

Close-out Report: North American Regional Action Plan on Environmental Monitoring and Assessment

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List of Abbreviations and Acronyms

CEC: Commission for Environmental Cooperation, also referred to as Commission for Environmental Cooperation of North America

Cenica: *Centro Nacional de Investigación y Capacitación Ambiental*

DFHCB TF: Dioxins, Furans and Hexachlorobenzene NARAP Implementation Task Force

EMA: Environmental Monitoring and Assessment

GEF: The Global Environment Facility

GAPS: Global Atmospheric Passive Sampling Network

IADN: Integrated Atmospheric Deposition Network, located in the Great Lakes region

MDN: Mercury Deposition Network

NAAEC: North American Agreement on Environmental Cooperation

NAFTA: North American Free Trade Agreement

NARAP: North American Regional Action Plan

NHANES: National Health and Nutrition Examination Survey

NOAA: National Oceanic and Atmospheric Administration

PBDEs: polybrominated diphenyl ethers

Planame: *Plan Nacional de Monitoreo y Evaluación de Sustancias Tóxicas Persistentes*

Proname: *Programa Nacional de Monitoreo y Evaluación Ambiental*

PCBs: polychlorinated biphenyls

POPs: persistent organic pollutants

PTS: persistent toxic substances

QA/QC: Quality Assurance/Quality Control

RETC: *Registro de Emisiones y Transferencias de Contaminantes*

SAICM: Strategic Approach to International Chemicals Management

SMOC: Sound Management of Chemicals

SMOC Working Group: Sound Management of Chemicals Working Group

US: United States of America

US EPA: United States Environmental Protection Agency

Abstract

This report represents the close-out report for the North American Regional Action Plan (NARAP) on Environmental Monitoring and Assessment (EMA) of the North American Commission for Environmental Cooperation (CEC). It provides an overview of the objectives and action items contemplated under this NARAP, highlights the results achieved, and draws conclusions about the success of this cooperative endeavor.

Executive Summary

One of the first resolutions adopted by the CEC Council¹ (95-05) called for the creation of an initiative to promote the sound management of chemicals (SMOC) in the three countries. Emphasis was placed on actions directed at controlling persistent, bioaccumulative and toxic (PBT) chemicals that were being released into the North American environment. When a PBT chemical was considered to be of mutual concern for all three countries, a North American Regional Action Plan (NARAP) was prepared to join efforts in managing that chemical. Early NARAPs were prepared for PCBs, chlordane and mercury.

It was recognized that environmental and human health monitoring would also be needed to determine contamination levels and track progress in reducing or eliminating the threats posed by chemicals of mutual concern. Therefore, in 2002, the Council signed a resolution (02-08), approving a NARAP on environmental monitoring and assessment (EMA). The main objective was to determine the levels of contamination in the environment and in humans, to follow their trends over time, and to support monitoring needs related to chemicals of mutual concern. A government Standing Committee was also established to oversee the implementation of this NARAP.

The mandate for the EMA NARAP was ambitious, comprising 14 key action items:

- Action item 1. North American Standing Committee on Monitoring and Assessment
- Action item 2. Preparation and approval of an implementation work plan
- Action item 3. Biennial assessments of persistent toxic substances
- Action item 4. Implementation of the NARAP
- Action item 5. Synoptic baseline survey of persistent toxic substances in Mexico
- Action item 6. Initial assessment of persistent toxic substances in Canada and the United States
- Action item 7. Exposure of newborn children and infants to persistent toxic substances
- Action item 8. Exposure of communities, populations and occupations to persistent toxic substances
- Action item 9. Mercury pilot study
- Action item 10. Initial collaborative monitoring sites
- Action item 11. North American Reference Network of Integrated Index Sites
- Action item 12. Satellite Sites
- Action item 13. Reference Data Sets
- Action item 14. Cooperation and capacity building

It was recognized that an unfortunate disparity existed between the three countries regarding their monitoring capacity. While monitoring and assessment programs in Canada and the US were robust,

¹ The CEC Council is composed of the federal environmental officials of cabinet level or the equivalent from Canada, Mexico and the United States.

Mexico needed to develop its capacity to put in place and operate a fulsome monitoring and analytical program. However, CEC resources were considered not sufficient to support Mexico to fully establish this capacity. Consequently, the SMOC Working Group prepared a leveraging strategy to secure significant funding from international funding institutions. An early and successful example of international financing was supported by the World Bank to conduct a study of contaminants in the blood of mothers in Mexico. However, it was not possible to access large amounts of sustained funding at the level necessary to develop and maintain a viable ongoing monitoring program. As a result, in 2005, the focus of the NARAP shifted to building Mexico's capacity in general, as it relates to environmental monitoring and assessment.

For its part, Mexico established the National Program for Monitoring and Assessment (*Programa Nacional de Monitoreo y Evaluación Ambiental*—Proname) as a policy response to the ongoing need for environmental monitoring in that country. CEC resources, coupled with the contribution of Party experts, were used to support Proname's implementation in Mexico. Activities included workshops to raise awareness of the importance of monitoring, training of field and laboratory technicians involved in collecting, storing and analyzing samples, development of laboratory protocols, as well as quality assurance and quality control techniques (INECC 2012; 2013).

As work on this NARAP progressed, broader international concern about persistent toxic substances (PTS) was beginning to evolve. In 2001, the Stockholm Convention on Persistent Organic Pollutants (POPs) was adopted and opened for signature and a global effort was launched to tackle many of the chemicals that were of interest under the CEC's SMOC initiative. Monitoring of POPs became a global effort and the Global Atmospheric Passive Sampling Network (GAPS) was initiated. The Strategic Approach to International Chemicals Management (SAICM) was launched in 2006, with the intent of reducing the gap between developed and developing countries in managing the risks the chemicals present to humans and the environment. A CEC report was prepared outlining the accomplishments of the SMOC initiative, including work undertaken under this NARAP and presented to SAICM as a model for international cooperation in 2013 (CEC 2013).

In 2013, it was decided to bring the EMA NARAP to a conclusion and prepare a close-out report. A separate report, entitled "Quantitative Analysis of Proname," was commissioned. It offers a comprehensive evaluation of all the results from the monitoring of PTS in environmental media at several different geographical locations in Mexico. The report is intended for government experts and decision-makers only as a guide to aid policy development in Mexico related to the maintenance and expansion of their monitoring network and analytical capacity for PTS.

This EMA NARAP close-out report summarizes the activities undertaken and the results obtained. It should be noted that the implementation of this NARAP was an ambitious undertaking and CEC resources were limited. While a number of the action items in the NARAP were not met, the NARAP can nevertheless be considered a success, given that Mexico, with the support of the CEC, has expanded its capacity to conduct environmental and human health monitoring programs through Proname. This is evidenced by the implementation of the human blood monitoring study, the establishment of index and satellite sites in Mexico, and the ongoing training and capacity building that took place during the course of implementation of this NARAP.

Introduction

The purpose of this report is to document and summarize the work that has been completed under the North American Regional Action Plan (NARAP) on Environmental Monitoring and Assessment (EMA). This work was carried out under the auspices of the Commission for Environmental Cooperation (CEC) and took place over an 11-year period (2002–2013).

Monitoring toxic chemicals had its origins as a result of mounting worldwide concerns about the adverse impacts of PTS in the environment. In 1995 CEC Council Resolution 95-05 was passed, authorizing the launch of the SMOC initiative. This Council Resolution created a mechanism for cooperative action in the three countries to deal with PBT substances deemed to be of mutual concern to the three Parties. The SMOC Working Group was established to guide implementation of this initiative. Initial focus was placed on polychlorinated biphenyls (PCBs). However, the SMOC Working Group was also asked to identify other PTS of mutual concern for follow-up action, as well as other appropriate measures to address harmful chemicals. The persistent toxic chemicals identified for follow-up action through individual NARAPs, included mercury, DDT, chlordane, lindane, and dioxins, furans and hexachlorobenzene. NARAPs were developed for many of these chemicals. Implementation task forces, composed of experts from the three countries, were created to undertake the work mandated under the various NARAPs. In addition, it was recognized that, in order to determine if NARAPs were achieving the desired results, ongoing monitoring of the levels of these chemicals in the environment and in humans would be necessary. Tracking trends over time would also be desirable.

In October 1998, the SMOC Working Group directed the preparation of a concept paper to outline how monitoring and assessment could be used to support the SMOC initiatives and the implementation of the various NARAPs. This led to a formal submission to the Council regarding the importance of EMA and, in 1999, Council passed Council Resolution 99-02, calling for the development of an EMA NARAP. The SMOC Working Group charged monitoring experts from the Parties to organize a workshop to determine monitoring needs and undertake the preparation of a draft EMA NARAP. The EMA workshop was held in Toronto in 2001. Information presented at the workshop showed that robust environmental and human health monitoring systems existed in Canada and the United States. In Mexico, on the other hand, monitoring programs were in the early formative stages. A national plan, the *Plan Nacional de Monitoreo y Evaluación de Sustancias Tóxicas Persistentes* (Planame), had been adopted and a work program approved—the *Programa Nacional de Monitoreo y Evaluación Ambiental* (Proname). Mexico had also entered into an environmental cooperation agreement with Japan, which led to the establishment of an environmental analytical laboratory in Mexico. It was evident that there was a significant disparity between Mexico's ability to mount a meaningful monitoring program for PTS and that of the US and Canada. Following the workshop, a draft NARAP was prepared and received public comment in early 2002. This was followed by Council approval of the EMA NARAP (via Council Resolution 02-08) in June 2002.²

² See <<http://www.cec.org/Page.asp?PageID=1366&ContentID=25509>> for the text of the NARAP, the enabling resolution, and other related documents.

North American Regional Action Plan on Environmental Monitoring and Assessment

Purpose

The purpose of the EMA NARAP was two-fold:

1. To assist the SMOC Working Group and its implementation task forces to meet monitoring and assessment obligations concerning Council Resolution 95-05 and related substance-specific NARAPs.
2. To assist Canada, Mexico and the US in developing and implementing actions to increase comparability, reliability, relevance and availability of data and information on PTS in the environment and in humans.

The EMA Standing Committee was charged with the responsibility of undertaking the following activities to meet the stated purpose.

1. To encourage cooperation and collective action related to monitoring and surveillance.
2. To support capacity building and international cooperation especially in Mexico.
3. To assist Canada, Mexico and the US in establishing a North American Reference Network of integrated monitoring sites with agreed-upon protocols for sampling, analysis and data sharing.

Objectives

There were nine general and nine specific objectives identified in the NARAP.

General objectives

1. To assist the Working Group for the Sound Management of Chemicals and its Implementation Task Forces in addressing the obligations and commitments contained in Council Resolution 95-05 on the Sound Management of Chemicals and in the North American Regional Action Plans (NARAPs) developed pursuant to that Resolution.
2. To ensure that the interests and needs of the Working Group for the Sound Management of Chemicals and its Implementation Task Forces are taken into account in the implementation of this NARAP on environmental monitoring and assessment and, in collaboration with these entities, to develop appropriate measures and mechanisms, for implementing specific action items contained in this NARAP.
3. To enhance the capacity of Canada, Mexico and the United States to work together in advancing international initiatives on the Sound Management of Chemicals including the signing and eventual ratification of the Stockholm Convention on Persistent Organic Pollutants.
4. To enhance the ability of policy makers, officials, managers and others to make informed and responsible decisions to reduce and virtually eliminate the anthropogenic releases of persistent and toxic substances to the North American environment.
5. To produce authoritative assessments of the implications of persistent and toxic substances to human health and the environment for use within the Sound Management of Chemicals initiative and for general distribution.

6. To establish a trinational forum, a framework and mechanisms to improve trinational cooperation and collaboration in the planning and implementation of monitoring, modeling, and research programs in support of the Sound Management of Chemicals initiative.
7. To increase the comparability, reliability, relevance and availability of data and information on persistent and toxic substances in North America.
8. To provide an effective focus for capacity building with respect to measuring, monitoring and assessing the status and risks of persistent and toxic substances in the North American environment, through sharing and exchange of information, experience, expertise, personnel, methodology and technology.
9. To stimulate cooperation between experts and officials involved in monitoring, modeling, research, and assessment of bioaccumulative, persistent and toxic substances in the environment and those involved in monitoring and assessing the exposure to, and effects of, bioaccumulative, persistent and toxic substances on humans, with particular reference to children's health and the environment.

Specific objectives

1. To assess progress towards meeting the monitoring, research, modeling and assessment obligations and commitments contained within Council Resolution 95-05 on the Sound Management of Chemicals and in the North American Regional Action Plans developed pursuant to that Resolution.
2. To produce biennial progress reports on the status, trends and significance of PTS in North America with particular reference to those substances being addressed under existing and anticipated NARAPs.
3. To plan and initiate a synoptic, baseline survey of the levels of selected PTS in selected environmental media at selected locations in Mexico. This survey is to provide data on the status of selected PTS in Mexico with particular reference to those substances being addressed under existing and anticipated NARAPs. It shall be designed to contribute to an overall assessment of the exposure to, and risks of, PTS to humans and the environment in Mexico.
4. To prepare an assessment of the levels of PTS in environmental media in Mexico together with an initial assessment of the exposure to, and risks of, POPs and certain heavy metals to humans and the environment in Mexico.
5. To plan and initiate a baseline survey in the North American region of the exposure of newborn children and infants to PTS.
6. To plan and recommend a baseline survey in the North American region of the exposure of reference communities or occupations which are believed to have a higher than average exposure to PTS.
7. To establish a North American Reference Network of designated Integrated Index Sites for the systematic collection of data and information on the concentrations, fluxes and effects of PTS in the North American Environment, with particular reference to North American Ecosystems and Human Health.
8. To identify and recommend satellite sites to be directly associated with the North American Reference Network in addressing one or more key considerations related to monitoring or understanding concentrations, fluxes and effects of PTS.
9. To identify and recommend other existing or planned Reference Data Sets to be directly associated with the North American Reference Network, including baseline environmental surveys, epidemiological surveys and studies, and important research

findings related to monitoring and understanding concentrations, fluxes and effects of PTS.

Action Items

The EMA NARAP comprised the following 14 key action items:

- Action item 1. North American Standing Committee on Monitoring and Assessment
- Action item 2. Preparation and approval of an implementation work plan
- Action item 3. Biennial assessments of persistent toxic substances
- Action item 4. Implementation of the NARAP
- Action item 5. Synoptic baseline survey of persistent toxic substances in Mexico
- Action item 6. Initial assessment of persistent toxic substances in Canada and the United States
- Action item 7. Exposure of newborn children and infants to persistent toxic substances
- Action item 8. Exposure of communities, populations and occupations to persistent toxic substances
- Action item 9. Mercury pilot study
- Action item 10. Initial collaborative monitoring sites
- Action item 11. North American Reference Network of Integrated Index Sites
- Action item 12. Satellite Sites
- Action item 13. Reference Data Sets
- Action item 14. Cooperation and capacity building

EMA NARAP Implementation

In assessing the implementation of this NARAP, it is important to note that one of the challenges that faced the SMOC Working Group at the onset was the issue of funding. The CEC, through the annual work planning and budgeting process, was able to provide modest financial support for meetings, conference calls, workshops, training and small projects. However, larger projects requiring a significant ongoing financial commitment such as NARAP implementation needed additional resources. In 2001, the SMOC Working Group prepared a leveraging strategy³ aimed at seeking additional financial and human resources for NARAP implementation by promoting NARAP-relevant project ideas as opportunities for other delivery agents such as research institutes, universities, private sector organizations, and international financing institutions. The CEC Secretariat⁴ was asked to work with the implementation task forces to identify projects of mutual interest and pursue opportunities for external funding. A number of action items in the EMA NARAP were found to fit the criteria set out in the leveraging strategy (e.g. human blood monitoring, establishment of POPs monitoring sites in Mexico, strengthening analytical capacity for POPs). However it was not possible to access large amounts of sustained funding at the level necessary to develop and maintain a viable ongoing monitoring program.

The following is a brief summary of the implementation of the 14 action items stated in the EMA NARAP that highlights meaningful results or significant challenges that were encountered. It is important to underscore that while a number of the action items were not carried out as prescribed, other initiatives that were not originally planned and which started under or stemmed from this NARAP supported different action items.

³ CEC 2001.

⁴ The CEC Secretariat provides technical, administrative and operational support to the Council.

Action item 1. Establishing the North American Standing Committee on Monitoring and Assessment

This action item laid out the need to establish a Standing Committee to facilitate, coordinate and oversee the implementation of this NARAP. In particular, it was noted that officials appointed to this committee should be managers of monitoring and research programs related to toxic substances. It was also noted that there should be ample provision for public input, up to six observers from stakeholder groups could be invited to participate and the terms of reference of the standing committee should be reviewed every four years.

The EMA Standing Committee was created in 2004 and terms of reference were developed. It has been standard practice for the SMOC Working Group and its implementation task forces to hold annual meetings along with three or four conference calls throughout the year to plan and track projects and budgets, review proposals for new initiatives and offer direction and guidance to various implementation projects. In keeping with this approach, the EMA Standing Committee met annually from 2004 to 2011. The cost of meetings, translation services, conference calls, travel support for stakeholders and other infrastructure costs were provided for in the annual budget of the CEC. The EMA Standing Committee reviewed their terms of reference in 2010.

Action item 2. Preparation and approval of an implementation work plan

This action item called for the preparation of a comprehensive work plan by December 2002 that would address each action item in the NARAP with a detailed description of activities, targets, time frames, assignment of responsibilities and funding needs and sources.

In the first meeting of the EMA Standing Committee following Council approval of the NARAP (January 2004), members agreed that additional expertise would be required to fulfill the obligations and actions set out in the NARAP. To accomplish this, the Standing Committee decided on an organizational substructure that would provide specific expertise related to monitoring and assessment. Six subgroups were proposed to address: human health, air deposition, aquatic and terrestrial, data management, planning and synthesis, sampling and laboratory analysis. The subgroups were asked to organize themselves and prepare work plans for consideration by the Standing Committee. A cursory budget analysis determined that adding six subgroups to the EMA Standing Committee, with their need for CEC support for meetings, workshops and conference calls would result in an annual budget request (\$263,000): far in excess of what could be managed within the 2004 CEC budget for the EMA NARAP (\$88,000). This did not include any projects that each subgroup might wish to undertake. Therefore the SMOC Working Group gave direction to focus on three priority areas:

1. Continue to advance monitoring projects that were already underway or in the advanced planning stages.
2. Initiate work to establish the baseline levels of NARAP chemicals in the environment.
3. Design and plan broader monitoring needs (index and satellite sites).

The following projects were developed and received approval by the Council to proceed: mercury wet deposition sites in Mexico, dioxin/furan ambient air monitoring in Mexico City and human blood biomonitoring.

The target date for submitting a comprehensive work plan was not met, given the EMA Standing Committee focused its early efforts on organizing the above-mentioned subcommittees to ensure that the appropriate expertise was made available to address monitoring, reporting and analysis. As a result, the first work plan, although not comprehensive, was presented in 2004. It was noted that tracking the fate and effects of NARAP substances in Canada and the United States would be

accomplished largely through already existing monitoring networks. In the case of Mexico, the need to establish new monitoring sites was underlined.

Action item 3. Biennial assessments of persistent toxic substances

Under this action item, a comprehensive assessment of PTS was to be prepared by May 2004 and biennially thereafter.

The development of a synthesis and assessment report was proposed to the Secretariat in 2004 that would examine the status and trends of PTS in North America as well as the threat they posed to environmental and human health in North America. It received funding, beginning in 2005, and was completed in 2009.⁵ The report is a scholarly treatment of the significant body of environmental monitoring information available in the literature related to PTS in the environment and related trend data. The author, who relied on data from the published literature to complete this assessment, found a wealth of Canadian and US data, but much less so for Mexico. *No subsequent assessments were carried out.*

Action item 4. Implementation of NARAP

This action item called for an assessment of progress being made under this NARAP by May 2004 with biennial updates thereafter. This assessment was to include a summary of major programs in each country that contribute to the status, trends and effects of PTS.

The ongoing assessment of the NARAP implementation was not carried out. However, in 2007, a study was undertaken to provide an initial review of major programs or activities in the three countries that contribute to the assessment of the status, trends and potential impacts of toxic chemicals. This activity was intended to document relevant on-going programs in this area in order to foster monitoring and assessment initiatives that are comparable across the three countries. In addition, it was felt that this might assist Mexico in developing its own national monitoring initiative (Proname). In 2009, the CEC published the findings of this study in a report that provided a summary of national and regional environmental and human health monitoring initiatives and emissions inventory activities in the three countries.⁶ The report concluded that the information documented in this study could provide the basis for decision-making related to state of the environment reporting.

Action item 5. Synoptic baseline survey of persistent toxic substances in Mexico

The intention under this action item was to initiate by December 2002 and complete by May 2004 a baseline survey of the levels of selected PTS in Mexico. The data generated in this survey was to be integrated in the first biennial assessment identified in action item 3.

This baseline survey was not undertaken. However, in 2006, a contract was initiated to search out and examine scientific studies and reports in Mexico related to PTS that may not have been formally documented in the scientific literature. It was hoped that some useful new research or monitoring work might contribute to the database of information that was being sought in Action Items 3, 4 and 5. Fifteen academic institutions were surveyed in Mexico and a total of 146 documents were found to

⁵ Robertson 2009.

⁶ CEC 2009b.

be of potential interest to work under the EMA NARAP. A report summarizing this work was published in 2009.⁷

Action item 6. Initial assessment of persistent toxic substances in Canada and the United States

This action item identified the need to carry out an initial assessment of PTS in Canada and the US with a view to combining it with the survey carried out in Mexico under action item 5. The assessment would also contribute to the first biennial assessment described in action item 3.

This assessment was not undertaken.

Action item 7. Exposure of newborn children and infants to persistent toxic substances

This action item envisaged, at a minimum, the collection and analysis of blood samples of pregnant women in the three countries. It was to start by December 2002.

The Secretariat was asked to search for external funding through international funding institutions like the World Bank or the Global Environment Facility (GEF) to support this activity. The first funding opportunity came with the signing of the Stockholm Convention on POPs in 2001 when funding became available to support POPs-related projects in developing countries. A project proposal was submitted to the World Bank and received favorable consideration. The sum of US\$100,000 was earmarked by the Bank to support the blood monitoring work. In 2004, funding was received from the World Bank to support a human blood monitoring survey for POPs and metals in Mexico. This study had two objectives, to obtain an initial trinational picture of human exposure to POPs and to build capacity in Mexico to undertake monitoring of this type. As a first step, Mexican scientists were trained in Canada and the US to perform analyses of metals and POPs in human blood. Blood was collected from first birth mothers at five sites in Canada and 10 sites in Mexico and data was also extracted from the NHANES database in the US from women of childbearing age. Blood was analyzed for several metals and selected POPs. Not unexpectedly, cadmium, lead, total mercury, selected PCB congeners, oxychlordane, beta-hexachlorocyclohexane (β -HCH) and dichlorodiphenyldichloroethylene (DDE—a decomposition product of the pesticide p,p'-DDT), were found in at least 70 percent of the women in each country. These were considered typical results in areas where chemicals have been used or produced in higher quantities.

This initiative gave the Human Health subgroup impetus to convene experts in workshops to design and implement the project. This work was completed over several years and a CEC report assessing the levels of POPs and selected heavy metals in the blood of first-birth mothers in southern Canada and Mexico and in women of reproductive age in the United States was published in 2011.⁸

In 2009, the presence of lindane and the alpha and beta isomers of hexachlorocyclohexane in children's blood and bovine raw milk samples was studied.⁹ Detectable levels of at least one of the isomers were found in a high percentage of the children studied. One or both isomers were also detected in bovine milk. As an adjunct to this study, an independent expert was asked to examine the quality assurance/quality control (QA/QC) procedures used by the analytical laboratory and found

⁷ See CEC 2009a.

⁸ CEC 2011.

⁹ CEC 2010.

sensitivity issues with the methods used, which resulted in a high number of samples in which low and very low concentrations simply went undetected.

Action item 8. Exposure of communities, populations and occupations to persistent toxic substances

The objective of this action item was to plan and recommend a baseline survey of exposure of selected communities or occupations that may have a higher exposure to PTS. This was to be carried out in conjunction with action item 7.

The baseline survey was not undertaken. However, other complementary activities were carried out.

The CEC's 2011–2012 Operational Plan identified a project to develop a multi-year human biomonitoring program in Mexico as a valuable addition to Proname. Some workshops were organized by the *Instituto Nacional de Salud Pública* (INSP) in Mexico, with the support of the CEC and expert guidance provided by Canada. These workshops helped lay out the basic elements of a long-term human biomonitoring program. It was recognized that an ongoing financial commitment from the Mexican government would be needed in order to implement this program. In 2011, the CEC published a report on blood monitoring of pregnant women in the three countries. For the purpose of this report, the Mexican samples were analysed at the Canadian laboratory to enhance comparability of the data. Subsequent quality assurance exercises were undertaken to ensure that proficiency in conducting analyses was retained by the scientists in Mexico, who also analyzed duplicates of these blood samples in-country. A major problem was identified with cross-border shipments of biological samples into Mexico for analysis and protocols had to be established to facilitate importation of these samples.

Action item 9. Mercury pilot study

This action item called for planning and conducting a pilot study to determine exposure to mercury in an area of Mexico where large amounts of mercury have been used. An initial report was to be prepared by December 2004.

In 2002, a preliminary field survey of mercury deposition in soil and on vegetation in Zacatecas was undertaken to determine the potential contamination from mercury and other heavy metals.¹⁰ At some sampling locations, some metals (arsenic, mercury, cadmium, lead and zinc) were found in soil at concentrations that exceeded the criteria thresholds of other jurisdictions (Ontario, Canada, and US EPA standards). Elevated levels of these metals were also found on vegetation (corn leaves) but the environmental or human health significance of these findings could not be determined without further study. Additional information on this initiative can also be found in the Mercury NARAP Close-out Report.¹¹

In addition, Canada loaned two TEKRAN® ambient air mercury monitors to Mexico and Mexican scientists were trained in their use. Measurements were taken in 2003–2004 to establish total gaseous mercury (TMG) concentrations at rural and urban sites, including open dumps and sanitary landfills, brick kilns, mining waste disposal sites, and mercury secondary extraction plants. Data collected in Mexico City showed correlation between atmospheric mercury levels and point sources of mercury emissions identified in the Mexican pollutant release and transfer registry (RETC).¹² Another paper

¹⁰ CEC 2002a.

¹¹ CEC 2013a.

¹² Rutter, A.P. et al. 2009.

reported elevated levels of mercury vapors in the atmosphere above the San Joaquin mining region of Querétaro, presenting a constant source of exposure for inhabitants of that region.¹³

In 2013, a study documenting mercury concentrations in fish in Mexico was published by the CEC.¹⁴ As a preliminary overview of mercury in fish tissue in Mexico, several different datasets were examined, which included a small number of various species of fish collected at different times in various parts of the country and analyzed by different laboratories. While three species of fish were found to have mercury levels higher than the Canadian commercial fish guidelines, the author cautioned against drawing any conclusions about the possible impact on humans. Further studies would need to be done to establish the extent to which fish are a part of the Mexican diet and what species are commonly consumed.

Action item 10. Initial collaborative monitoring sites

The intention in this action item was to establish initial monitoring sites in Mexico for selected PTS. These were to be modeled after existing sites in the US and Canada with a view to eventually becoming Index Sites or Satellite Sites,¹⁵ as will be described in action items 11 and 12. Consideration was to be given to monitoring at one or more sites for: mercury wet deposition, dioxins and furans in ambient air as well as extending the Integrated Atmospheric Deposition Network (IADN) in the Great Lakes to other parts of North America, including Mexico.

In 2002–2003 Mexico developed and implemented a monitoring program using sediment cores extracted from three remote lakes and reservoirs.¹⁶ This work received financial support from the CEC and analytical support and expert guidance from the US EPA. The findings yielded interesting results, namely that there was no spike in dioxin/furan concentrations in Mexico during the period from the late 1940s to the late 1970s as was reported elsewhere in the literature.

In 2003–2004, with financial support from the CEC, equipment provided by Canada and laboratory analytical support from the US, two mercury wet deposition sites were established in Mexico as a two-year pilot project. The sites were audited to ensure that they met the strict certification requirements necessary for inclusion in the Mercury Deposition Network (MDN). They passed and the data were accepted for inclusion in the MDN database, thus providing complete continent-wide coverage of mercury deposition for the first time. Unfortunately, Mexico could not find sufficient funding to operate the sites at the completion of the pilot project and the sites were shut down.

In 2004, the Dioxins, Furans, and Hexachlorobenzene Task Force (DFHCB TF) set out to plan the development of an ambient air-monitoring network for dioxins, furans, and hexachlorobenzene in Mexico. By 2009, nine monitoring stations were set up and operating across the country to measure dioxins and furans in ambient air. Efforts were also made to extend atmospheric measurements POPs to other regions of North America through the Global Atmospheric Passive Sampling (GAPS) Network. Monitoring results showed that levels of dioxins and furans at urban stations were as high as those measured in the US and Canada had been in the late 1990s, when fewer risk management actions were in place. The GAPS Network currently operates 19 sites in North America.

¹³ Martinez-Trinidad, S, et al. 2013.

¹⁴ CEC 2013c.

¹⁵ A definition of index sites and satellite sites is provided at the end of this report.

¹⁶ Hansen, A.M. et al. 2010.

In 2009, two Proname sites were established and commenced operation: one at Valle del Yaqui (farm site) and at Celestún (background site). Substances sampled included POPs, metals, polyaromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) in some or all media (soil, sediment, water, air, biota). In 2010, the CEC continued to support Proname development with the addition of a third new monitoring site at Manantlán, and as well as ongoing support for the operation and maintenance of the already existing sites. The 2011–2012 Operational Plan identified continued support for Proname under the EMA NARAP. Two new monitoring sites were added to the Mexican network in 2011: Valle de Bravo and Coatzacoalcos. Under Proname, by 2013 four monitoring sites had been established in Mexico with support from the CEC. These included the Biosphere Reserve Rio Celestún, Yucatán; the Biosphere Reserve Sierra de Manantlán, Jalisco; the Yaqui Valley, Sonora; and the Valle de Bravo, State of Mexico. In addition, Mexico established sites in Coatzacoalcos, Veracruz; Salamanca, Guanajuato; and at the Biosphere Reserve Mapimí, Durango. The types of samples included water, sediment, soil, air, and animal and plant biota. These samples were analyzed for a variety of chemicals, including chemical elements, organochlorine pesticides (OCPs), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls and homologues (PCBs) and brominated compounds (INECC, 2008; 2011; 2013).

Mexico also established in 2011 a Proname website with a view to promote public access to information about this monitoring program. To date there have been 61,000 visitors to the site.

In 2013 a workshop entitled ‘Trinational Workshop on Assessment of Monitoring Results from Mexico’s Proname Program and Exploring Possible Synergies between North American Environmental Monitoring Programs’ brought together monitoring experts to compare notes on the current status of the North American monitoring networks and to examine ways to continue to work together and share information and expertise on an informal basis after the closure of the EMA NARAP.

A qualitative evaluation of the EMA NARAP was completed in 2013 with the aim of determining progress made in achieving the objectives set out in the NARAP.¹⁷ Information was gathered from the CEC and the Parties, and interviews were conducted with key experts and stakeholders. From the numerous findings and recommendations, and despite the objectives set out in the NARAP, no mechanisms in place to measure progress or to determine priorities for action were found. The progress in meeting objectives was slow and the ability to achieve the objectives in the near term seemed to be questionable. It was felt that a more rigorous approach to setting priorities was needed. Six areas of opportunity were identified for improvement, including: prioritizing the objectives, adopting a formal performance measurement strategy and evaluation framework, seeking external funding, clarifying roles and responsibilities between the Parties involved in the SMOC initiative, improving coordination on projects, and streamlining the project selection and approval process.

In 2014, the CEC released a separate report entitled “Quantitative Analysis of Proname” intended to provide decision-makers in Mexico with policy options for the maintenance and expansion of their monitoring network and analytical capacity for PTS.¹⁸ It offered a comprehensive evaluation of all the results from the monitoring of PTS (89,338 discrete records, of which 72,827 are noted as “not detectable” and 16,511 contain numerical measurements) in environmental media at several different

¹⁷ <http://www3.cec.org/islandora/en/item/3425-north-american-regional-action-plan-environmental-monitoring-and-assessment>

¹⁸ CEC 2014.

geographical locations in Mexico. It also described the detailed database assembly, analysis and statistical interpretation performed on these data.

Action item 11. North American Reference Network of Integrated Index Sites

Under this action item, the intention was to identify and designate a number of key multimedia index sites that would constitute a North American Reference Network. All sites in the reference network would have common sampling, analysis, data management and reporting protocols and procedures. By 31 December 2003, Canada, Mexico and the US were to nominate, at a minimum, six, three and nine sites, respectively.

This action item was only partially fulfilled. Given that index sites were already in existence in Canada and the US, but none in Mexico, it was decided that as a first priority, the CEC would provide financial support, and Canada and the US would provide technical support to assist Mexico in establishing a number of index sites in that country. This effort finally commenced only in 2009, after the first years were invested in defining Mexico's monitoring needs as described under action item 14, below.¹⁹

Action item 12. Satellite sites

This action item called for the identification and designation of a number of satellite sites, which were to be run in conjunction with the index sites in the North American Reference Network. These were also to complement and expand those data gathering efforts. As with the designated index sites, common sampling, analysis, data management and reporting protocols and procedures would be followed.

This action item was only partially fulfilled. Instead, financial assistance from the CEC and technical assistance from Canada and the US were provided to Mexico to establish some satellite sites that could subsequently be integrated into a North American network. This work commenced in 2009 and the first years were invested in defining Mexico's monitoring needs as described under action item 14 below.

Action item 13. Reference data sets

Under this action item, experts were to identify and designate, by December 2013, 'reference data sets' that would be associated with the North American Reference Network noted in action items 10 and 11 above. These data sets would then be used to interpret and assess data coming from the Reference Network in a standardized fashion. Reference data sets might include data on PTS in biota, humans, air, water, sediment, etc.

This action item was not undertaken.

¹⁹ INECC 2009.

Action item 14. Cooperation and capacity building

This action item called for building capacity in Mexico to support the implementation of this NARAP. Two initiatives were to be undertaken. First, by May 2003, a conference or a workshop was to examine opportunities for supporting and encouraging capacity building. The intention was to bring experts from varied backgrounds to discuss the scientific and technical aspects of monitoring and define their needs. Granting agencies and international funding institutions would be encouraged to participate. Second, another workshop was to be convened by May 2004 to bring together experts to develop recommendations on facilitating the exchange of information and personnel to build capacity related to interpreting data on PTS in North America.

This action item was not completed as originally envisaged in the NARAP.

The first part of this action item was superseded by a complementary effort by the World Bank and other partners, which held a workshop in Mexico City in 2002 to identify capacity building needs for producing data and information on POPs in Mexico and Central America. The second part became an ongoing effort by the CEC to support workshops and training sessions for Mexican scientists, all with the intent of building capacity related to environmental monitoring and assessment.

It was clear from EMA Standing Committee deliberations that the limited number of people in Mexico available to work on monitoring activities and the lack of data and information on PTS posed a challenge for NARAP implementation. The impetus for capacity building was elevated when in 2005 Council adopted the Puebla Declaration and specifically acknowledged and encouraged capacity building as a cornerstone CEC activity. The Puebla Declaration put priority on ‘three pillars’ of activity:

- Information for Decision-making
- Capacity Building
- Trade and the Environment

From 2005 onward, activities under the EMA NARAP were anchored under the first two pillars from the Puebla Declaration, namely ‘Information for Decision-making’ and ‘Capacity Building.’²⁰ The Trade and Environment pillar was unrelated to the work of the SMOC initiative and was therefore not referenced in the SMOC work program. In response to direction given by the SMOC Working Group, the EMA Standing Committee reduced the number of subgroups to three: the Indicators Subcommittee, the Data Discover, Access and Integration Subcommittee, and a Synthesis and Assessment Subcommittee.

The EMA Standing Committee reviewed work being undertaken in the NARAP and decided to put more focus on how Proname could be better supported so that Mexico could meet the terms of action items 11 and 12. A Proname workbook²¹ was prepared that outlined the key elements of a properly constituted environmental monitoring program. This was used as a guide to identify Mexico’s needs in order to properly address these action items.

²⁰ See <<http://www.cec.org/Page.asp?PageID=30101&ContentID=17614&SiteNodeID=580>>.

²¹ Proname Planning Workbook (draft), 2006, unpublished.

In 2006, an expert group ('Tiger Team') was appointed to work out the details of Mexico's needs. They convened a workshop to review all the elements contained in the Proname workbook. Based on this close analysis, they prepared a summary of specific actions for EMA Standing Committee consideration. They recommended that one urban and three rural reference sites be established, as a minimum, along with a small number of satellite sites at 'hotspots' near industrial or other sources of contamination. They prepared a template for the design of a monitoring program, using criteria previously established in Canada and the US. Given that some monitoring was found to be taking place at various locations in Mexico, they recommended that a mechanism be devised to bring various agencies with monitoring programs together to examine the possibility of working more closely together to share facilities, resources, lab capacity, etc.

It was clear that Mexico would need substantial funds to develop and put in place a meaningful number of index and satellite sites and that external funding sources should be tapped to help support start-up. The EMA Standing Committee accepted the recommendations and proposed that two inter-agency workshops be held in Mexico, one that would bring the scientists together to share information on the various monitoring programs and a second, policy-level workshop at which agency heads would discuss ways to enhance cooperation.

Given the ongoing concern about the need for external funding to support Proname, in 2007 the executive director of the CEC met with the executive director of the GEF. The latter expressed interest in funding projects related to environmental monitoring as that is a major lack in developing countries. However, a number of factors would need to be taken into account if a monitoring project proposal were to be brought forward for GEF consideration. First, the project would have to be submitted directly by Mexico, not through the CEC. Second, only one agency of the government could not submit a project. It had to have the approval of the government. The GEF wanted to ensure that there was no competition between agencies or projects within the government and that the project truly reflected the top priority of the government. Third, the country would need to demonstrate 'quick start' capability if a project was approved for funding.

The EMA Standing Committee arranged a scientific workshop in 2007 to examine how work under the NARAP could be channeled to support advancement of Proname. The Proname workbook noted above was used as a guide to identify Mexico's monitoring needs.²² The workshop also took note of the Executive Director's meeting with the GEF related to funding opportunities and the fact that the GEF gave positive signals. It was decided that a small team from Mexico, with CEC Secretariat support, would be assembled to develop the basic technical elements of a GEF project proposal.

A policy-level workshop was held in Mexico in 2008 with the participation of heads and deputy heads of nine agencies with responsibility for monitoring. The invited agencies welcomed the opportunity to share information on their monitoring programs. Much interest for collaboration was generated as a result of this workshop and many participants expressed a willingness to identify where inter-agency cooperation could be enhanced, such as: sharing monitoring sites, laboratory capacity, field and lab personnel, training programs, etc. They proposed to cement their cooperation through formal memoranda of understanding. Full support was offered for Proname as a priority initiative for the Government of Mexico. It was agreed that the *Instituto Nacional de Ecología* (INE), now the *Instituto Nacional de Ecología y Cambio Climático* (INECC), should continue to be the lead agency to advance Proname. However, there is no information to indicate whether there was any interagency follow-up to this workshop.

²² Levine 2006.

Following this workshop, Mexican officials approached the United Nations Industrial Development Organization (UNIDO) to ask for assistance in preparing a project proposal to the GEF for funding Proname. Senior-level discussions took place both within Semarnat, INE and the *Centro Nacional de Investigación y Capacitación Ambiental* (National Center for Environmental Research and Training—Cenica) and with central agencies [(*Secretaría de Hacienda y Crédito Público*—SHCP, *Secretaría de Relaciones Exteriores* (Ministry of Foreign Affairs)] to build support for a GEF project proposal. Work continued in 2009 to prepare background information for a GEF project proposal. However, it came to light that other agencies within the Mexican government were also considering seeking GEF funds for biodiversity-related projects. *In the end, no project proposal for Proname was submitted to the GEF.*

Nevertheless, the CEC continued to support capacity building projects related to environmental monitoring in Mexico. At Mexico's request, more CEC resources were devoted to training and capacity building. Training included a course on sample treatment and analysis for POPs and metals in environmental matrices and in humans. In 2012, specific projects included practical, hands-on laboratory training for Mexican scientists by Canadian and US government experts, a laboratory validation exercise as well as validation of the sampling and analysis protocols used by Proname. These training exercises were led by Cenica, with expert guidance from an international consultant, and a number of Mexican laboratories were invited to participate. The participating labs were sent samples with predetermined concentrations of POPs and asked to analyze them and submit their findings. Cenica then reviewed the results and provided feedback to the participating laboratories. The consultant concluded that Cenica has demonstrated its capacity to organize inter-laboratory comparison exercises. Several recommendations were made to improve this program and make it financially self-sufficient.²³

The CEC also supported the development of a Proname micro website in Mexico.²⁴ This site is intended to serve as the main entry at which the public can obtain information on the work being undertaken under Proname and a repository where other scientists and researchers can find data and information.

In 2013, to support the work under SAICM²⁵ and contribute to the 10-year review of goals agreed to at the Johannesburg World Summit on Sustainable Development,²⁶ a CEC report was prepared entitled, 'Summary of North American Accomplishments in Support of SAICM'. It outlined the key objectives set out under SAICM and indicators of progress and provided a summary of actions undertaken in North America through the CEC to meet those objectives. The report was presented to SAICM as a model for international cooperation in 2013. As a result, the work completed under the EMA NARAP has been highlighted among the accomplishments, particularly as it relates to the SAICM objectives related to risk reduction, capacity building and technical cooperation.²⁷

²³ Weber 2013.

²⁴ See <www2.inecc.gob.mx/dgcenica/proname/>.

²⁵ In 2006, the International Conference on Chemicals Management (ICCM) adopted the Strategic Approach to International Chemicals Management (SAICM). SAICM is a policy framework intended to promote the sound management of chemicals throughout their lifecycle. Countries and regions were encouraged to implement programs by 2020 so as to minimize significant adverse impacts of chemicals on humans or the environment.

²⁶ The Summit goals were to ensure that chemicals are produced and used in ways that minimize significant adverse impacts on the environment and human health.

²⁷ CEC 2013.

List of training and capacity building activities

A total of 17 training and capacity building activities for Mexican scientists were identified in various CEC documents. Note that this is not intended to be an exhaustive list.

- POPs capacity building workshop for Mexico and Central America (2002)
- Capacity building workshop to support CEC/World Bank biomonitoring study (2002)
- Training for mercury analysis in environmental matrices at the University of Michigan (2003).
- Training in the operation and maintenance of the TEKRAN® mercury vapor analyzer (2003)
- Training in analysis of dioxins/furans in air, Environment Canada, Ottawa (2004)
- Training in analysis of dioxins/furans in food, Health Canada, Vancouver (2004)
- Training in the analysis of methyl mercury in fish at the Wildlife Research Centre of Environment Canada (2006).
- A workshop entitled, 'Transport and Fate Modeling of Air Toxics in Mexico' for modelers in the use of atmospheric modeling tools, Mark Cohen, NOAA. (2009)
- A workshop related to the selection and use of biota as indicator species at Proname sites, Roger Helm, US Fish and Wildlife Service, Peter Husby, US EPA. (2009)
- A workshop on 'Data Analysis and Validation' in Cuernavaca. (2009)
- Laboratory training at Cenica by US EPA staff for analysis of chlorinated pesticides and PCBs, Wayne J, Whipple, US EPA. (2010)
- Technical training and workshops on source characterization and Analytical Issues (2011)
- Technical training on quality assurance/quality control for air sampling analysis and foods analysis in Canada. (2011)
- Capacity building workshop to develop a multi-year human biomonitoring in Mexico (2011)
- Laboratory training at Cenica by US EPA staff related to the preparation and analysis of sediment samples for chlorinated pesticides and PCBs, J. Ferrario, US EPA. (2012)
- Training by Environment Canada staff in preparation and analysis of PBDEs in air samples (2012)
- Training in inter-laboratory validation techniques and protocols (2012–2013)

Outreach activities and communications materials

A number of fact sheets addressing the SMOC initiative and activities related to the NARAPs were prepared in 2003 in lay language to be used principally for public consumption.²⁸ These were made available at all public meetings of the SMOC Working Group and NARAP implementation task forces.

The SMOC Working Group held a major outreach initiative in 2012. Entitled the ‘Chemicals Management Forum,’ this meeting showcased all the work that had been accomplished since the SMOC initiative was launched in 1995 and provided an opportunity for public discussion and input from the stakeholders that were present.²⁹ Work on the EMA NARAP was included in the presentations at this meeting and specific attention was drawn to Proname and the results obtained to-date. Several overarching themes came out of the discussions at the meeting, including:

- Value of the three countries working cooperatively
- Value of promoting public awareness of SMOC projects
- Value of promoting “greener” products and processes
- Importance of ongoing regional stakeholder networking and engagement
- Caution not to lose ground on chemicals management progress to date.

The Proname micro site (website) has been in operation since 2011 and to-date has received 61,000 visitors.³⁰

An updated version of the EMA fact sheet was prepared in 2012 and is available on the CEC website.³¹

A public information summary on dioxins, furans, and hexachlorobenzene, along with some frequently asked questions, was made available on the CEC website in 2013.³²

Conclusions

The EMA NARAP, as envisaged by its authors and approved by Council in 2002, was an ambitious undertaking. It was seen as supporting other international monitoring program, such as amongst others, the Canada-US Great Lakes Collaborative Science and Monitoring Initiative (CSMI), U.S.-Canada Integrated Atmospheric Deposition Network (IADN) in the Great Lakes, and the Arctic Monitoring and Assessment Programme (AMAP). As noted in the NARAP and several times throughout the course of its implementation, there was a need to secure significant funding from external sources in order to support Mexico in the achievement of NARAP objectives. Where modest external funding was secured it helped advance project implementation (e.g., human blood monitoring). However, attempts by the CEC and Mexico to secure a large block of funds from international funding institutions to support capacity building for environmental monitoring in

²⁸ <http://www.cec.org/Page.asp?PageID=1323&SiteNodeID=312>

²⁹ <http://www3.cec.org/islandora/en/item/10985-commission-environmental-cooperation-chemicals-management-forum>

³⁰ <http://www2.inecc.gob.mx/dgcenica/proname/>

³¹ http://www.cec.org/Storage/130/15482_EM&A_cec_projectssummary_en_web.pdf

³² <http://cec.org/Page.asp?PageID=749&SiteNodeID=1243>

Mexico were unsuccessful. While Council Resolution 02-08 directed that external to the CEC resources and agencies should be engaged to support implementation of the EMA NARAP, it appears that the CEC did not have the institutional capacity or appropriate mechanisms in place to seek out external funding sources on an ongoing basis. Lack of significant additional funding support meant the NARAP objectives could be achieved only if implemented over a very long timeframe. This suggests that in the future an analysis should be made of the human and financial resources required to implement a NARAP (or any significant CEC undertaking for that matter), and those resources, including from domestic sources, should be secured before Council approval is sought.

Nevertheless, the EMA NARAP provided a formal structure for experts from the three countries to meet on a regular basis and collaborate on projects of mutual interest and concern. This regular contact was made easier through the meeting facilitation services that were provided for in the CEC budget. The objectives and action items in the NARAP were clear as to their intent, and a number of the action items identified due dates. Certain action items were not undertaken. However, as described above, in many cases complementary or related activities were implemented instead, based on actual circumstances encountered.

An important shift also took place in 2005 when, at the request of the SMOC Working Group, the EMA Standing Committee shifted its emphasis to provide more support for Proname-related activities. Similarly, when it became clear in 2010 that no external to the CEC funding would be forthcoming, the EMA Standing Committee focused on capacity-building and training to support Proname implementation. Moreover, with the adoption and opening for signature of the Stockholm Convention in 2001, and with the advent of other multilateral actions aimed at improved monitoring of toxic chemicals, the CEC's trilateral effort was overtaken by events and became a component of a broader global effort to support the Global Atmospheric Passive Sampling Network (GAPS). As a result, the EMA program enabled Mexico's deployment of Proname which is now a national monitoring effort which contributes to domestic, trinational and a broader international understanding of monitoring needs.

In summary, while a number of the action items in the NARAP were not met, the NARAP can nevertheless be considered a success, given that Mexico, with the support of the CEC, has expanded its capacity to conduct environmental and human health monitoring programs through Proname. This is evidenced by the implementation of the human blood monitoring study, the establishment of index and satellite sites in Mexico and the ongoing training and capacity building that took place during the course of implementation of this NARAP.

Definitions

Integrated Index Sites: The primary index sites are set up within the “North American Reference Network” for the systematic collection of data and information on the concentrations, fluxes and effects of persistent and toxic substances in the North American Environment, with particular reference to North American ecosystems and human health. These elected sites are those where, at a minimum, the wet/and or dry atmospheric deposition of three or more targeted substances at one or more locations within the geographic area encompassed by the site are monitored, and where the fluxes, fate and accumulation of targeted substances within the area are monitored and assessed, including at a minimum, the concentrations of the targeted substances in biota and other environmental media. The geographic area encompassed by an Integrated Index Site is a “North American Reference Area.” The Integrated Index Sites shall cooperate as part of the Reference Network and shall follow agreed-upon protocols and procedures for the collection of samples, the laboratory analyses of samples, and the storage, management and reporting of data and information.

Satellite Sites: These selected sites are cooperating sites associated with the North American Reference Network, which while not meeting all the criteria of an integrated index site do monitor at least one of the targeted substances in wet and/or dry deposition or which monitor the fluxes, fate and accumulation of at least one targeted substances within an area or region. All Satellite Sites will cooperate with the Reference Network and shall follow agreed- upon protocols and procedures for the collection of samples, the laboratory analyses of samples, and the storage, management and reporting of data and information.

North American Reference Network: The North American Reference Network for Monitoring and Assessment consists of network of cooperating sites for the systematic collection of data and information on the concentrations, fluxes and effects of persistent and toxic substances in the North American Environment, with particular reference to North American ecosystems and human health. The Network is to consist, at least initially, of existing or planned “Integrated Index Sites” in Canada, Mexico and the United States. In addition, “Satellite Sites” and “Reference Data Sets” will be included to increase the scope and potential of the Network.

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