traditional/country foods, particularly marine mammals, as an essential part of their diet are exposed to elevated levels of contaminants in a scenario that is unique to the Arctic. NCP's Contaminants of concern include POPs, mercury, and other chemicals categorized as CEACs for which there is a reasonable probability of Arctic contamination resulting from long-range atmospheric and oceanic transport (see Appendix A for more information on the NCP contaminants of concern). Information related to temporal trends of contaminants in traditional/country food species can be used to forecast potential changes in dietary exposure to contaminants. Similarly, the identification of new chemical contaminants in the environment provides an indication of possible future risks to human health and may lead to preliminary screening of human tissues (e.g. blood) and assessment of dietary exposure.

The successful implementation of international conventions to reduce contaminant emissions is the best method available for reducing contaminant exposure of humans and ecosystems in the Arctic. Arctic monitoring and research are among the most important sources of information for supporting current agreements, including the Stockholm Convention on POPs and the United Nations Economic Commission for Europe (UNECE) Convention on Long-Range Transboundary Air Pollution (CLRTAP) Protocols on POPs and heavy metals, as well as the more recent Minamata Convention on Mercury, which was formally adopted in 2013 and entered into force in August 2017. Each of these international and global agreements have requirements for ongoing monitoring and research, with a particular need for Arctic data and information. Results from NCP monitoring and research will be particularly important for the global monitoring plan established under the Stockholm Convention and being proposed within the Minamata Convention, and for periodic effectiveness evaluations of both Conventions.

One of the main objectives of monitoring contaminants in the Arctic is to assess how the environment is responding to actions taken under the Stockholm and Minamata Conventions and to assess the effectiveness of those actions. Because the Arctic accumulates contaminants primarily from long-range transport, monitoring data on new chemicals in the Arctic are regarded as critical evidence when assessing the need to add new substances to the Stockholm Convention. The NCP needs to ensure that it can provide the most comprehensive and up-to-date datasets possible for substances being considered within the frameworks of these Conventions (see Appendix A for more information on the NCP's contaminants of concern).

The NCP Environmental Monitoring and Research subprogram is also intended to support ongoing assessments of human health risks, and global assessments of contaminants including POPs and mercury under the Arctic Council's Arctic Monitoring and Assessment Programme (AMAP). The NCP is Canada's main contributor of contaminants-related science to the circumpolar Arctic Monitoring and Assessment Programme (AMAP) under the Arctic Council. The NCP works very closely with AMAP and other Arctic nations on circumpolar collaborative monitoring and research activities, as well as on the preparation of scientific assessments. Further information can be found on the AMAP website (www.amap.no). Thus, it is highly encouraged that NCP project leaders and teams participate in circumpolar monitoring networks and collaborations with other Arctic nations on NCP and AMAP priority research is encouraged. Information related to temporal trends in traditional/country food species can be used to forecast potential changes in dietary exposure to contaminants. Similarly, the identification of new chemical contaminants in the environment provides an indication of possible future risks to human health and may lead to preliminary screening of human tissues (e.g. blood) and assessment of dietary exposure.

Interpreting temporal variability in monitoring data and explaining the potential causal influence of global contaminant emissions and their sources can be very difficult. Contaminant concentrations in environmental media may be influenced by numerous factors in addition to global emission sources. For example, environmental changes brought on by climate shifts have been shown to influence temporal trends of contaminant levels quite dramatically. For instance, discerning the sources (anthropogenic or natural) and understanding the dynamic processes responsible for contaminant uptake and accumulation in Arctic food webs presents a particular challenge to the interpretation of trends in mercury. Source apportionment and consideration of changing environmental processes (e.g. with the use of environmental models) for all contaminants will continue to be important topics for NCP research and monitoring.

Levels of contaminants reported in Arctic wildlife can exceed reported thresholds for effects that were established mainly through laboratory-based dosing studies. Since the last time risks to wildlife associated with contaminants were reported in the Canadian Arctic Contaminants Assessment Report III (CACAR III; available on-line: pubs.aina.ucalgary.ca/ncp/79027.pdf), a number of important considerations have come to light which may warrant additional assessment. As already noted, climate change can influence contaminant pathways and processes that will result in modulating levels of exposure among Arctic wildlife. Wildlife are also being put under increasing stress because of climate-related changes in their environment and in food webs that may

make them more vulnerable to the potential risks posed by exposure to contaminants. Comparison of tissue residues to published guidelines and thresholds for effects will continue to be an important aspect of NCP assessment reports; however, it is recognized that these comparisons are of limited value given the lack of thresholds developed specifically for Arctic species. The direct investigation of toxic effects in Arctic wildlife (i.e., toxicological studies) is, therefore, an important element in the ongoing assessment of contaminant-related ecological risks. Submission of research proposals that address these gaps are encouraged, however new methods for effects assessment need to be well supported by proof of concept work and information from the scientific literature.

Plastic pollution, and microplastics (fragments <5 mm) specifically, are global pollutants. Plastic pollution particles vary in size from mega (>200 cm) to nano (<10 µm). Depending on the size and type, plastic pollution can travel long distances through the atmosphere, rivers, and oceans. In addition, depending on the polymer type and additives, plastic pollution can be extremely persistent in the environment, accumulate in some marine organisms, and can be transferred from prey to predator, properties typically associated with POPs. Ingested plastic pollution can inflict physical damage on organisms and/or deliver toxic chemicals, including POPs, to organisms. It has been demonstrated that microplastics can act as vectors for chemical contaminant exposure, therefore, plastic pollution represents a direct exposure risk to Arctic ecosystems and people from the plastic polymer itself as well as posing potential risks due to contaminants that are attracted to and adsorbed by plastic from the ambient environment, though more data are needed on these latter topics.

The NCP began assessing microplastics as long-range pollutants in the Canadian Arctic in 2017-2018, focussing on measuring the presence and spatial distribution of microplastics in the marine environment via water samples, and evaluating long-range atmospheric transport through measurements in Arctic air. These continue to be priorities, along with additional measurements in the abiotic environment, invertebrates, fish and wildlife. The assessment of plastic pollution in seabirds has been supported by the NCP since 2017-2018 through projects that built on the Environmental Monitoring and Research core monitoring program for seabirds. The NCP continues to seek information on the presence, spatial distribution, abundance and types of plastic pollution in freshwater and terrestrial environments in order to comprehensively understand plastic pollution throughout the Northern and Arctic environments of Canada. AMAP has now developed a pan-Arctic Litter and Microplastics Monitoring Plan and Monitoring Guidelines. The NCP encourages projects to implement and adapt these approaches and harmonized protocols to ensure that information on plastic pollution data is comparable across the pan-Arctic region, and with other global monitoring initiatives.

To the greatest extent possible, NCP monitoring and research projects must be carried out in cooperation and collaboration with northern communities, which should begin in the planning stage of the research. Pre-engagement prior to the initiation of any proposal is highly encouraged. Researchers are advised to contact Regional Contaminants Committee (RCC) members who can provide valuable feedback during project and proposal development, as well as contacts in the community/communities of interest. In the case of wildlife sampling, collections should be carried out in association with regular community harvesting. In cases where harvesting may have been limited because of concerns regarding regional population numbers (e.g. polar bears, barren ground caribou) the project leaders are encouraged to work with community members to develop or apply non-destructive techniques for sampling wildlife independently or in combination with approved tissue collections. Collection of fat biopsies or fur/hair (for example) in addition to tissue sampling in collaboration with subsistence hunters can provide valuable comparative information between sample types and methods.

Project leaders are asked to work with community members to utilize Indigenous Knowledge and have Indigenous Knowledge holders as part of their projects at all stages including project development, sample collection, data analysis/interpretation and in communicating results. The project leaders must provide results to the appropriate RCCs for review before disseminating any contaminant-related or health results and information to communities. If results indicate that any contaminants or other health indicators in wildlife are a

concern or risk to the health of Northerners, regional and territorial health authorities should be consulted in conjunction with the RCCs before any information is communicated to communities to avoid miscommunication regarding food safety issues. This might, for example, include the documentation of observations made through the course of sampling and related to the state of individual specimens being collected and the environment from which they are collected, including the Global Positioning System (GPS) coordinates of the sampling location. These observations must be reported and the information attributed to the individual that provided it. Project leaders are encouraged to develop projects under the Community-Based Monitoring and Research Subprogram where possible and participate when proposals are led or co-led by local partners in Northern communities. Community-Based Monitoring and Research projects often utilize Indigenous Knowledge and can complement and enhance Environmental Monitoring and Research projects.

7.4 Atmospheric Monitoring and Research

Monitoring contaminant levels in the atmosphere over the Arctic continues to be a priority under the NCP. The NCP will participate in internationally coordinated air monitoring activities through the Arctic Council's AMAP. Air monitoring data collected at Alert and Little Fox Lake continues to be a major contribution to AMAP by the NCP. Data collected since 1992 will be used to evaluate temporal trends of atmospheric input of contaminants and to monitor current source regions and validate global long-range transport models. Monitoring will contribute key data to evaluate the overall effectiveness of the provisions outlined in the Stockholm Convention and the CLRTAP protocols on POPs and heavy metals. Another priority for atmospheric monitoring will continue to be measuring new substances that demonstrate a reasonable probability of Arctic contamination as a result of long-range transport. These data are critical to the assessment of potential new POPs and other CEACs (see Appendix A, Schedule B and C Contaminants) and their possible incorporation into international conventions. Temporal trend data will also be used to provide a general indication of whether or not contaminant input to the Arctic ecosystem is increasing or decreasing, a critical question for consumers of traditional/country foods.

The current NCP priorities incorporate continuous automated monitoring of mercury and active air sampling of POPs using a high volume air sampler at Little Fox Lake, Yukon, and POPs and mercury at Alert, Nunavut, which is the longest running air monitoring station in the Arctic. Since 2014, the NCP has expanded the air monitoring network with the addition of 7 passive monitoring stations distributed across all 5 Arctic regions. This expansion will be extremely valuable in providing a more geographically complete picture of atmospheric contamination, including POPs and mercury, and assessing global transport pathways and sources. The NCP's passive sampling network is integrated with the Global Atmospheric Passive Sampling (GAPS) network which is one of the primary sources of POPs monitoring data to the global monitoring plan under the Stockholm Convention. This network is also integrated with the ECCC global passive sampling project to monitor mercury in the air on a global scale. The use of models, or other methods, in collaboration with other programs/projects (e.g. ArcticNet), should be employed to evaluate global atmospheric pathways and potential sources associated with the trends observed at Alert and Little Fox Lake. Models may also be used to provide more detailed information on atmospheric contaminant distribution and deposition across the Canadian Arctic. These efforts should now be enhanced by integration of data from the 7 new passive monitoring stations being incorporated into the NCP air monitoring network. Snow is also collected at some air monitoring sites to assess deposition of contaminants in precipitation, which is an important pathway for contaminants to terrestrial, freshwater, and marine systems.

7.4.1 Priorities for atmospheric monitoring

The following priorities have been established for atmospheric monitoring:

- *Mercury in the atmosphere*: Monitoring of atmospheric concentrations and deposition of mercury at Alert and Little Fox Lake will allow assessment of the temporal trends for mercury deposition and advance our

understanding of atmospheric processes that may influence levels and trends being observed throughout the Arctic environment. This project is led by Alexandra Steffen, Environment and Climate Change Canada.

- *POPs in the atmosphere*: Monitoring atmospheric concentrations of contaminants, including POPs and CEACs (see Appendix A) at Alert will allow for the assessment of temporal trends and the advancement of our understanding of atmospheric processes that may influence levels and trends being observed throughout the Arctic environment. Samples should continue to be collected weekly; however, only one out of four weekly samples will be analyzed for routine trend analysis and the remaining samples will be archived. Passive air sampling with a flow-through air sampler at the Yukon site of Little Fox Lake has been changed to a high-volume air sampler as of summer 2022, which can capture Chemicals of Emerging Arctic Concern (CEACs), including per- and polyfluoroalkyl substances (PFASs), to assess long-range transport from the Pacific Rim. This project is led by Hayley Hung, Environment and Climate Change Canada.

- *Passive air sampling*: This network expands the geographic coverage of the air monitoring program by developing, installing and operating passive air sampling devices capable of operating remotely under Arctic conditions. This is complementary to the work at Alert and Little Fox Lake. A network of passive air samplers in the Arctic could be an important contribution to the global monitoring network that was established to provide monitoring data to the Stockholm Convention and CLRTAP, and will play a role in the effectiveness evaluation for the Minamata Convention. Passive air sampling can be used to determine latitudinal and longitudinal gradients in air concentrations from which empirical estimates of characteristic travel distances (CTDs) can be made. Such information can be used to verify and improve the CTD estimates of long-range atmospheric transport models. Currently, passive air sampling sites have been installed and are operating in Nunatsiavut (Nain and Northwest River), Nunavut (Iqaluit and Cambridge Bay), Nunavik (Kuujjuaq) and Northwest Territories (Inuvik and Fort Resolution). This project is led by Hayley Hung and Alexandra Steffen, Environment and Climate Change Canada.

- *Plastics in the atmosphere*: Atmospheric circulation and wind represent a pathway for microplastics to enter the Arctic environment. Knowledge of microplastic contamination in air is limited and the presence of synthetic fibers in snow infers potential deposition by air currents. Air deposition may also represent a significant input into marine and freshwater systems. The identification and quantification as well as the occurrence, characteristics and distribution of airborne plastic contamination in Arctic and Northern regions represent a significant knowledge gap. Co-Monitoring POPs or CEACs along with microplastic pollution can also provide information on the sources, transport and fate of plastic-derived or associated contaminants.

7.4.2 Priorities for atmospheric research

- Assess long-range atmospheric transport of microplastics to the Canadian Arctic. This includes the identification and quantification as well as the occurrence, characteristics, distribution and deposition of airborne plastic contamination in Arctic and Northern regions, and the development of related standard protocols and approaches for research and monitoring.
- Assess how the changing ice conditions in the Canadian Arctic affect mercury, POPs, CEACs, and microplastics deposition and cycling in the air-sea ice-water system. This includes the investigation of the occurrence, distribution and transport pathways of these contaminants between the atmosphere, different types of ice/snow (multi-year ice, first-year ice, frost flowers and snow) and the sea water. In addition, how the changing environment and biogeochemical cycle of the air-sea ice-water system affect the distribution and cycling of contaminants.

7.5 Ecosystem-based monitoring and research

Under the Blueprint, ecosystem-based monitoring and research will focus on several geographic areas encompassing locations of past monitoring and research activity on which the current Blueprint aims to build. A number of focal ecosystems have been chosen among Arctic marine, freshwater and terrestrial environments. It is intended that monitoring and research in focal ecosystems will complement one another and will contribute to future synthesis and integration studies. This will further refine our understanding of contaminant cycling in these specific ecosystems, and consider the influence of climate change. While much of the ecosystem research and monitoring should concentrate on the focal ecosystems, research at other locations that contributes to a general understanding of contaminant pathways, processes and effects will also be considered. This section describes monitoring and research priorities for each of the ecosystem types and specific focal ecosystems. There are, however, a number of common elements to monitoring and research across all ecosystem types which are described below. Note that research related to wildlife often requires specific permits from the territory where the study is taking place. Please ensure that these are in place prior to any work commencing. For information on requirements for wildlife and other scientific permits, contact the appropriate territorial government authority and the relevant RCC if guidance is needed. When planning to sample wildlife tissues for contaminant analysis, researchers are asked to consult with communities and RCCs to assess which tissues are the most relevant for consumption and include those in the study.

Monitoring

The focus of the current ecosystem monitoring plan is to measure long-term trends and variability in contaminant concentrations in Arctic biota. The plan builds on projects to monitor temporal trends established in 2004 whereby samples from a number of key species at several locations across the Canadian Arctic are collected and analyzed annually to maximize the statistical power of the temporal datasets. Species were selected based on the important role they play in their respective ecosystems and their importance to Indigenous communities (see Section 7.7).

As the temporal datasets become longer and more robust, the monitoring objective has been improved from the detection of a 10 % change over 10 to 15 years, to detection of a 5% change over a 10 to15-year period with a power of 80 % and confidence level of 95%, which is a common objective of monitoring under NCP and AMAP. The annual collection and analysis of 10 samples per species and location is felt to be sufficient to achieve this goal; however, the inclusion of more samples may be acceptable if it significantly improves the trend analysis and is economically feasible (e.g. mercury). For the assessment of temporal trends in biota every effort should be made to explain, and control for, variance components by considering confounding factors such as age, sex and time of collection. Ancillary data such as lipid content, stable isotope ratios, fatty acid profiles, and body condition should be included as needed to help explain and correct for confounding variance in the data.

Along with monitoring contaminant trends in biota, the long-term monitoring plan for marine ecosystems includes annual monitoring of seawater for POPs and mercury. Vertical profiles are collected for contaminant concentrations and include standard oceanographic data (e.g. salinity, temperature, nutrients, particulate organic carbon (POC), dissolved organic carbon (DOC), $\partial^{18}O$, tracers such as SF6, and inorganic carbon), as well as data for zooplankton and forage fish where possible. In the case of mercury, data collection should include full speciation (Hg(II), methylmercury, particulate mercury) and for POPs, it should include the full suite of POPs and CEACs when possible.

The CACAR III POPs report demonstrated that nearly all of the monitoring projects have produced some statistically significant trends for POPs. The results show that most Schedule A contaminants (Appendix A) covered by international regulations have been decreasing in environmental compartments, wildlife, fish and humans. It was therefore decided that the frequency of Schedule A POPs analysis would be decreased to every

other year (biennial). This decrease in monitoring frequency will have a minimal impact on the program's ability to measure temporal trends of Schedule A POPs based on the last statistical assessment of the program. Since sampling will continue on an annual basis for POPs listed in Schedule B and CEACs in Schedule C (Appendix A), sample archives could be used in future years on a case by case basis to investigate certain trends with annual data, this could include research on climate related drivers of contaminant trends. The analysis of POPs listed in Schedule A is also staggered among the different monitoring projects to even out the analytical budget. Schedule B POPs require annual monitoring to quickly detect trends and changes in those trends. In the case of new chemicals (CEACs), annual monitoring aids in definitively establishing their presence in Arctic ecosystems over several consecutive years.

Research

Ecosystem-based contaminants research is intended to improve our understanding of contaminant pathways, processes and the effects of contaminants on the health of Arctic wildlife. Research projects should be formed around a set of clearly rationalized hypotheses related to the priorities described in this Blueprint. Results of this research will contribute to our interpretation of temporal trends and/or variability, particularly as they relate to the influence of climate change and changing sources (i.e., global emissions). While building on our current understanding of POPs listed in Schedule A and mercury remains a priority, there is also a need to learn about recently regulated or CEACs, such as halogenated organic chemicals such as fluorinated (e.g. perfluorinated alkyl substances (PFAS), brominated (e.g. polybrominated diphenyl ethers (PBDEs) and PBDE replacements), and chlorinated (e.g. current-use pesticides) contaminants that have the potential for long-range transport and Arctic contamination. Studies related to ecosystem pathways and processes are required in each of the ecosystem types (i.e., terrestrial, freshwater and marine).

There is still a need for more field data on microplastics in Arctic environmental media and biota, so the NCP has identified assessing the presence and distribution of microplastics in marine, freshwater and terrestrial ecosystems as an ongoing priority. Potential matrices for long-term monitoring have been identified as: freshwater fish, marine fish, seabirds (northern fulmars, thick-billed murres, common eiders, black-legged kittiwakes), and mammals (beluga, polar bears, ringed seals), as well as air, snow, ice, fresh water, seawater, and sediments. From an international monitoring perspective, the AMAP Litter and Microplastics Monitoring Plan prioritized annual monitoring in the following environmental compartments: Priority 1: beaches/shorelines, water, sediments and seabirds; Priority 2: air, invertebrates and fish; and Priority 3: snow/ice, seabed, terrestrial soils and mammals. Applicants should keep these priorities in mind when designing their research proposals.

The investigation of contaminant-related effects in wildlife should focus on those species that, based on the best available information, are at greatest risk and/or may be significant to human exposure. The most important considerations should be the current level of exposure, the expected changes in exposure (i.e., are levels increasing or expected to increase), the potential vulnerability of a given population to toxic effects (e.g. some species may have diminished health status as a result of climate-related stresses), and whether or not the species is consumed by people. Based on these considerations, species that might be considered for effects studies include polar bear, beluga, seabirds and ringed seal.

Wildlife effects studies should include the measurement of a suite of endpoints designed to provide a comprehensive assessment of contaminant related biological effects. These endpoints should be designed to detect changes in key biological systems (e.g. immune, reproductive, metabolic and neurological) that could be compromised by contaminant exposure. It is recognized that studies on wildlife in their natural environment can at best establish associations between contaminant exposure and effects. A weight-of-evidence approach, which considers multiple lines of evidence from both wildlife studies and laboratory studies where causative relationships between contaminants and effects can be established, is a sound approach to assess the impact of contaminants on wildlife and ecosystem health. Proposals that study cumulative effects of contaminants and other stressors (e.g. climate change, disease, parasites) on the health of wildlife such as omics (metabolomics,

transcriptomics, genomics) and One Health approaches are also encouraged, but methods, objectives and value of the research to Northerners should be thoroughly described. Note that the NCP will fund contaminants-related components of these studies, but additional sources of funding should be included to address the other factors. Ultimately, the health and food safety and security of Northern Indigenous populations are intimately linked to the health of Arctic ecosystems which represent a source of traditional/country foods and social and cultural well-being.

In 2018-2019, some RCCs identified the need for new information on contaminant levels in certain wildlife species that are important to the traditional diet of Indigenous Peoples. These priority species are identified in the following sections.

7.5.1 Terrestrial ecosystems

The focal ecosystem for the purpose of research is the range of the Porcupine caribou herd.

Monitoring

The Porcupine caribou herd (sampled in Yukon) and the Qamanirjuaq Caribou herd (sampled from Arviat) are monitored annually for mercury and inorganic elements. Samples will also be analyzed for new POPs including PBDEs and PFAS categorized as perfluoroalkyl acids (PFAAs, see Appendix A, Schedule B) and selected precursors. Caribou fat and liver provide an opportunity to assess temporal trends of new POP and CEACs in an important terrestrial species with an archive of samples for retrospective analysis if merited. This monitoring is led by Mary Gamberg, Gamberg Consulting, Whitehorse, Yukon.

In order to update contaminant information on caribou herds and reindeer herds (where applicable) from across the Canadian Arctic, the Blueprint now provides for periodic monitoring of the 12 herds that are not routinely monitored for temporal trends. One or two additional caribou herds will be sampled each year as part of the NCP core program when the budget allows for it. The choice of herds will be determined in consultation with RCCs and based on 1) level of use, 2) length of time since the last sampling campaign and 3) ease of sampling. Ideally, sampling would occur as part of ongoing body condition or community monitoring programs (i.e. supported by territorial governments), which would minimize the cost to NCP.

Research

The following bullets outline research priorities in terrestrial ecosystems:

- Uptake and accumulation of contaminants in terrestrial food webs with a focus on new contaminants that display a high potential for accumulation in terrestrial food webs.
- Influence of climate-induced changes on terrestrial ecosystem contaminant cycles.
- Physical-chemical processes related to mercury in Arctic soils, with a focus on fluxes to and from the atmosphere from different media (soils, snow, ice), and characterization of soils as a source or sink in the Arctic mercury cycle under a variety of climatic conditions.
- Development of standard protocols and approaches for research and monitoring of plastics.
- Nunavut and the Yukon have expressed an interest in contaminant levels in edible plants. These proposals should focus on contaminants delivered by long range transport (see Appendix A), and not those originating from local sources where possible.

7.5.2 Freshwater ecosystems

The focal ecosystems are: Kusawa Lake, Yukon; Great Slave Lake, NWT; and High Arctic lakes on Cornwallis and Ellesmere Islands, Nunavut.

Monitoring

The following freshwater ecosystems areas are the priority areas being monitored:

- Kusawa Lake and Lake Laberge:[2] lake trout are monitored annually for mercury and new POPs. Biennial monitoring of legacy POPs will take place during even numbered sampling years (i.e. 2022, 2024,...). This project is led by Mary Gamberg of Gamberg Consulting on behalf of the Yukon Contaminants Committee.
- Great Slave Lake: lake trout and burbot are monitored annually for mercury and new POPs. Biennial monitoring of legacy POPs will take place during odd numbered sampling years (i.e. 2023, 2025,...). This project is led by Marlene Evans of Environment and Climate Change Canada.
- Fort Good Hope: burbot are monitored annually for mercury and new POPs. Biennial monitoring of legacy POPs will take place during odd numbered sampling years (i.e. 2023, 2025, ...). This project is currently led by Gary Stern and Paloma Carvalho of the University of Manitoba.
- High Arctic lakes: land-locked arctic char are monitored annually for mercury and new POPs. Biennial monitoring of legacy POPs will take place during odd numbered sampling years (i.e. 2023, 2025, ...). This project is led by Derek Muir and Jane Kirk of Environment and Climate Change Canada.

Research

The following bullet outlines research priorities in freshwater ecosystems:

- Ecosystem changes in focal ecosystem lakes and impacts of these changes on contaminant dynamics in the system, particularly how climate change might influence levels and trends in key monitoring species (i.e. lake trout, char and burbot).
- The potential impact of expanding species ranges of temperate species on contaminant pathways, e.g. the expansion of Pacific salmon into the Mackenzie River via the Arctic Ocean.
- Given the importance of nutrient enrichment and food web transfer of methylmercury in freshwater systems, more information is needed on mercury and nutrient pathways through freshwater food webs.
- The Yukon and Nunavut have identified the need for information on mercury concentrations in predatory fish species (e.g. lake trout) from lakes and rivers throughout the territories where these fish are commonly harvested.
- Updates to mercury assessments for lakes in the Northwest Territories for which consumption advice has been issued and for which individual communities have requested additional study of local lakes. Impacts of high mercury concentrations on fish health based on these assessments could also be useful.
- Identification of methylmercury hotspots within a given ecosystem and subsequent identification of factors affecting mercury methylation rates and spatial variability within and between lakes, rivers and delta ecosystems.
- Assessing contaminant fate and pathways in the Mackenzie Delta, a highly productive system that transports large volumes of water and organic matter into larger water bodies such as lakes and the Beaufort Sea. Estuaries could also merit attention, e.g. the Husky Lakes (Inuvialuit Settlement Region).
- There is a need for information on the distribution, sources, transport and fate of microplastics in Arctic freshwater ecosystems

[2] Continuation of monitoring at Lake Laberge and Fort Good Hope aims to build on long existing time series, although neither of these are considered focal ecosystems for the purpose of ecosystem research.

7.5.3 Marine ecosystems

The Focal ecosystems are: Beaufort Sea/Amundsen Gulf, Barrow Strait/Lancaster Sound, Cumberland Sound/Davis Strait, Hudson Bay, Labrador Sea (coastal waters), and the Dease Strait/Queen Maud Gulf.

Monitoring

The following bullets outline species and sampling locations for monitoring in marine ecosystems.

- Ringed seal: Sachs Harbour (Beaufort Sea/Amundsen Gulf), Resolute (Barrow Strait/Lancaster Sound), Arviat (Hudson Bay), and Nain (Labrador Sea) are monitored annually for mercury and new POPs and CEACs. Biennial monitoring of legacy POPs will take place during even numbered sampling years (i.e. 2022, 2024,...). This project is led by Magali Houde, and Derek Muir of Environment and Climate Change Canada, and with Steve Ferguson of Fisheries and Oceans Canada.
- Beluga: Hendrickson Island (Beaufort Sea/Amundsen Gulf), Pangnirtung (Cumberland Sound), and Sanikiluaq (Nunavut) are monitored annually for mercury and new POPs. Biennial monitoring of legacy POPs will take place during odd numbered sampling years (i.e. 2023, 2025,...). This project is led by Lisa Loseto, Cortney Watt, and Steve Ferguson of Fisheries and Oceans Canada.
- Polar bear: Hudson Bay population (Hudson Bay) are monitored annually for mercury and new POPs (CEACs). Biennial monitoring of legacy POPs will take place during even numbered sampling years (i.e. 2022, 2024,...). Samples from the Baffin Bay subpopulation are also collected and archived annually for potential retrospective studies if needed. This project is led by Robert Letcher of Environment and Climate Change Canada.
- Seabird eggs: thick-billed murres and northern fulmars from Prince Leopold Island (Barrow Strait/Lancaster Sound), thick-billed murres from Coats Island (Hudson Bay) are monitored annually for mercury and new POPs (CEACs). Biennial monitoring of legacy POPs will take place during even numbered sampling years (i.e. 2022, 2024,...). This project is led by Jennifer Provencher of Environment and Climate Change Canada.
- Sea-run Arctic char: Cambridge Bay (Beaufort Sea/Amundsen Gulf) are monitored annually for mercury. This project is led by Marlene Evans of Environment and Climate Change Canada.
- Ship-based monitoring of POPs in seawater with concurrent air monitoring. This project is led by Liisa Jantunen of Environment and Climate Change Canada, and carried out in conjunction with ArcticNet aboard the CCGS *Amundsen* and other Canadian Coast Guard ships.
- Community centred monitoring of POPs and mercury in seawater. Currently based in Resolute, Nain, and Cambridge Bay. This project is led by Amila De Silva, Jane Kirk, Derek Muir, and Amber Gleason of Environment and Climate Change Canada.

Research

The following bullets outline research priorities in marine ecosystems.

- Contaminant distribution (particularly for CEACs) in marine food webs with a focus on marine fishes and other species that represent forage for key monitoring species.
- Ecosystem changes in focal marine areas and the impact of these changes on contaminant dynamics in the system, particularly how change might influence levels and trends in key monitoring species (e.g. ringed seal).
- Contaminant-related effects in wildlife with a focus on those species that, based on the best available information, are at greatest risk or may serve as early warning indicators of effects in humans. Important considerations should be: the level of contaminant exposure and expected changes in exposure, and the

potential vulnerability of a given wildlife population to potential effects (e.g. diminished health status as a result of climate-related stresses).

- Collaborations between wildlife research project leaders and health experts to include biological information about diseases, parasites, etc. in addition and in relation to contaminant levels (e.g. cumulative effects or a One Health approach) are encouraged. Note that the NCP will fund contaminants-related components of these studies, but additional sources of funding should be included to address the other factors.
- Nunavut has identified the need for updated information on contaminant levels in killer whales, narwhal, walrus, harp seal, and shellfish particularly from areas where they are commonly harvested.
- Nunatsiavut has identified the need for information on contaminant levels in porpoise, known locally as jumpers.
- Nunavik is interested in PFAS measurements in wildlife in the Hudson Bay area.
- Comparison of mercury methylation and bioavailability of methylmercury at sites with large tidal ranges (e.g. Hudson Bay, Frobisher Bay) compared with those with low tidal ranges.
- Assess the presence and distribution of plastic pollution in the abiotic environment of marine (as well freshwater and terrestrial) ecosystems to advance understanding of the sources (long range vs. local), pathways, and environmental fate of plastic pollution in northern ecosystems, via the implementation of standard protocols and harmonized approaches for research and monitoring plastic pollution.
- Assess the presence, abundance, and type of plastic pollution in invertebrates, fish, seabirds and marine mammals to further describe the fate of plastics in the environment and gauge potential risks to wildlife health.
- Evaluate the environmental fate and transformation processes (e.g. fragmentation, degradation, and adsorption/leaching of contaminants) of plastic pollution in the ocean under Arctic conditions.
- Measure the levels of plastic associated contaminants (additives) in the Arctic environment and biota, specifically marine mammals, birds and fish.

7.6 Contaminants of Interest

Researchers are asked to rationalize an analytical program and schedule that best suits the proposed project. Substances that are either currently included in or are being considered for inclusion in international conventions are identified and discussed in Appendix A. An important function of the NCP is to provide monitoring data on substances that are already covered by these conventions. However, the NCP needs to ensure that it can provide the most complete dataset possible for substances under consideration, particularly those substances that are chemicals of emerging Arctic concern (CEACs). The NCP prioritizes contaminants delivered through long-range transport processes rather than those with a largely local source, so analytical programs should be reflective of this priority. Samples should also be screened for CEACs that demonstrate the potential for Arctic contamination but have yet to be identified in the Arctic environment. Because the presence of a chemical in a remote environment such as the Arctic automatically implies that it is persistent and subject to long-range transport, this evidence is critical to domestic and international chemical assessment activities. Analytical proposals to measure new contaminants should be well justified, using physicochemical properties, modelling results and existing data to demonstrate the potential for long-range transport and Arctic contamination and should not be "fishing expeditions" for a large array of contaminants that have little chance of accumulating in the North. Plastic pollution and plastic-derived contaminants are now also included as CEACs, as they exhibit similar characteristics of POPs and have been detected in environmental media and Arctic species occupying most trophic levels.

7.7 Selection of Species for Long-Term Trend Monitoring

It should be noted that the vast majority of samples collected for NCP research and monitoring are collected by hunters from nearby communities as part of their subsistence hunting activities. When possible, GPS coordinates should be captured when samples are collected. Morphometric and condition information (length, girth, fat thickness, weight) should also be included as these have been identified by RCCs as important to Northern communities as well as to contaminant data interpretation by researchers. Project leaders for these long-term trend monitoring projects have already been identified, and funding has been committed for this work.

7.7.1 Ringed seal

Ringed seal, a widely distributed species found throughout the circumpolar Arctic, is an important traditional/country food species for Inuit. Contaminants have been measured in samples of ringed seal collected near Arctic communities, such as Resolute, over the past twenty-five years and represent an excellent opportunity to study temporal trends. A number of other Arctic countries also maintain ringed seal monitoring programs which provides the opportunity for international comparisons, particularly through the NCP's participation in AMAP. Ringed seals will be sampled annually under this program with the help of hunters from the communities of Sachs Harbour, Resolute, Arviat and Nain. These four locations represent very different regions in the Canadian Arctic that are experiencing varying degrees of climate change and contaminant input.

7.7.2 Beluga whales

Beluga whales are an important traditional/country food species for many Arctic communities. Samples of beluga have been collected from places such as the Mackenzie Delta, Hudson Bay and Pangnirtung at various times over the past twenty-five years and analyzed for contaminants. The existing temporal dataset for this species will be augmented with annual sampling at Hendrickson Island in the Mackenzie Delta, Cumberland Sound and Hudson Bay by hunters from Tuktoyaktuk, Pangnirtung, and Sanikiluaq. This monitoring plan will allow researchers to compare beluga from the western and eastern Arctic as well as Hudson Bay. These areas have regional differences with respect to the impacts of climate change and contaminant inputs.

7.7.3 Polar bear

Polar bears are the top predators in the Arctic marine food chain and have the highest concentration of some contaminants found in the Arctic. Polar bear meat is consumed by Inuit and the animal has special socio-cultural and economic importance (through commercial hunts) to Inuit communities. As with other species, polar bears have been sampled periodically in the past and analyzed for contaminants. The most extensive temporal dataset for contaminants in polar bear has been collected for Hudson Bay (Western and Southern Hudson Bay subpopulations), which is also Canada's most southerly Arctic sea and is expected to undergo the most rapid climate change. Recent results from ongoing monitoring of polar bear in Hudson Bay over the last few decades have suggested that the dietary habits of polar bear have already changed and continue to change as a result of climate change, and that this affects contaminant dynamics in these animals substantially.

7.7.4 Seabird eggs

The eggs of seabirds have been used for long-term monitoring of contaminants since the 1970s. The Arctic is an important breeding ground for a large number of seabirds that nest on the rocky shores and cliffs of Arctic islands. During the nesting season seabird eggs are a popular food item for Inuit, for whom collecting and consuming eggs is an important spring tradition and source of nutrition. Since 1975, eggs have been collected

periodically from Prince Leopold Island and Coats Island by Environment and Climate Change Canada and represent one of the best temporal contaminant datasets. Eggs of thick-billed murre and northern fulmar are collected once a year from each of these colonies to build on the past data and improve our assessment of temporal trends. Eggs are ideal for monitoring because they are relatively easy to collect and do not involve killing an adult bird. Seabird eggs are also collected as part of monitoring programs in other Arctic countries, allowing for international comparisons. The two colonies selected for monitoring are located in the High Arctic: Prince Leopold Island and, further south in the mouth of Hudson Bay, Coats Island. These two sites provide opportunities to examine changes over time in two different ecosystems undergoing varying degrees of change. This program samples eggs for three additional species (black-legged kittiwake, black guillemot, glaucous gull) every five years, and adult birds of four species (thick-billed murre, northern fulmar, black-legged kittiwake, black guillemot) every ten years.

7.7.5 Sea-run arctic char

This type of Arctic char is widely distributed throughout the Arctic and is one of the most important traditional/country food species for Arctic people. Char represent a widely available and highly nutritious source of food and is promoted by public health authorities. Char is promoted because contaminant levels are thought to be relatively low in char compared with other traditional/country foods, and it is an excellent source of protein, polyunsaturated fatty acids and other micronutrients. Sea-run char have been collected from communities across the Canadian Arctic and the results confirm that contaminant levels are quite low, particularly in comparison with marine mammals. One location in the central/western Arctic (Cambridge Bay), has been selected for continued annual monitoring to ensure that contaminant levels remain low.

7.7.6 Land-locked arctic char

This species of char is also widely distributed in Arctic lakes and rivers. The NCP has been monitoring land-locked char in High Arctic lakes around the community of Resolute and on Ellesmere Island for the past twenty years and has built strong temporal datasets on contaminant levels. The lakes receive contaminants from the atmosphere and, therefore, are good indicators of changing atmospheric inputs of contaminants. High Arctic lakes are also undergoing significant changes related to climate change which also influence contaminant concentrations in the fish.

7.7.7 Lake trout and burbot

Lake trout and, to a lesser extent, burbot are also important traditional/country food species for many northern communities and like char both are excellent sources of nutrition. Lake trout and burbot can, however, contain fairly high levels of mercury, especially older fish, which can be a significant source of mercury to people who consume it frequently. Trout have been monitored for over twenty years in Yukon and the NWT and burbot are monitored in the NWT only, both of which represent valuable temporal trend datasets. The program will continue to monitor lake trout and burbot annually in the important fishery of Great Slave Lake; burbot caught in the Mackenzie River near Fort Good Hope; and lake trout in Lake Laberge and Kusawa Lake in Yukon.

7.7.8 Caribou

Caribou were selected for temporal trends monitoring because of their importance as a traditional/country food and because there is good historical information on contaminant levels in some herds with most contaminant levels being among the lowest of any traditional/country food species. Two caribou herds were selected for continued annual monitoring of heavy metals and POPs listed in Schedule B: the Porcupine herd and the Qamanirjuaq herds. The range of the Porcupine herd is northern Yukon and Alaska; these areas may be exposed to atmospheric deposition of contaminants originating in Asia, whereas the range of the Qamanirjuaq

herd is from eastern NWT to southern Nunavut and the shores of Hudson Bay, which is more likely to receive atmospheric contaminant input from North America.

8 – BLUEPRINT FOR COMMUNITY-BASED MONITORING AND RESEARCH

8.1 Purpose

The Community-Based Monitoring and Research subprogram aims to promote the application of community knowledge and perceptions within NCP projects. This includes community led projects that are linked to projects funded under the Human Health and Environmental Monitoring and Research subprograms as well as standalone community-based projects that combine Indigenous Knowledge and/or local knowledge with contaminants science.

> Are you a first time applicant? Get in touch with the Northern Contaminants Program Secretariat and we will be happy to guide you through the application process: plcn-ncp@rcaanc-cirnac.gc.ca

Project proposals submitted for consideration under the Community-Based Monitoring and Research subprogram are encouraged to consider focusing on priority species and areas as identified in the Environmental Monitoring and Research Blueprint and on priority areas identified in the Human Health Blueprint, such as dietary choices and risk perception of traditional/country foods.

In addition to the funding priorities outlined below in sections 8.3-8.6, understanding levels of plastic pollution in the environment and wildlife is a particular priority for NCP this year. Also, projects that address both NCP priorities and climate change questions will be of particular interest.

To be eligible for funding under the Community-Based Monitoring and Research subprogram, projects **must be led or co-led by a community organization or a northern based institution**. Eligible northern based institutions include Hunters and Trappers Committees, community research organizations, Arctic College facilities (such as Aurora Research Institute, Nunavut Research Institute, etc.), territorial/northern regional governments and other community-based groups. Additionally, it is expected that the majority of the project funds are to be allocated to activities and services in the North. For exceptions to this, a justification must be provided. For further guidance on eligibility, please contact the NCP Secretariat.

The annual funding for Community-Based Monitoring and Research projects under the Northern Contaminants Program is currently set at $230,000 total. In 2023-2024 there is an additional $130,000 available for studies or components of studies that focus on plastic pollution and related contaminants. The total amounts of funding available through this call for proposals in the 2023-2024, 2024-2025, and 2025-2026 fiscal years, after considering multi-year funding commitments, are shown in Table 1.2.

8.2 Introduction

Projects currently being carried out under the Environmental Monitoring and Research subprogram are measuring the temporal trends of contaminants in specific fish and wildlife species at a limited number of locations and conducting research to improve our understanding of how contaminants move through the environment.

Projects under the Human Health subprogram focus on research issues and questions to enable Northerners to assess, understand and better manage the health risks in Northern Canada related to the long-range transport of contaminants and their subsequent presence in people and traditional/country foods.

It has become increasingly evident that the changing climate is having significant effects on ecosystem structure and function in the Arctic. These ecosystem changes could influence contaminant uptake and accumulation in the food web, which in turn could affect contaminant concentrations in the fauna and flora that the NCP is monitoring (complete list of species available in Environmental Monitoring and Research Blueprint).

8.3 Community Knowledge and Environmental Trends

In order to make the link between trends (year-to-year changes) and contaminants emissions worldwide, there is a need to understand the cause of the trends, and this requires knowledge of how the ecosystem has changed over the monitoring period.

Community members have been keen observers of the environment and biological systems that sustain their communities for thousands of years, including during the period of recent dramatic climate-driven changes in the Arctic, and also since the NCP began its monitoring program. Hunters and community members are in the best position to assess future trends and substantiate truth modeling results. With ongoing observations, hunters and community members will also be able to collect the data that supports their local priorities in a way that can help them to quantify or test relevant predictions. This understanding of Arctic ecosystems can make a significant contribution to the understanding of temporal trends in contaminant concentrations and the far reaching impacts of worldwide pollution. Advances in observational techniques, mobile technologies and community capacity, amongst other things, are increasing the ability to systematically document these local observations or indicators in a way that is understandable for the community and hunters, be useful to contaminant research scientists, and support international initiatives to reduce emissions of these long range contaminants. The NCP encourages the use of these and other innovative tools.

Project teams are encouraged to include researchers who have expertise working with communities and using participatory research methods. Project teams will be encouraged to collaborate with past and current NCP scientists whose work pertains to the species and focal ecosystem proposed for study by the project team. The goal of the project should be to document and analyse local observations and Indigenous Knowledge on the ecology of key NCP monitoring species and changes over time. Please contact the NCP Secretariat for contact information and further details on past and current NCP scientists that have worked on species and focal ecosystems in your area of interest.

8.4 Monitoring the effects of climate change in your community

Climate change can affect the circulation and concentrations of contaminants in the environment, including in wildlife species that are important to the traditional diets of northern Indigenous peoples.

Projects studying this link should involve community members in the monitoring of climate change variables that will provide the data necessary to support adaptation activities and fill knowledge gaps in Canada's North. Areas of interest include trends and changes in flora, fauna, permafrost, sea ice conditions, flooding events, etc.

8.5 Community Studies on Diet Choices and Risk Perception of Traditional/Country Foods

There is a need for timely, relevant information about food choices. In order to fully understand how people perceive the dietary choices available to them, and the extent to which contaminants play a role in their choices, it is important to have up-to-date information from the communities. Additionally, a further understanding of how Northerners perceive the risks of long-range, transboundary contaminants is important, because this can help us to communicate information about contaminants in a way that is more effective and useful for communities.

Projects in this category may focus on how risk perceptions and dietary choices have changed over time or may focus on current perceptions about contaminant risk in relation to food.

The following are projects that could be funded in this category:

- Community survey (e.g. in person, web-based, on mobile, etc.) of the factors influencing household diet choices and whether knowledge of contaminants plays a role.
- Study of a community's perception of the risks associated with long-range contaminants in traditional/country foods.

8.6 Other Community-based Monitoring and Research Initiatives

The NCP is soliciting community and/or regionally led proposals to conduct small-scale and short duration monitoring activities related to **contaminants from long-range sources**. At the same time, local sources also exist, and NCP recognizes a need to be able to distinguish between long-range sources and local emissions in the North.

Projects under this category could include sampling and analysis of important traditional/country foods for contaminants that may pose a risk to human health and for which recent contaminant information is not available. This is also an opportunity for communities to become involved with new passive air sampling tools for persistent organic pollutants (POPs). The NCP also supports community-based monitoring and research on plastics and microplastics, and encourages communities to consider research areas for plastics identified in the Environmental Monitoring and Research subprogram Blueprint. Shoreline surveys for plastic pollution, or beach monitoring can be implemented by a variety of people and does not require specialized equipment. If submitting a plastics focused proposal, applicants should consult the AMAP Litter and Microplastics Monitoring Plan and Monitoring Guidelines.

Projects that incorporate educational and training opportunities for local students and community members interested in environmental science, public health and/or community wellness into project activities are encouraged.

8.7 Further Guidance

Projects under the Community-Based Monitoring and Research subprogram should be coordinated at a regional level with the assistance of the pertinent Regional Contaminants Committees (RCCs). Proposals to measure contaminants in traditional/country foods should be developed in consultation with regional health authorities so that data can be properly used for dietary exposure assessment. Regional health authorities are also responsible for developing and communicating health-related information in the region and will, therefore, need to be key partners in any community-based monitoring project with implications for human health.

Projects should complement, not duplicate, existing Environmental Monitoring and Research subprogram projects. Applicants should also look for ways to complement other programs and build on existing monitoring activities.

Territorial departments of natural resources and other regional wildlife and fisheries management agencies may also be useful project partners.

Applicants wishing to submit a proposal under the Community-Based Monitoring and Research Blueprint are encouraged to work with NCP scientists who have expertise in the methods needed to accurately measure contaminant levels in environmental samples. It is important that the results of community knowledge projects be of the same internationally-recognized high quality as the results produced under other NCP subprograms. In addition, applicants are encouraged to consult with experts in participatory research methods to ensure rigour in the research design and methods expected in these kinds of projects. Participating analytical laboratories must follow rigorous quality assurance/quality control (QA/QC) practices and participate in the NCP's interlaboratory QA/QC program. Contact the NCP secretariat for more details on the QA/QC program.

When looking for guidance on proposal development, including ideas for potential projects and partners, applicants are encouraged to contact the chairs of their respective RCCs (see Contacts in Appendix B).

9 – BLUEPRINT FOR COMMUNICATIONS, CAPACITY AND OUTREACH

9.1 Introduction

This blueprint outlines the funding priorities under the Communications, Capacity and Outreach subprogram of the NCP.

The total amounts of funding available through this call for proposals in the 2023-2024, 2024-2025, and 2025-2026 fiscal years, after considering multi-year funding commitments, are shown in Table 1.2. The annual funding for Communications, Capacity and Outreach projects under the Northern Contaminants Program is currently set at $600,000, of which $450,000 is for Core Communications and Capacity-Building as described under section 9.4.4. In 2023-2024 there is an additional $50,000 available annually for studies or components of studies that focus on plastic pollution and related contaminants.

9.2 Objectives

The objectives of the Communications, Capacity and Outreach subprogram are to support and facilitate activities and initiatives that:

(a) raise awareness of contaminants in the North from long-range sources and the work that is under way to address the issue;

(b) help to support food choice decisions among consumers of traditional/country foods; and

(c) build capacity in the North to participate in and/or contribute to addressing these issues.

9.3 Background

The NCP has been communicating about long-range contaminants and building capacity in the North for more than twenty years. In that time, much has been learned about the presence, trends, and health effects of contaminants in the North. Much has also been learned about how to communicate this complex information and how best to engage Northerners in research, monitoring, and outreach activities. There have been many outreach efforts to target audiences over the years using a variety of methods (e.g. posters, newsletters, development of school curricula, community tours, radio call-in shows, regional and community workshops, frontline training courses, and Elder–scientist retreats).

The presence and effects of long-range contaminants is one of several environmental, social, and health issues faced in the North. NCP-funded studies in which community members across the North were surveyed on the importance of contaminants information in their food choices have concluded that, in most cases, the contaminant issue is low on the list of driving forces for community members in choosing what to eat.

Given this finding, the NCP's approach reflects an understanding that information about contaminants is best shared with northern community members within the context of other relevant information and concerns. For example, instead of creating focused workshops and newsletters entirely devoted to the issue of contaminants, public health authorities have deemed it appropriate to insert contaminant messaging into existing public health messages and education efforts. This type of work is encouraged by the NCP. Wherever possible, NCP communications work should be integrated into already existing avenues for communication.

9.4 Project Opportunities

The NCP is seeking proposals for projects and activities that are cross-cutting and strategic, and that are broader in scope than project-specific results dissemination.

9.4.1 Assessment of Promising Practices in Communication and Engagement

NCP is seeking proposal applications that assess existing contaminants communication methods to provide recommendations on best practices for northern audiences. Past NCP communication and other northern program engagement methods would be assessed for their effectiveness. New approaches to communications (e.g. use of new technologies) may also be explored in a northern context. The goal of this priority is to provide evidence-based recommendations on improving contaminants communications and to make them readily available to NCP researchers and frontline communicators. Activities may include regionally-based projects, or projects centered on a particular type of research (e.g. human health communications, or methods of engagement around wildlife monitoring).

9.4.2 Delivery of Synthesized Contaminants Messages

This priority area supports the delivery of synthesized messages related to contaminants, particularly as presented in a regional context, bringing together information from several NCP projects, and building on the results and key messages from the most recent NCP and AMAP reports.

Note that delivery of individual project results falls under the responsibility of the Human Health, Community-Based Monitoring, or Environmental Monitoring and Research subprograms.

Activities may include:

- delivering a synthesis or compilation of the results of several projects on contaminants in one or more regions (e.g. regional results workshops, posters, newsletters)
- delivering a regionally-focused workshop, especially if there is significant co-funding and a demonstrated need to disseminate information (e.g. elevated levels of contaminants and a perceived health risk related to traditional/country foods)

9.4.3 Development and Assessment of New Tools and Resources for Communication and Engagement

The development and assessment of new tools and methods of communication and engagement are a priority in this subprogram. This priority promotes the assessment of the effectiveness of technologies like social media, webinars, and browser-based applications in communicating information about long-range environmental contaminants.

While there are many barriers in the North to extensive use of internet-based tools, projects under this priority could assess which regions would be best placed to use new communications technologies, and which methods would be most successful in reaching an audience to provide information that assists informed decision making by individuals and communities in their food use.

This priority could include development of tools for translators/interpreters to work with contaminants terminology.

9.4.4 Core Communications and Capacity Building

The NCP supports Regional Contaminants Committees in six regions (Yukon, Northwest Territories, Inuvialuit Settlement Region, Nunavut, Nunavik, Nunatsiavut) and Inuit Research Advisors in four regions (Inuvialuit

Settlement Region, Nunavut, Nunavik, Nunatsiavut), all of which play a key role in the communications network of the NCP. The committee for the Inuvialuit Settlement Region is currently being established.

Proposals for Regional Contaminants Committees and Inuit Research Advisors are invited from the organizations listed as project leaders in Tables 9.1 and 9.2. A total of $450,000 is available for these projects.

Table 9.1 Project Leaders for Regional Contaminants Committees

Project	Project Leader
Yukon Contaminants Committee	CIRNAC-Yukon
NWT Regional Contaminants Committee (including participation funds for members)	CIRNAC-NWT
Inuvialuit Settlement Region Contaminants Committee	Inuvialuit Regional Corporation
Nunavut Environmental Contaminants Committee	CIRNAC-Nunavut and Nunavut Tunngavik, Inc.
Nunavik Nutrition and Health Committee	Nunavik Regional Board of Health and Social Services
Nunatsiavut Government Research Advisory Committee	Nunatsiavut Government

Table 9.2 Inuit Research Advisors

Region	Host Organization
• Inuvialuit Settlement Region (currently vacant) • Nunavut (currently vacant) • Nunavik • Nunatsiavut	• Inuvialuit Regional Corporation (IRC) • Nunavut Tunngavik Incorporated (NTI) • Kativik Regional Government (KRG) • Nunatsiavut Government – Department of Lands and Natural Resources

9.5 Responsibilities and Activities of a Regional Contaminants Committee

Regional Contaminants Committees act as NCP representatives in the North, liaising with communities to inform them of NCP activities, but also to bring community concerns and issues back to the program. They support and assist NCP researchers to develop communications plans, build northern capacity within their projects, and consult with appropriate northern stakeholders. Activities include, but are not limited to:

- facilitating a contaminants communications network that ensures community members are informed and involved in contaminant related activities
- identifying regional and community priorities and information gaps related to environmental contaminants and human health research
- providing updates on research activities in the region that relate to environmental contaminants
- maintaining a current catalogue of contacts and resource materials regarding environmental contaminants
- assisting in the development of appropriate communication strategies to effectively relay information regarding contaminants
- reviewing NCP proposals, Blueprints and communication materials related to the region on an annual basis
- providing advice to contaminants researchers working in the region on matters related to community engagement, consultation, research permitting, results communication, and capacity building and training

9.6 Responsibilities and Activities of Inuit Research Advisors

The NCP, along with ArcticNet, has supported regional Inuit Research Advisor positions in each of the four Inuit Land Claim regions of the Canadian Arctic.

The Inuit Research Advisors can help facilitate research in Inuit regions for these programs on contaminants, climate change, and environmental health and engage Inuit in undertaking research activities of importance to their communities. Activities include, but are not limited to:

- participating in meetings of Regional Contaminants Committees and informing committee of research activities in their region, as well as activities of their host organization
- communicating with researchers who have been funded about the communication of their findings and the need to build capacity in communities
- communicating with all NCP researchers working in their region to discuss their plans to communicate, to whom, and when, and present this information at Regional Contaminants Committee meetings
- reviewing and commenting on the messages being developed by NCP researchers (as part, or independent of Regional Contaminants Committees)
- tracking and reporting on support provided to NCP and other researchers

10 – BLUEPRINT FOR PROGRAM COORDINATION AND INDIGENOUS PARTNERSHIPS

This section describes how funding under the *Program Coordination and Indigenous Partnerships* subprogram is allocated.

The total funding under this subprogram in the 2023-2024 fiscal year is $1.24 million for ongoing projects and is not open to general applicants.

10.1 Coordination and Administration of the Northern Contaminants Program

The NCP Secretariat prepares two proposals for review by the NCP Management Committee to cover the costs and expenses of: (1) administering the program; and (2) for coordination of NCP activities in related international initiatives, particularly the Arctic Monitoring and Assessment Programme (AMAP), a Working Group under the Arctic Council. These proposals include costs for NCP meetings, publications, website, program-wide communications, data management, and a quality assurance/quality control (QA/QC) program.

10.2 Indigenous Partner Capacity Building

The four northern Indigenous Partners (Inuit Tapiriit Kanatami (ITK), Inuit Circumpolar Council-Canada (ICC), Dene Nation, and Council of Yukon First Nations (CYFN)) are funded for their active participation in the management and implementation of the NCP and its activities, both nationally and in the region(s) for which they are the relevant Indigenous organization. This is to ensure that the NCP incorporates and addresses Indigenous specific concerns and needs into its planning and program delivery, and to facilitate the exchange of information and coordination of activities among and between the NCP community and Indigenous organizations at various levels and northern communities. Activities include, but are not limited to:

- participating in and preparing for Management Committee meetings (twice annually in-person plus by teleconference, as needed)
- participating in and preparing for Regional Contaminants Committee meetings
- participating in meetings of NCP subcommittees and/or task groups, and other related initiatives nationally or internationally
- reviewing regionally relevant NCP projects and consulting with project leaders and communities as necessary
- conducting outreach activities related to the NCP
- participating in the NCP Results Workshop and contributing to its success in part by assisting the NCP Secretariat in workshop planning and delivery
- providing timely input and feedback in the development of and/or revisions to key NCP documents

APPENDIX A – NCP'S CONTAMINANTS OF CONCERN

The Northern Contaminants Program (NCP) is concerned with persistent, bioaccumulative, and toxic contaminants that reach the Arctic via long-range transport from source areas around the globe. These include a large number of persistent organic pollutants (POPs) and heavy metals, particularly mercury. These contaminants can reach elevated concentrations in the tissues of Arctic wildlife and present a toxicological risk to wildlife and humans who consume them. The NCP has recently added microplastics, another emerging concern, to this list.

HEAVY METALS

The UNEP Minamata Convention on Mercury, a legally-binding agreement to cut emissions and releases of mercury to the environment, was formally adopted in October 2013 and entered into force on August 16, 2017, advancing an international effort to reduce global mercury pollution and protect the environment and human health. The NCP seeks **annual monitoring** of mercury from NCP projects as identified in the blueprints for Environmental Monitoring and Research, Human Health, and Community-Based Monitoring and Research. Cadmium and lead can be delivered through the atmosphere but may also have significant local sources, and **applicants are reminded that NCP research proposals should focus on contaminants subject to long-range environmental transport**.

Additional heavy metals and essential elements of interest (e.g. selenium) can provide valuable companion data for metals of concern and can potentially be analyzed together with the priority metals at reasonable costs in multielement analytical suites. If justified in the proposed matrix of study, the NCP will consider these analyses for support in environmental, biotic and human media.

Table A1. Metals of Concern for the NCP, in relation to long-range environmental transport (eligible for annual sampling)

Mercury
Cadmium
Lead

PLASTIC POLLUTION

Plastic composition and use is varied and extremely broad. In the environment, it can be characterized as macroplastics (2.5 cm – 1 m), mesoplastics (0.5 mm – 2.5 cm), and microplastics (< 5 mm). In addition to the possible direct physical effects of exposure to plastic there is evidence that plastics may also act as vectors for contaminant exposure to both plastic-derived chemicals and POPs. Plastic-derived chemicals can be released to the environment during production and potentially during their degradation in the environment. Proposals that include plastic-derived contaminants such as synthetic phenolic antioxidants (SPAs) and benzotriazole UV stabilizers (BZT-UVs) or plastic-associated contaminants such as plasticizers, flame retardants and other POPs are welcome, but sufficient justification for the type and number of samples and relevance of the proposed contaminant(s) to northern environments and people should be provided from applicable sources and literature. Applicants focussing on plastic and microplastic pollution in their proposals should refer to the recent AMAP Litter and Microplastics Monitoring Plan and Monitoring Guidelines for information on pan-Arctic priorities, appropriate methods, sample sizes, etc.

PERSISTENT ORGANIC POLLUTANTS (POPs)

Most of the targeted POPs that have been found in the Arctic environment are managed through international agreements including the United Nations Environment Programme (UNEP) *Stockholm Convention on Persistent*

Organic Pollutants and the United Nations Economic Commission for Europe's *Convention on Long-range Transboundary Air Pollution* (*CLRTAP*). The Stockholm Convention routinely assesses candidate chemicals and, when faced with strong evidence to suggest that a certain compound should be considered a POP, they are added to the convention annexes and managed appropriately. These conventions rely heavily on NCP data to support the assessment of candidate POPs and to evaluate the effectiveness of the control measures at reducing POPs in the environment.

Researchers are asked to rationalize an analytical program and schedule that best suits their proposed project. Schedules A and B identify POPs and some chemicals of emerging arctic concern (CEACs) that are of high priority and concern for the NCP, and are substances that are currently included in, or being considered by, international conventions. An important role for the NCP is providing monitoring data on substances that are already covered by these conventions. However, it is also very important that the NCP provide information on substances that are under consideration for inclusion in these conventions.

New chemicals are nominated by Parties to the Stockholm Convention for review by the technical committee, the POPs Review Committee (POPRC), which includes a member from Canada (currently from Health Canada's Pest Management Regulatory Agency). Additionally, the Inuit Circumpolar Council (ICC), who also have a representative on the Northern Contaminants Program Management Committee, regularly participate in annual meetings of the POPRC as observers.

At the 17th POPRC meeting (January 2022), the risk management evaluation of methoxychlor was adopted and it was recommended for listing in Annex A to the Stockholm Convention (for elimination) without specific exemptions. At the 18th POPRC meeting (September 2022), the risk management evaluations for the ultraviolet (UV) stabilizer UV-328 (also known as BDTP (2-(2H-Benzotriazol-2-yl)-4,6-di-tert-pentylphenol)) and Dechlorane Plus (*syn*- and *anti*-isomers) were adopted, and these contaminants were also recommended for listing in Annex A with several specific exemptions. The risk profiles for two other groups of contaminants: long-chain (C9-C21) perfluorocarboxylic acids, their salts and related compounds (LC-PFCAs), and chlorinated paraffins with carbon chain lengths in the range C_{14-17} and chlorination levels at or exceeding 45 per cent chlorine by weight (MCCPs, also known as medium-chain chlorinated alkanes) were adopted and the compounds moved forward in the review process. Risk management evaluations will be prepared for each of these groups of contaminants in the intersessional period and will be reviewed at the next POPRC meeting (taking place October 2023). The POPRC was not able to agree that the pesticide chlorpyrifos is likely, as a result of it long-range environmental transport (LRET), to lead to significant adverse human health and/or environmental effects, such that global action is warranted. POPRC is therefore seeking information related to the adverse effects of chlorpyrifos (resulting from LRET) and will further discuss the risk profile of this pesticide at its next meeting.

Decisions on listings of proposed POPs are made by the Stockholm Convention Conference of the Parties (COP). The 10th Stockholm Convention COP was split into two events due to the COVID-19 pandemic. The first segment of the meeting took place virtually in summer 2021 and the second was held in person in June 2022. At that meeting, COP decided to list perfluorohexane sulfonate (PFHxS), its salts and PFHxS-related compounds in Annex A without specific exemptions. At the next Stockholm Convention Conference of the Parties (COP-11 in May 2023), decisions on the listing for methoxychlor, Dechlorane Plus, and UV-328 are expected.

For more information on the Stockholm Convention on POPs and the work of the POP Review Committee (POPRC), please visit chm.pops.int.

Table A2 - Schedule A & B: POPs Listed in the Stockholm Convention on Persistent Organic Pollutants

Compound	DESCRIPTION OF USE/SOURCE
SCHEDULE A: ORIGINAL ("LEGACY") POPs	
Aldrin	Pesticide applied to soils to kill termites, grasshoppers, corn rootworm, and other insect pests. Used on crops such as corn and cotton. Can also kill birds, fish, and humans.
Chlordane	Used extensively to control termites and as a broad-spectrum insecticide on a range of agricultural crops, such as vegetables, small grains, potatoes, sugarcane, sugar beets, fruits, nuts, citrus, and cotton.
Dieldrin	Used to control termites and textile pests. Also used to control insect-borne diseases and insects living in agricultural soils.
DDT	Insecticide used on agricultural crops, primarily cotton, and insects that carry diseases such as malaria and typhus.
Endrin	Insecticide sprayed crops such as cotton and grains. Also used to control rodents such as mice and voles.
Mirex	Insecticide used to combat fire ants, termites, and mealybugs. Also used as a fire retardant in plastics, rubber, and electrical products.
Heptachlor	Insecticide used against soil insects and termites. Also used against some crop pests and to combat malaria.
Hexachlorobenzene (HCB)	Kills fungi (e.g. wheat bunt) that affect food crops. Also an industrial chemical used to make fireworks, ammunition, synthetic rubber, and other substances; a by-product of the manufacture of certain industrial chemicals; and an impurity in several pesticide formulations.
Polychlorinated biphenyls (PCBs)	Used for a variety of industrial processes and purposes, including electrical transformers and capacitors, heat exchange fluids, paint additives, carbonless copy paper, and plastics.
Toxaphene	Insecticide used on cotton, cereal grains, fruits, nuts, and vegetables. Also used to control ticks and mites in livestock.
Polychlorinated dibenzo-*p*-dioxins (PCDD)	Produced unintentionally due to incomplete combustion, and during the manufacture of pesticides and other chlorinated substances. Emitted mostly from the burning of hospital, municipal, and hazardous waste; and from automobile emissions, peat, coal, and wood.
Polychlorinated dibenzofurans (PCDF)	Produced unintentionally from many of the same processes that produce dioxins, and also during the production of PCBs. Have been detected in emissions from waste incinerators and automobiles.
SCHEDULE B: MORE RECENT ("NEW") POPs	
alpha-Hexachlorocyclohexane (α-HCH)	Intentional use as an insecticide was phased out but this chemical is still produced as an unintentional by-product of lindane.
beta-Hexachlorocyclohexane (β-HCH)	Intentional use as an insecticide was phased out but this chemical is still produced as an unintentional by-product of lindane.
Chlordecone	Agricultural insecticide used to control pests on tobacco, ornamental shrubs, bananas, citrus trees, and in ant and roach traps. Chlordecone is chemically similar to the Schedule A POP mirex and is not currently used in any known applications.
DecaBDE (commercial decabromodiphenyl ether mixture)	Used as an additive brominated flame retardant, and has a variety of applications including in plastics/ polymers/composites, textiles, adhesives, sealants, coatings and inks. Also used in housings of computers and TVs, wires and cables, pipes and carpets. It is used in commercial textiles, mainly for public buildings and transport, and in textiles for domestic furniture.
Dicofol	An organochlorine pesticide that is chemically related to DDT. The substance is a miticidal pesticide and acaricide used in many countries around the world on a wide variety of fruit, vegetables, ornamental and field crops.
Endosulfan and its related isomers	Insecticide used since the 1950s to control crop pests, tsetse flies, ectoparasites of cattle, and as a wood preservative. As a broad-spectrum insecticide, endosulfan remains in use in some countries to control a wide range of pests on crops including coffee, cotton, rice, sorghum, and soy. Exemptions allow for continued use until viable alternatives can be adopted.

Hexabromobiphenyl	Flame retardant also known as FireMaster BP-6 AND FireMaster FF-1. Was used primarily in thermoplastics (machine housings, radio and TV parts), in coatings and lacquers, and in polyurethane foam in upholsteries.
Hexabromocyclododecane (HBCDD)	Used as an additive brominated flame retardant, providing fire protection during the service life of vehicles, buildings or articles, as well as protection while stored. Main global use is in polystyrene foam insulation, and in textile applications and electric/electronic appliances.
Hexabromodiphenyl ether and Heptabromodiphenyl ether (commercial octabromodiphenyl ether mixture)	Used as additive brominated flame retardants, hexabromodiphenyl ether and heptabromodiphenyl ether are the main components of the commercial octabromodiphenyl ether mixture. Used mainly in electrical and electronic housings in polymers and plastics such as acrylonitrile butadiene styrene (ABS), high impact polystyrenes (HIPS), polybutylene terephthalate (PBT), and polyamides. Still present in many in use products and may degrade to lower brominated PBDEs including penta- and tetraBDEs.
Hexachlorobutadiene (HCBD)	Mainly a by-product in the manufacture of chlorinated hydrocarbons like tri- and tetrachloroethene and tetrachloromethane and was/is used as a fumigant.
Lindane (gamma-hexachlorocyclohexane, γ-HCH)	Broad-spectrum insecticide for seed and soil treatment, foliar applications, tree and wood treatment, and against ectoparasites (e.g. fleas and lice) on people and other animals.
Pentachlorobenzene (PeCB)	Was used in PCB products, dyestuff carriers, as a fungicide, a flame retardant, and as a chemical intermediate. Also produced unintentionally during combustion, thermal and industrial processes, and present as impurities in products such as solvents or pesticides.
Pentachlorophenol (PCP) and its salts and esters	Used as a wood preservative in the 1930s and has had a variety of other applications (e.g. biocide, insecticide, fungicide, disinfectant, defoliant, anti-sapstain agent and anti-microbial agent). It has been also used in the production of textiles.
Perfluorohexane sulfonate (PFHxS), its salts and related compounds	Past and current uses include addition to fire-fighting foams, as surfactants, in metal plating, cleaning, waxing, and polishing, water- and stain-protective coatings for carpets, paper, leather and textiles. PFHxS and related compounds have been used as replacements for perfluorooctane sulfonic acid (PFOS). These compounds can also be produced unintentionally during the production of other PFAS.
Perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOS-F)	PFOS is both intentionally produced and an unintended degradation product of related manmade, perfluorinated chemicals. The current intentional use of PFOS is widespread and includes: electric and electronic parts, fire fighting foam, photo imaging, hydraulic fluids, and textiles.
Perfluorooctanoic acid (PFOA), its salts and related compounds	Used in direct applications in the production of fluoroelastomers and fluoropolymers, with polytetrafluoroethylene (PTFE) being the most important fluoropolymer. PFOA-related substances are used in fire-fighting foams, wetting agents and cleaners, in textiles and leather, paper and cardboard (e.g. food packaging), paints and lacquers as well as other uses (non-woven medical garments, floor waxes and stone/wood sealants, thread sealant tapes and pastes, adhesives, products for apparel) where side-chain fluorinated polymers are used. Abiotic environmental measurements of PFOA are of interest in order to characterize exposure and bioaccumulation from the arctic environment.
Polychlorinated naphthalenes (PCNs: di, tri, tetra, penta, hexa, hepta, octa)	Used in wood preservation, as an additive to paints and engine oils, and for cable insulation and in capacitors. PCNs have not been used in Canada in over 20 years, but can be produced unintentionally as a by-product of a number of industrial processes that contain chlorine particularly under heating or during combustion.
Short-chain chlorinated paraffins (SCCPs), also known as short-chain chlorinated alkanes	SCCPs can be used as a plasticizer in rubber, paints, adhesives, flame retardants for plastics as well as an extreme pressure lubricant in metal working fluids. Chlorinated paraffins are produced by chlorination of straight-chained paraffin fractions. The carbon chain length of SCCPs is between C_{10} and C_{13}. The production of SCCPs has decreased globally as jurisdictions have established control measures.
Tetrabromodiphenyl ether and pentabromodiphenyl ether (commercial pentabromodiphenyl ether mixture)	Used as additive brominated flame retardants, tetrabromodiphenyl ether and pentabromodiphenyl ether are the main components of the commercial pentabromodiphenyl ether mixture. Major applications included polyurethane foams and printed electronic circuit boards. Still present in many in use products and may be produced by debromination of more highly brominated congeners.

Table A3 - Schedule C: Chemicals of Emerging Arctic Concern (CEACs) and/or chemicals currently under review for listing as POPs in the Stockholm Convention on Persistent Organic Pollutants

COMPOUND	DESCRIPTION OF USE/SOURCE
Dechlorane plus, *syn*- and *anti*-isomers and degradation products	Used as a chlorinated flame retardants in thermoplastics including nylon, rubber, acrylonitrile butadiene styrene (ABS), rubber, polypropylene. Dechlorane plus is also used in thermosetting resins such as epoxy and polyester resins, polyurethane foams, silicon rubber and neoprene. Dechlorination products and monoadducts of the *syn* and *anti* isomers are also of interest given their persistent, bioaccumulative, and toxic properties.
Methoxychlor	Broad-spectrum organochlorine insecticide that was used as a replacement for DDT. Agricultural and veterinary applications included use on field crops, vegetables, fruits, gardens, marshes livestock and pets in order to control flies, mosquito larvae, cockroaches, and other insect pests.
Long-chain (C9-C21) perfluorocarboxylic acids, their salts and related compounds	Long-chain PFCAs are used for surfactant applications and in the production of fluoropolymers. Precursors of long-chain PFCAs have been used in a range of applications, including use in coating products, fabric/carpet protectors, textile impregnation agents and firefighting foam. Long-chain PFCAs, their salts and precursors can also be produced unintentionally during the production of other PFAS.
UV-328, also known as 2-(2H-Benzotriazol-2-yl)-4,6-di-tert-pentylphenol (BDTP) and other benzotriazole UV stabilizers	A benzotriazole used as an ultraviolet (UV) absorber/stabilizer in many applications, including automobile and industrial paints, coatings and plastics, and personal care products. UV-328 is also used as a printing ink additive in food contact materials.
Chlorpyrifos	Chlorpyrifos is a broad-spectrum chlorinated organo-phosphate insecticide widely used in agriculture and as a biocide for non-agricultural pests. It has been used on various crops (corn, soybeans, alfalfa, oranges, wheat, and walnuts) as well as on lawns and ornamental plants. There are also public health uses, including adulticidal fogger treatments for mosquitoes, and the control of fire ants and certain species of ticks that may transmit diseases. It is released to the air, water and soil. Major health issues such as neurodevelopmental toxicity and neurotoxicity have been linked to chlorpyrifos exposure in humans. Uncertainty remains regarding its genotoxic potential. Chlorpyrifos is highly toxic to aquatic communities, early life stages of fish and aquatic invertebrates, bees, birds and mammals.
Medium-chain chlorinated paraffins (MCCPs), also known as medium-chain chlorinated alkanes	Medium-chain chlorinated paraffins (MCCPs) are chlorinated paraffins with carbon chain lengths in the range C_{14-17} and a chlorination level at or exceeding 45% chlorine by weight. MCCPs have a number of use such as a secondary plasticizer in polyvinyl chloride (PVC), adhesives, sealants, paints and coatings; a flame retardant in PVC and rubber compounds, adhesives, sealants, paints and coatings, and textiles; an extreme pressure lubricant and anti-adhesive for metal working fluids; a waterproofing agent for paints, coatings and textiles; and a carrier solvent for colour formers in paper manufacture.

OTHER CHEMICALS OF EMERGING ARCTIC CONCERN (CEACs)

Other contaminants of emerging concern can be proposed, but may require additional justification for measurement in their proposed environmental or biotic matrix. Technical aspects such as sample numbers, cost per sample for analysis, and Quality Analysis and Quality Control should be described, as should the CEACs relevance to the North and Northerners. Some examples of CEACs with a long-range origin that could be included with justifications include alternative halogenated flame retardants (e.g. PBDE and HBCDD replacements), organophosphate esters (flame retardants and plasticizers), short-chain (C4–C7) and ultra short-chain (C2–C3) PFAS, polycyclic aromatic hydrocarbons (PAHs), and some current use pesticides (CUPs).

Applicants can refer to the AMAP Assessment 2016: Chemicals of Emerging Arctic Concern as well as AMAP Assessment 2020: POPs and Chemicals of Emerging Arctic Concern: Influence of Climate Change for more information on CEACs that may be relevant to the NCP. When proposing CEACs in an analytical suite, they should be within the typical scope of the NCP and be delivered to the North via long range transport and not originate primarily from a local source.

APPENDIX B – CONTACT INFORMATION

NCP Secretariat

NCP Secretariat – General enquiries
Email: plcn-ncp@rcaanc-cirnac.gc.ca

Sarah Kalhok Bourque
Chair, NCP Management Committee
Crown-Indigenous Relations and Northern Affairs Canada
Email: sarah.kalhok@rcaanc-cirnac.gc.ca

Simon Smith
Acting Manager and Environmental Scientist
Crown-Indigenous Relations and Northern Affairs Canada
Email: simon.smith@rcaanc-cirnac.gc.ca

Adam Morris
Environmental Scientist
Crown-Indigenous Relations and Northern Affairs Canada
Email: adam.morris@rcaanc-cirnac.gc.ca

Chase Morrison
Environmental Scientist
Crown-Indigenous Relations and Northern Affairs Canada
Email: chase.morrison@rcaanc-cirnac.gc.ca

Yukon

Yukon Regional Contaminants Committee Co-Chair
Jennifer Laliberte
Crown-Indigenous Relations and Northern Affairs Canada
Email: jennifer.laliberte@rcaanc-cirnac.gc.ca
Tel: (867) 334-9387

Yukon Regional Contaminants Committee Co-Chair
Jesse Hudson
Council of Yukon First Nations (CYFN)
Email: jesse.hudson@cyfn.net
Tel: (867) 393-9200 ext. 9240

Northwest Territories

NWT Regional Contaminants Committee Co-Chair
Emma Pike
Crown-Indigenous Relations and Northern Affairs Canada
Email: emma.pike@rcaanc-cirnac.gc.ca
Tel: (867) 445-4830 (cell); Fax: (867) 669-2439

NWT Regional Contaminants Committee Co-Chair
Lorne Napier
Northwest Territory Métis Nation
Email: lands@nwtmetis.ca
Tel: (867) 621-0655 (cell); Fax: (867) 872-2772

Inuit Research Advisor (Inuvialuit Settlement Region)
NWT Regional Contaminants Committee Co-Chair
Vacant

Nunavut

Nunavut Environmental Contaminants Committee Co-Chair
Selma Al-Soweydawi
Crown-Indigenous Relations and Northern Affairs Canada
Email: selma.al-soweydawi@rcaanc-cirnac.gc.ca
Tel: (867) 975-4732

Nunavut Environmental Contaminants Committee Co-Chair
Jean Allen
Nunavut Tunngavik Incorporated
Email: jallen@tunngavik.com
Tel: (867) 975-4950

Inuit Research Advisor (Nunavut)
Nunavut Environmental Contaminants Committee Co-Chair
Vacant

Nunatsiavut

Inuit Research Advisor (Nunatsiavut)
Nunatsiavut Government Research Advisory Committee, Chair
Carla Pamak
Nunatsiavut Government
Email: carla.pamak@nunatsiavut.com
Tel: (709) 922-2380; Fax: (709) 922-2504

Nunatsiavut Government Research Advisory Committee
Liz Pijogge
Nunatsiavut Government
Email: liz.pijogge@nunatsiavut.com

Nunavik

Nunavik Nutrition and Health Committee (Nunavik's Regional Contaminants Committee)

Public Health Research Advisor
Lucy Grey
Nunavik Regional Board of Health and Social Services
Email: lucy.grey.rr17@ssss.gouv.qc.ca
Tel: (819) 964-2222

Nunavik Nutrition and Health Committee Coordinator
Marie-Josée Gauthier
Nunavik Regional Board of Health and Social Services
Email: marie.josee.gauthier@ssss.gouv.qc.ca
Tel: (418) 609-4782

Inuit Research Advisor (Nunavik)
Monica Nashak
Kativik Regional Government
Email mnashak@krg.ca

APPENDIX C – GUIDELINES FOR RESPONSIBLE RESEARCH

I. INTRODUCTION

The following document represents a guideline for communications planning to assist Northern Contaminants Program (NCP) project leaders in initiating community contacts and developing research agreements with communities. Ultimately, the objective is that communications/ participation planning will become integral to research proposal development.

II. KEY POINTS

The following are key points to consider when planning communications and community participation in NCP projects:

A. ENGAGEMENT

- Engage early with the Regional Contaminants Committees and Inuit Research Advisors, before and during the development of a proposal.
- During engagement, researchers should explain the potential beneficial and harmful effects of the research on individuals, communities and/or the environment.
- No undue pressure should be applied to obtain consent for participation in a research project.
- Greater consideration should be placed on the risks to cultural values than to potential contributions of the research to knowledge.

B. RESEARCH OBLIGATIONS

- Research should include community participation in the identification of research topics, Indigenous Knowledge and priorities.
- Community participation in project planning and implementation goes beyond "moral" obligations; rather it is a legal and constitutional requirement associated with land claims.
- For all parties to benefit from research, efforts should be made, where practical, to employ and train local (especially Indigenous) researchers and assistants.
- It is important to develop approaches to research that are responsive to local or regional needs. The Regional Contaminants Committees and Indigenous organizations are good mechanisms for achieving this.
- Research must respect sacred sites, cultural materials, and cultural properties.
- Subject to requirements for confidentiality, publications should give appropriate credit to everyone who contributes to the research.
- All project leaders are required to prepare a report on their project for inclusion in the annual NCP Synopsis of Research report to be used by the Regional Contaminants Committees for communications purposes.

C. RESEARCH RELATIONSHIPS

- Community-researcher relationships should be established early on in the project planning process, outlining details of "level of engagement" and "mutual obligations" for each partner. This will ensure a meaningful two-way exchange of information.
- Researchers and communities may wish to set out the parameters of their agreements and understandings in a Memorandum of Understanding.
- From the NCP perspective, development of researcher-community relationships is a dynamic and evolving process. As research projects progress, common elements will emerge regarding the perceptions, needs, and resource/capacity strengths of individual communities and researchers, including their criteria and preferred form of participation in scientific research projects.
- The right to refuse participation always rests with the individual at any point in any study.

D. COMMUNICATIONS

- Researchers are advised to contact the appropriate Regional Contaminants Committee and Inuit Research Advisor for advice on communications planning during the development of their proposal.
- Researchers should incorporate advice on communication into their proposal. Communication of results should include consideration of media other than printed reports. Examples of effective methods for information dissemination include: face-to-face discussion, local radio, DVD, pamphlets, videos and web sites. Many of these can successfully present highlights of several projects or categories of research activity over several years. Public presentations that allow for little interaction are seldom regarded as useful. Regional Contaminants Committees will direct the project leader if communication of results is required.
- Communication support materials, such as pamphlets, posters, videos, and posts on social media platforms such as Facebook, should not be seen as solutions to communications problems, but as tools to be used in combination with person-to-person communication. Communication support materials should be sent to the appropriate Territorial/Regional Contaminants Committee for review.
- Social media posts that are focused on experiences and/or non-sensitive information do not require approval from territorial health experts or Regional Contaminants Committees. However, posts that are health-related, refer to contaminant levels in subsistence animals, or that contain other potentially sensitive/concerning information generated from NCP-related work should be reviewed by the Regional Contaminants Committees and potentially territorial health authorities before posting.
- Translation of summary reports into local languages is recognized as critical and should be done wherever possible/appropriate.

E. REPORTING OF SPECIFIC HEALTH RISK RESULTS

- The existing protocol for reporting results from human health risk assessments (from analysis of fish/wildlife contaminants burdens) must be adhered to. The decision to conduct such assessments is part of this protocol.
- Researchers must ensure the accuracy of their results since these may influence decisions and policy that can directly affect individuals and communities.
- There is a process to prepare contingency plans if results are reported that require some form of intervention or action, in relation to reporting of individual human results. This is done by the responsible health authority (e.g. regional departments of health and social services) in consultation with the Regional Contaminants Committees, the four NCP Indigenous Partners, and the NCP Management Committee.

APPENDIX D – GLOSSARY OF ACRONYMS

I. ORGANIZATIONAL TERMS

AMAP Arctic Monitoring and Assessment Programme

CACAR Canadian Arctic Contaminants Assessment Report

CaPSA Canada's Plastics Science Agenda

CCGS Amundsen Canadian Coast Guard Ship Amundsen

CIRNAC Crown-Indigenous Relations and Northern Affairs Canada

CLRTAP Convention on Long-range Transboundary Air Pollution

CYFN Council of Yukon First Nations

ECCC Environment and Climate Change Canada

GAPS Network Global Atmospheric Passive Sampling Network

HTC Hunters and Trappers Committee

HTO Hunters and Trappers Organization

ICC Inuit Circumpolar Council

IRA Inuit Research Advisor

ITK Inuit Tapiriit Kanatami

NCP Northern Contaminants Program

- **CBMR** Community-based Monitoring and Research
- **CCO** Communications, Capacity and Outreach
- **EMR** Environmental Monitoring and Research
- **HH** Human Health

NGMP Nunavut General Monitoring Plan

NWT CIMP Northwest Territories Cumulative Impact Monitoring Program

RCC Regional Contaminants Committee

- **YCC** Yukon Contaminants Committee
- **NWTRCC** Northwest Territories Regional Contaminants Committee
- **NECC** Nunavut Environmental Contaminants Committee
- **NGRAC** Nunatsiavut Government Research Advisory Committee
- **NNHC** Nunavik Nutrition and Health Committee

Stockholm Convention on POPs related:

- **COP** Conference of the Parties
- **POPRC** Persistent Organic Pollutants Review Committee
- **POPRC-15** 15th POPRC meeting
- **POPRC-16** 16th POPRC meeting. January 2021.

UNECE United Nations Economic Commission for Europe

UNEP United Nations Environment Programme

II. CHEMICAL TERMS

$\partial^{18}O$ oxygen isotope 18

BDTP 2-(2H-Benzotriazol-2-yl)-4,6-di-tert-pentylphenol also known as **UV-328**

CEACs chemicals of emerging Arctic concern

SCCPs short-chain chlorinated paraffins

CUPs current-use pesticides

DDT dichlorodiphenyltrichloroethane

DOC dissolved organic carbon

HBCDD hexabromocyclododecane

PAHs polycyclic aromatic hydrocarbons

PBDEs polybrominated diphenyl ethers

- **PentaBDE** pentabromodiphenyl ether
- **OctaBDE** octabromodiphenyl ether
- **DecaBDE** decabromodiphenyl ether

PCB polychlorinated biphenyl

PFASs per- and polyfluorinated alkyl substances

- **PFCAs** perfluorinated carboxylic acids
  - **PFOA** perfluorooctanoic acid
- **PFOSF** perfluorooctane sulfonyl fluoride
- **PFSAs** perfluorinated sulfonic acids
  - **PFHxS** perfluorohexane sulfonate
  - **PFOS** perfluorooctane sulfonate

POC particulate organic carbon

POPs persistent organic pollutants

- **Schedule A POPs** formerly known as legacy POPs.
- **Schedule B POPs** new POPs and chemicals of emerging Arctic concern (CEAC)

SF_6 sulfur hexafluoride

UV ultraviolet

III. GENERAL TERMS

CTD characteristic travel distance

FY fiscal year

IK Indigenous Knowledge

QA/QC Quality Assurance/Quality Control

TDI Tolerable Daily Intake