Appendix 9:

Assessment of national capacity on POPs monitoring and technical support to strengthen regional coordination on sustainable monitoring of POPs in the Asia Pacific Region

This document has been developed within the framework of the SSFA under Global Environment Facility (GEF) project “Integrated SC toolkit to improve the transmission of information under Articles 07 and 15” (GEF ID 9884) and GEF-funded project "Continuing Regional Support for POPs Global Monitoring Plan under the Stockholm Convention" (GEF ID 4894)

Assessment of national capacity on POPs monitoring and technical support to strengthen regional coordination on sustainable monitoring of POPs in the Asia Pacific Region

Basel Convention Regional Centre for Asia and the Pacific/
Stockholm Convention Regional Centre for Capacity-building and
the Transfer of Technology in Asia and the Pacific
July 2023

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1. Introduction

Enhancing the national capacity for monitoring persistent organic pollutants (POPs) among member Parties of the Stockholm Convention is a critical strategy to promote the global monitoring plan for POPs. This strategy can help identify changes in POPs concentrations over time and their regional and global environmental transport. To achieve this goal, the GEF project "Continuing Regional Support for POPs Global Monitoring Plan under the Stockholm Convention" has been implemented by the BCRC/SCRC China in the Asia Pacific region.

As part of this project, a series of capacity building activities have been conducted, including disseminating a questionnaire on POPs monitoring capacity among regional countries, organizing forums to discuss the current situation and emergent needs in these countries, providing guidance on developing national monitoring plans, and identifying assistance from the Regional Centre, among others. These activities have enabled a clear understanding of the situation and difficulties related to POPs monitoring and have provided technical support to improve the national capacity for sustainable monitoring of POPs in these countries.

2. Assessment on the national POPs monitoring capacity and needs in the Asia Pacific Region

In order to strengthen the regional coordination and collaboration on POPs monitoring and increase the capacity for conducting POPs inventories and monitoring, BCRC China developed a questionnaire on national POPs monitoring capacity and needs in the Asia Pacific Region. The Parties served by BCRC China were invited to provide their inputs. The questionnaire is attached on Annex 1 in this report. Additionally, during the POPs forum held on 22 May 2023 in China, a couple of information was collected from the participating countries, including Mongolia, Cambodia, Maldives and

Myanmar. As a result, BCRC China analyzed such information and summarized in this report.

2.1 National POPs monitoring capacity in countries of Mongolia, Cambodia, Maldives and Myanmar

（1） Regarding the POPs monitoring projects which has been implemented and the selected contaminants and media

For Mongolia:

Mongolia conducted air sampling in Bayanzurkh district of Ulaanbaatar city, and surface water sampling at the Tuul river in Ulaanbaatar. The human milk sampling survey was conducted to allow analysis for brominated, chlorinated, and fluorinated all POPs listed in the annexes of the Convention. In addition, the national samples were collected by choosing 16 different matrices of samples, which include14 biotic matrices of beef, fish, mutton, horse meat, pork, chicken, sheep's tail fat oil, chicken egg, butter, cow milk, mare's milk, sea buckthorn, sea buckthorn oil, flaxseed, and 2 abiotic matrices of soil and water.

The contaminants monitored include Polychlorinated biphenyls (PCB), Organochlorine Pesticides (OCP), HCH, HCB, PeCBz, HBCD and DDT, et al.

For Cambodia:

Cambodia implemented Global Monitoring Plan (GMP) Project with focus on 2 main areas of passive air sampling and human milk survey.

For Maldives

Maldives collected soil and fish samples and sent them overseas for POPs and heavy metal analysis.

For Myanmar:

The National Implementation Plan for POPs in Myanmar had been developed and submitted to the Secretariat of the Stockholm Convention in 2021. Through the POPs Monitoring Project in East Asian Countries provided by

ECD/UNIDO/GEF, Myanmar conducted survey for inventory on POPs substances of Preliminary POPs Pesticides, DDT, PCBs, PBDE, HBCD, PFOS, and health impact for the assessment of the related POPs.

（2）Regarding the personal capacity and laboratory capacity for the technic of POPs monitorin

For Cambodia:

Cambodia received the POPs theory training and POPs analysis training in Vrije University Amsterdam, the Netherlands. But there is no regular training for the technical personnel.

For Mongolia:

A PCB laboratory was established at the Institute of Chemistry and Chemical Technology, where the PCB monitoring tests in the electrical fluids of the imported equipment and monitoring of the decontaminated equipment are being performed.

At present, the country is still dependent on international laboratories to analyze these samples for POPs but the national capacity for chemical analysis is being built.

For Maldives:

Pre-treatment facility equipped with a chemical laboratory is being established in Thilafushi.

2.2 Demands on national POPs monitoring capacity building

（1）Regarding financial support

Cambodia and Myanmar expressed their need for the financial sources from various sponsors.

（2）Regarding professionals and technical personnel

Cambodia needs the training courses on POPs monitoring and analysis for officials. Mongolia needs to receive training on analytical methods and instruments as well as on laboratory personnel. Myanmar needs the technical

assistance from other experienced organizations.

（3）Regarding the professional testing equipment and laboratory capacity

Cambodia is lack of analytical capacity, poor monitoring programme and very limited capacity of laboratory related with POPs monitoring and management, thus put forward a need for laboratory analytical instruments.

In Mongolia, all laboratories dealing with environmental sample analysis in the country cannot deliver an analysis of POPs with sufficient accuracy. Thus, they need to enhance the laboratory capacity and laboratory personnel for POPs chemicals analysis to identify contamination in core matrices and food products. Mongolia wish to take part in global or regional monitoring plans on POPs continuously in collaboration with UNEP, WHO, and other experienced organizations and expert laboratories in generating high-quality POPs data in as many different matrices as possible. Maybe a regional expert laboratory that can assist and work closely with the National Laboratory would be beneficial.

Myanmar also expressed their need to increase the analytic and laboratory capacity for POPs monitoring.

2.3 Summary

The Parties participating involved in the assessment of POPs monitoring capacity are all developing countries with relatively slow economic growth. As such, they all have a significant demand for financial support. In these countries, the technical skills of personnel, analytical equipment, and laboratory capacity are insufficient to meet the requirements of the national monitoring plan outlined in the Stockholm Convention. Currently, the participating countries are showing a keen interest in GMP projects and are developing their action plans. Therefore, it is crucial to assist them according to the demands they have put forward. However, more work is needed in dissemination and communication to improve regional coordination.

3. Priority areas where regional coordination is needed for sustainable monitoring of POPs

Addressing the issue of POPs requires a coordinated global effort, and the Stockholm Convention on POPs provides a framework for international cooperation. However, effective monitoring of POPs requires regional coordination to address the unique challenges and priorities of different regions. In this context, identifying priority areas where regional coordination is needed for sustainable monitoring of POPs is crucial. BCRC China called on regional countries to identify priority areas by analyzing their national monitoring situations. As a result, Maldives and Myanmar responded with their respective priority areas.

3.1 Priority areas identified for the national implementation plan of Maldives

(1) In order to improve chemical and waste management, it is necessary to strengthen the institutional and regulatory framework. This can be achieved through the development of effective chemical and waste management legislations, building institutional capacity, addressing the issue of fragmented and overlapping mandates, and implementing robust data collection and management systems. It is also important to establish hazardous waste management facilities and enhance the Makudi portal. To achieve better management of chemicals, a unified chemicals management regime and legislation should be established, and all roles and responsibilities related to persistent organic pollutants (POPs) should be clearly defined for relevant agencies and institutions. Furthermore, streamlining the overlaps of mandates of state institutions can be done by creating a single window policy.

(2) Open burning is the primary method of waste management in Maldives, which is the source of 98.6% of Unintentional Persistent Organic Pollutants (UPOPs). To address this issue, it is necessary to make proper incineration

mandatory and prohibit open burning of hazardous waste. This can help to reduce the amount of UPOPs released into the environment and ensure that those responsible for open burning of hazardous waste are held accountable for their actions.

(3) The lack of rigid vehicle emission standards has resulted in the release of UPOPs through transport. To address this issue, it is necessary to revise the vehicle emission and engine capacity standards to ensure that they are more stringent and effective in reducing UPOPs emissions. Additionally, a mechanism must be put in place to support the use of low emission vehicles, which can further contribute to reducing UPOPs emissions and promoting sustainable transportation practices.

(4) To eliminate Polychlorinated Biphenyls (PCBs) by 2025, a comprehensive action plan must be put in place. This plan should include measures such as labeling and mapping PCB-containing equipment and materials, as well as properly storing and treating them to prevent further release of PCBs into the environment.

(5) To reduce nonadherence to regulations concerning POPs, public and stakeholder education and awareness must be prioritized. This education should focus on gender aspects and consider the different impacts of POPs on men and women. Additionally, studies on the impacts of POPs on health can help to raise awareness of the dangers of these pollutants and encourage individuals to take action to reduce their exposure. Waste segregation and the implementation of a labeling system in local languages, English, and common expatriate languages can also help to improve adherence to regulations and ensure that individuals are aware of the proper disposal methods for POPs-containing materials.

3.2 POPs related priority areas in Myanmar

(1) To effectively address environmental challenges related to POPs, it is essential to strengthen coordination between institutions and stakeholders,

build the capacity of relevant committees and enhance their knowledge and expertise to improve decision-making.

(2) It is critical to develop legislation and its related implementation. This involves the creation of laws and regulations that are aimed at reducing or eliminating the use and release of POPs, as well as the establishment of mechanisms for enforcing these regulations.

(3) Capacity building, research, education, information, and awareness raising are essential components of addressing the POPs related environmental challenges. This involves training on monitoring, reporting, and responding to POPs-related concerns. Research can help to identify the sources and impacts of POPs, as well as effective strategies for their management and elimination. Education and information sharing can help to increase public awareness of the dangers of POPs and encourage individuals to take action to reduce their exposure. Finally, awareness raising efforts can help to mobilize support for policies and programs aimed at addressing POPs.

(4) Environmentally sound management of POPs stockpile, including the proper handling, storage, and disposal of POPs-containing materials, such as Polychlorinated Biphenyls (PCBs), pesticides, Polybrominated Diphenyl Ethers (PBDEs), Hexabromocyclododecanes (HBCD), and Perfluorooctane Sulfonate (PFOS).

(5) Improving waste management and introducing a waste hierarchy towards a more circular economy can help to reduce the formation of Unintentionally Formed Persistent Organic Pollutants (UPOPs) from open burning.

(6) Best Available Techniques (BAT) and Best Environmental Practices (BEP) are key approaches for reducing the release of Dioxins and Unintentionally Formed Persistent Organic Pollutants (UPOPs) into the environment.

(7) Monitoring of POPs is essential to identify trends in their levels over time and in different locations, as well as to assess the effectiveness of interventions aimed at reducing their release. Collaboration between various

stakeholders, including government agencies, industry, civil society, and the public, is essential to ensure that monitoring and evaluation efforts are comprehensive and effective.

(8) Substitution of POPs with green and sustainable alternatives is key strategy for promoting a circular economy. This involves identifying chemicals and materials that are safer and more environmentally friendly than those containing POPs, and promoting their use in various applications.

4. Technical support to strengthen regional coordination and national capacity on sustainable monitoring of POPs.

Strengthening regional coordination and national capacity for sustainable monitoring of POPs is crucial to effectively addressing global POPs issue. Technical support plays a vital role in achieving this goal by providing the necessary skills and expertise to develop and implement effective monitoring programs. For this goal, BCRC China developed a framework structure for national monitoring plans by reviewing the POPs monitoring programs in China. At the POPs forum held on 22 May 2023, BCRC China presented China's national monitoring plan and invited regional countries to use the framework structure to initiate discussions and develop their own national monitoring plans. This support will help countries in the Asia Pacific region to develop effective and sustainable monitoring plans, tailored to their specific needs and priorities. The content of China's national monitoring plan of POPs is detailed in the report titled "A4 Supplementary National Monitoring Plan of POPs in China".

4.1 Framework for conducting the National Monitoring Plan

Effective and sustainable monitoring of POPs requires several key areas to be addressed. Institutional arrangements should be established to ensure effective communication and coordination among different stakeholders involved in POPs monitoring. This can involve establishing inter-ministerial

committees or task forces with representation from relevant government agencies, civil society organizations, and academic institutions.

To support these coordination mechanisms, legal documents on POPs monitoring should be developed to provide a clear legal framework for monitoring activities. Technical standards are also crucial for ensuring the accuracy and comparability of monitoring data. These should cover sampling, analysis, and quality control procedures and should be based on internationally recognized standards.

To ensure the ongoing effectiveness of the monitoring system, it is important to conduct regular analysis and evaluation, identifying strengths and weaknesses to improve performance over time. Capacity building activities should be conducted to enhance the technical expertise of staff involved in monitoring activities.

The focus of POPs monitoring should be on those listed under the Stockholm Convention Annex A and B, which includes a range of persistent and bioaccumulative chemicals that pose significant risks to human health and the environment. Appropriate methods for sampling, analysis, and data handling should be defined for different media, including human milk and blood, water, and other environmental samples. Standardized methods should be used wherever possible to ensure the comparability of monitoring data across different regions and countries.

Overall, by addressing these key areas, it is possible to develop effective and sustainable POPs monitoring systems that can contribute to the global POPs monitoring and management.

4.2 Current situation and needs for the national monitoring plan of POPs in Myanmar

Based on the communication and training on the POPs forum on 22 May 2023 in China, Myanmar established the national monitoring plan according to the framework provided by BCRC-China. The plan generally summaries the

current situation and action plan of national monitoring of POPs in Myanmar, and furthermore, asks for assistance from international organizations and regional coordination to improve the monitoring capacity in Myanmar.

(1) National coordination mechanisms

- Ministry of Natural Resources and Environmental Conservation
- Ministry of Commerce
- Ministry of Agriculture, Livestock and Irrigation
- Ministry of Health and Sports
- Ministry of Industry
- Ministry of Electricity and Energy
- Ministry of Education
- Ministry of Transport and Communications
- Ministry of Planning and Finance
- City Development Committee

(2) Capacity of organization and management in POPs monitoring activities in Myanmar

In Myanmar, there are 17 governmental laboratories under 7 Ministries, including the Ministry of Agriculture, Livestock and Irrigation (MOALI), Ministry of Education (MOE), Ministry of Industry (MOI), Ministry of Natural Resource and Environmental Conservation (MONREC), Ministry of Health and Sport (MOHS), Ministry of Electricity and Energy (MOEE), and Yangon City Development Committee. Additionally, several private laboratories are located in Myanmar. The Myanmar Food Laboratory Network (MFLN) was established in October 2015. The MFLN consists of 15 government labs and 3 private labs and aims to develop a platform to share laboratory-related information and knowledge.

Despite these efforts, there is currently no analytical capacity for POPs in Myanmar. However, there is a plan to conduct a capacity building workshop for the analysis of PCB, the first POPs, at the FDA Laboratory in Nay Pyi

Taw. This workshop will be supported by the United Nations Industrial Development Organization (UNIDO) and Japan.

Strengthening laboratory capacity for POPs analysis in Myanmar is essential to effectively monitor and manage these toxic chemicals. It is important to continue building partnerships and collaborations with international organizations and private sector partners to support the development of laboratory capacity in Myanmar.

(3) Assessment of legal documents on POPs monitoring in Myanmar

Improvement and development of legislation on POPs and general chemicals and their management is needed. While POPs pesticides are largely banned in Myanmar, there is a lack of legislation for industrial POPs. Also an improved legislation for wastes containing POPs and general hazardous waste management is needed. A range of waste fractions potentially containing POPs need particular control and regulatory frames for their management. (e.g. PCB equipment; e-waste and related plastic; end-of-life vehicles, waste oils, waste wood). Here the activities should be coordinated/ mainstreamed with the Master Plan for Hazardous Waste Management.

Where gaps have been discovered appropriate legislation should be developed. There is a need for institutional strengthening in the area of chemical and waste possibly with employment of additional staff for chemical and waste management to have the necessary capacity for the needed national tasks. Also other ministries need institutional strengthening for chemical and waste management. This strengthening of institutions is needed for the development of the appropriate legislation and regulation and for the implementation of the regulatory framework and the action plans.

(4) Analysis and evaluation of the system of regulations and technical standards

- Chemical Management Guideline
- Import/export management

- Restriction
- Research development
- BAT/BEP

(5) Target POPs

- PCBs
- Pesticides
- POP-PBDEs
- HBCD
- PFOS

(6) Methods of sampling, analysis and data handling

- Assessment of contaminated sites
- Air Sample Analysis
- Water Sample Analysis

4.3 Monitoring activities for POPs and national monitoring plan in Maldives

(1) Capacity of organizations and management in POPs monitoring

Regular testing and monitoring is not conducted under any organization. The Ministry of Environment, Climate Change, and Technology is the main institution responsible for the management of POPs, particularly the Chemicals Management Unit, Waste Management Department, and the "Eliminating Persistent Organic Pollutants through sound management of chemicals" project (POPs project). The project aims to reduce the risks of POPs on human health and the environment through strengthening of the institutional capacity, and the policy and regulatory framework for the environmentally sound management (ESM) of hazardous chemicals with focus on POPs. Technically, the project will develop sustainable systems for the sound collection, labeling, storage, and disposal of hazardous POPs chemicals and waste.

Components under the POPs project:

- Component 1: Strengthening the regulatory and policy framework and institutional and technical capacity for the sound management and disposal of POPs, chemicals and wastes.
- Component 2: Establish systems for the sound collection, labeling, storage and disposal of hazardous chemicals and wastes.
- Component 3: Monitoring and learning, adaptive feedback, outreach and evaluation.

Current efforts by the POPs project to address the NIP recommendations:

- Hazardous Chemicals Management Bill drafted, covering lifecycle management of chemical
- Baseline assessment of national use of chemicals published in 2022
- Updating Makudi portal to include spatial data, inventories, notifications for relevant agencies, automated red flag warnings for restricted chemicals, import quotas/volumes, licensing details for use
- Soil and fish samples collected and sent overseas for POPs and heavy metal analysis
- Construction of an Interim Hazardous Chemicals and Waste Storage Facility in Addu City
- Pre-treatment facility equipped with a chemical laboratory is being established in Thilafushi

The Ministry of Fisheries, Marine Resources and Agriculture is also involved in POPs management as they are responsible for the management of pesticides including storing, treatment, and regulation of import and distribution.

Imports data is collected by Maldives Customs Services. Detailed statistics pertaining to the chemicals imported into the country are unavailable except for import data. The broad categories of imports of chemicals and related industries are subdivided under the harmonized system into a number of groups and are managed by the MCS. All chemicals require prior permission

from the Ministry of Defence before import into the country can take place. The Ministry of Defence and National Security is also responsible for monitoring the control and flow of chemicals. These responsibilities can be categorized as regulation of chemical weapons, import of chemicals into the country and the disposal of chemicals.

Limited capacity for testing chemicals: Local capacity for testing chemicals is unavailable to support enforcement and monitoring and this issue needs serious attention. It has been identified by numerous stakeholders as one of major challenges in the management of chemicals. Monitoring and sampling for routine testing is infrequent and can be improved by increasing technical capacity for testing. The laboratory at Maldives Customs Service is non-functional and samples are sent to the Police Forensic Laboratory or overseas when necessary for enforcement, which is very costly and time consuming. The National Health Laboratory currently has the capacity to test the levels of major chemical contaminants in water and has limited capacity for testing chemicals in food and pharmaceuticals. However, testing facilities for POPs, heavy metals, and other important parameters (such as pesticides) are not available.

Makudi portal is a harmonized database that shows the most common types of chemicals imported to Maldives in order to help monitoring and surveillance of imported chemicals. The online portal is used to obtain import permits, hazardous chemicals permits are given by the Ministry of Defense, HCFC import permits are given by the Ministry of Environment, and fertilizer/pesticide permits are given by the Ministry of Fisheries and Agriculture. The portal also allows inter agency communication facilitated.

(2) Assessment of legal documents on POPs monitoring in Maldives

All chemicals restricted under Stockholm Convention are banned in Maldives except for PCBs. However, this ban is not tied to any legislative norm, and has been exercised via public announcement. There is a lack of a special

normative base for POPs treatment, many state institutions have an overlap in mandates on chemicals management. Currently a Chemicals Bill is being drafted which will cover the lifecycle management of chemicals.

Existing legislations and regulations related to the sound management of chemicals and hazardous waste (not specific to POPs alone) are as follows:

- The Law on Importation of Prohibited Items to the Maldives (Law no. 4/75)
- The Environmental Protection and Preservation Act (Law no. 4/93)
- Pesticide Bill
- Waste Management Act (Law no. 24/2022)
- Draft Chemicals Management Bill: which will cover the lifecycle management of chemicals

Capacity building trainings conducted under POPs project:

- Capacity building on identification and prevention of illegal import of POPs and hazardous wastes and their safe handling for enforcement officers in the Maldives: trained staff from Customs, Maldives Ports Limited, Hithadhoo Port, Police, Maldives National Defence Force, Environmental Protection Agency
- On field PCB sampling training for Fuvahmulah and Addu City's Fenaka Corporation staff members

Future trainings planned following procurement of lab equipment and establishment of legislative policies.

(3) National coordination mechanisms

Steering committee under the POPs project is composed of representatives from each stakeholder. The committee holds annual meetings to discuss the annual budget and workplan for the project. A joint steering committee has also been formed between the POPs projects and the ISLANDS project which will also discuss chemicals and waste management and coordination between the two projects.

Stakeholders consulted for the NIP 2017 are as follows:

Environment: Ministry of Environment and Energy (now Ministry of Environment, Climate Change and Technology), Environmental Protection Agency, Waste and Pollution Control Department, Energy Department, Water and Sanitation Department, Maldives Energy Authority, Ministry of Fisheries and Agriculture

Other government agencies: Ministry of Tourism, Ministry of Defence Marine, Maldives Police Services, Maldives National Defence Force, Maldives Customs Services, Transport Authority, Attorney General's Office

Health: Ministry of Health, Health Protection Agency, Maldives Food and Drug Authority, Hulhumeedhoo Hospital, Indira Gandhi Memorial Hospital, Kulhudhuffushi Regional Hospital, Fuvahmulah Regional Hospital, ADK Hospital

Private: State Electric Company Limited (STELCO), Male' Water and Sewerage Company (MWSC), PESTEX Maldives, FENAKA Corporation, Maldives Road Development Cooperation, Thilafushi Corporation, Southern Maldives

Research/education: Research Centre, Maldives National University

Local government: Local Government Authority, Laamu Atoll Council, Addu City Council, Kulhudhuffushi Island Council, Fuvahmulah island Council

(5) Target POPs

- PCBs
- Pesticides
- PCD/PCDF
- TOX
- TPH

（6）Methods of sampling, analysis and data handling

1) Under the POPs project, samples were collected from Thilafushi (main

landfill island) for analysis (not regular monitoring):

Types of samples:

Fish: 3 different species from 3 different trophic levels each. The table below summarizes the fish sample details.

Sediment: 2 samples from Thilafush island, lagoon, and reef ocean side, each

Trophic level	Species	Number of samples
Planktivores	Species 1	5
	Species 2	5
	Species 3	5
Herbivores	Species 1	5
	Species 2	5
	Species 3	5
Carnivores	Species 1	5
	Species 2	5
	Species 3	5
	Total	45

POPs and heavy metals analysed:

- PCB congeners 28, 52, 101, 105, 118, 123, 153, 128
- 2, 3, 7, 8-substitutes PCD/PCDF (17 congeners)
- TOX (total organic halogen), TPH (total petroleum hydrocarbons)
- Metals: Ag, As, Cd, Cr, Cu, Hg, Ni, Pb

Sample analysis:

Samples were collected and sent to the Çınar Laboratory in Turkey as Maldives lacks the capacity to test for most of these chemicals. Sample

analysis methods were as per the table below.

Sample type	Parameters to be Analyzed	Method
Sediments	PCB congeners 28,52,101,105,118,123,153,128,	TS EN 17322
	TOX (total organic halogen),	evs En 16166
	Ag, As, Cd, Cr, Cu, Ni, Pb ,	EPA 3051 A EPA 6020 B
	Hg	EPA 3051 A EPA 6020 B
	TPH (total petroleum hydrocarbons)	TS ISO 14507 TS EN 14039
	2,3,7,8-substituted PCD-PCDF (17 congeners)	İn house method (Ta.352)
Fish Species/ Biota	PCB congeners 28,52,101,105,118,123,153,128,	EPA 3540 C EPA 3620 C EPA 3630 C TS EN 17322
	TOX (total organic halogen),	evs En 16166
	Ag, As, Cd, Cr, Cu, Ni, Pb ,	EPA 3052 EPA 6020 B
	Hg	EPA 3052 EPA 6020 B
	TPH (total petroleum hydrocarbons)	TS ISO 14507 TS EN 14039
	2,3,7,8-substituted PCD-PCDF (17 congeners)	İn house method (Ta.352)

*Results: t*o be released in the future

2) PCB containing equipment - PCB equipment inventory:

Potential PCB containing equipment in the country has been identified based on the manufacturing details and oil, waste, and soil sample analysis.

Sample analysis:

5 Waste Oil, 3 Soil and 2 Waste samples were collected and sent to Çınar Laboratory in Turkey The parameters analyzed in the samples were as per the table below:

Type of Analysis	Parameters to be Analyzed	No. of Samples to be Analyzed
Soil	Contaminants: TOX, TPH and PCB congeners	3
Waste Oil	PCB congeners	5
Waste	TOX (total organic halogen), TPH (total petroleum hydrocarbons), Ag, As, B, Cd, Cr, Cu, Hg, Ni, Pb, Sb, Se, Sn, Zn, V	2

The results of this study helped update the first PCB equipment inventory. Since then, mission trips have been conducted to potential contaminated sites in the country, after each trip, the inventory was updated as per the findings.

The table below shows the potentially PCB contaminated Transformers and Switchgears to be exported (final inventory after the update from the last mission trip):

Equipment		Dimensions (lxbxh) (ft)	Volume	QTY	Total volume
FUVAHMULAH ISLAND					
HV Room (0°17'47.70"S, 73°25'23.70"E)					
	Transformer 500 kVA	6x3x7	126	2	**252**
	Large SG 200 kVA	6x2.5x5	75	1	**75**
	Single SG 200 kVA	1.5x1.5x5	11.25	5	**56.25**
Substation 1 (0°17'39.68"S, 73°25'44.10"E)					
	Large SG 200 kVA	6x2.5x5	75	1	**75**
	Transformer 150 kVA	3x3x3	27	4	**108**
	Transformer 30 kVA	3x3x3	27	1	**27**
	Transformer 300 kVA	4x3x4	48	3	**144**
	Transformer 200 kVA	4x3x4	48	2	**96**
	Transformer 100 kVA	3x3x3	27	2	**54**
	Single SG 200 kVA	1.5x1.5x5	11.25	7	**78.75**
Substation 4 (0°18'12.10"S, 73°25'40.40"E)					
	Medium SG 200 kVA	2x2x5	20	1	**20**
	Single SG 200 kVA	1.5x1.5x5	11.25	1	**11.25**
ADDU CITY ISLANDS					
Hithadhoo Power Station (0°37'45.48"S, 73° 5'55.88"E)					
	Transformer 500 kVA	6x3x7	126	1	**126**
Maradhoo Fenaka office (0°40'23.05"S, 73° 7'36.39"E)					
	Transformer 500 kVA	6x3x7	126	1	**126**
				TOTAL	**1249.25**

*Volume given for the equipment are only approximate and may vary

*The transformers have been decommissioned

Annex 1

Questionnaire on national POPs monitoring capacity and needs in the Asia Pacific Region

Part I: Basic Background

Country: _____

Institution: _____

Occupation: _____

Part II: National POPs Monitoring Capacity

Q1. What are the POPs monitoring plans/projects that have been or are being implemented? What contaminants and media are involved?

Q2. Please indicate the funding sources for the POPs monitoring plans/projects answered in Q1:

Q3. Are there any technical guidelines (on sampling, analysis, testing, inventory survey, etc.) or standard methods related to POPs monitoring? If yes, please list below.

Q4. Personnel capacity:

(1) Are there any specialized technical personnel for field sampling or laboratory instrument operation

(2) Is there regular training on sampling and analysis skills of technical personnel?

(3) What is the average academic level of specialized technical personnel?

Q5. Laboratory testing capacity:

(1) Is there any accredited professional testing laboratory for POPs? If yes, please list below.

(2) Are there professional testing instruments/equipment for POPs? If yes, please indicate what pollutants (e.g. dioxins, etc.) and media (e.g. atmosphere, human milk/blood, surface water, soil, sediment, etc.) they are used for.

(3) Please introduce the laboratory quality assurance (QA) and quality control (QC) plan if there is any.

Part III: Demand on National POPs Monitoring Capacity Building

Q6. Do you think the current funding for POPs monitoring is sufficient, and in what aspects do you think it is necessary to increase funding?

Q7. Which factors do you think are the main factors restricting the development of your country's POPs monitoring capacity (multiple choice)

(1) Lack of funds

(2) Lack of professionals and technical personnel

(3) Insufficient knowledge and training of the technical team

(4) Lack of professional testing equipment and methods

(5) Difficulties in building professional laboratories

(6) Others _____

Q8. What kind of help do you think is most needed (multiple choice)

(1) POPs sample testing and analysis equipment

(2) Professionals and technical personnel

(3) Training of technicians

(4) Technical guidelines and standard methods

(5) Funds

(6) Others _____

Q9. Other suggestions or comments on national POPs monitoring capacity building: _____

Questionnaire on national POPs monitoring capacity and needs in the Asia Pacific Region

Part I: Basic Background

Country: _____

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Q1. What are the POPs monitoring plans/projects that have been or are being implemented? What contaminants and media are involved?

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(3) Insufficient knowledge and training of the technical team

(4) Lack of professional testing equipment and methods

(5) Difficulties in building professional laboratories

(6) Others _____

Q8. What kind of help do you think is most needed (multiple choice)

(1) POPs sample testing and analysis equipment

(2) Professionals and technical personnel

(3) Training of technicians

(4) Technical guidelines and standard methods

(5) Funds

(6) Others _____

Q9. Other suggestions or comments on national POPs monitoring capacity building: _____

National Monitoring Plan of POPs in China

March 2023

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ABBREVIATIONS AND ACRONYMS

NIP	National Implementation Plan
COP	Conference of the Parties
POPs	Persistent Organic Pollutants
WHO	World Heath Organization
USEPA	United States Environmental Protection Agency
α-HCH	Alpha-hexachlorocyclohexane
β-HCH	Beta-hexachlorocyclohexane
γ-HCH	Gamma-hexachlorocyclohexane
DDT	Dichlorodiphenyltrichloroethane
HBCD	Hexabromocyclododecane
HCB	Hexachlorobenzene
PFOS	Perfluorooctane sulfonic acid
PCB	Polychlorinated biphenyls
PCDD	Polychlorinated dibenzo-para-dioxins
PCDF	Polychlorinated dibenzofurans
HCBD	Hexachlorobutadiene

PCP	Pentachlorophenol
PCNs	Polychlorinated naphthalenes
PFOAs	Pentadecafluorooctanoic acid its salts
GC	Gas chromatography
GC-MS	Gas chromatography mass spectrometry
PUF	Polyurethane foam
ASE	Accelerated Solvent Extraction
SPE	Solid-phase extraction
SPME-HPLC-MS	Solid phase extraction-high performance liquid chromatography-mass spectroscopy
GC-HRMS	Gas chromatography-high resolution mass spectroscopy
PD-GC-ECD	Pre-column derivative-gas chromatography-electron capture
OCPs	Organochlorine pesticides
PBDEs	Poly Brominated Diphenyl Ethers
Parlar26	P26
Parlar50	P50
Parlar62	P62

1 Background and objectives

1.1 Preparation background

POPs are chemicals with high bioaccumulation or bioconcentration factors, resistance to degradation, ability to be transported long distances by air or water, and toxicity to biota including humans.

The Stockholm Convention on Persistent Organic Pollutants (hereinafter referred to as the Convention) was adopted on 22 May 2001 and entered into force on 17 May 2004. As of January 2023 the Convention had 184 Parties. The Convention contains 30 articles and 6 annexes.

The objective of the Stockholm Convention on POPs is to:

> Protect human health and the environment from persistent organic pollutants by reducing or eliminating releases to the environment.

The Chinese government signed the Stockholm Convention on May 23, 2001, and the Tenth Session of the Standing Committee of the Tenth National People's Congress ratified the Convention on June 25, 2004. The Convention entered into force for China on November 11, 2004, which also applied to Hong Kong Special Administrative Region and Macao Special Administrative Region.

As required in Article 7 of the Convention, China issued the National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants (hereinafter referred to as NIP) in April, 2007. For the initial group of 12 persistent organic pollutants (POPs) listed in the Convention, the NIP set objectives in stages and by region and industry for Convention implementation, developed implementation measures and specific action plans, and made action objectives in detail for the first stage (by 2010), the second stage (2010-2015) and the long-term future.

Since the NIP was carried out, China has made a series of progress and solved a number of environmental hazards of POPs that seriously threaten human health and safety. Firstly, the production, use, import and export of the initial group of intentionally produced POPs has been stopped, the content level of which in the environmental and biological samples has an overall downward trend. Secondly, the emission intensity of Dioxins in key sectors such as iron ore sintering, secondary non-ferrous metal smelting, and waste incineration has decreased by more than 15%. Thirdly, over 50,000 tons POPs-containing legacy waste has been cleaned up and disposed.

On August 30, 2013, the Fourth Session of the Standing Committee of the Twelfth National People's Congress ratified the *Amendment for Listing Nine New Persistent Organic Pollutants and the Amendment for Listing*

Endosulfan. On July 2, 2016, the Twenty-first Session of the Standing Committee of the Twelfth National People's Congress ratified the Amendment for Listing Hexabromocyclododecane (HBCD). By March 2023, the number of POPs restricted and controlled in China according to the Convention and its amendments has increased from 12 to 23.

1.2 The objectives of the document

This document is focused on the development and implementation of arrangements to provide comparable monitoring information on the presence of the chemicals listed in Annexes A, B and C of the Convention, as well as their regional and environmental transport in China.

2. Capacity of organization and management in POPs monitoring activities in China

2.1 Assessment of legal documents on POPs monitoring in China

2.1.1 Environmental documents

Environmental protection is a central policy in China and a critical responsibility of governments at all levels. Since the 1980s, the competent administrative departments of environmental protection have implemented unified supervision and management to prevent and control environmental contamination in their administrative areas, following the Environmental Protection Law and relevant regulations. Other departments responsible for ecological environment protection must also perform their duty within their respective scope of liability. Governments at all levels are accountable for the environmental quality within their administrative regions.

China's environmental policies are multifaceted and comprehensive with three principles.

Prevention first, prevention and control combined. New construction, alteration, expansion projects, and regional development projects must

undergo rigorous environmental impact assessments, "three simultaneous" (simultaneous design, construction, and operation) policy, and cleaner production measures to minimize the generation and discharge of pollutants. Existing sources of pollutant emissions are required to declare, register, and obtain pollutant emission licenses and pay emission fees based on the certificates. For enterprises and organizations with severe contamination, local authorities should take legal measures to make them treat the pollution within a specified time limit.

The polluter-pay policy. Environmental economics recognizes that the environment is a valuable and limited resource that must be protected for the benefit of current and future generations. To prevent the "tragedy of the commons", whereby shared resources are depleted due to overuse and exploitation, it is essential that the costs of environmental remediation are borne by the polluters who cause harm to the environment. This is known as the polluter-pay principle, which is recognized internationally as a key strategy for promoting environmental sustainability.

To implement the polluter-pay principle, there are several measures that can be taken. Firstly, excessive emission fees can be levied on enterprises and institutions that emit pollutants above the permitted emission standards. These fees are designed to incentivize these organizations to reduce their emissions and invest in pollution prevention and management measures.

Secondly, deadlines can be set for enterprises and institutions to remediate and mitigate severe contamination. This ensures that polluters are held accountable for the damage they cause to the environment and that remediation efforts are undertaken in a timely and effective manner.

Finally, technology improvements can be made to prevent and control industrial pollution. This includes investing in cleaner production processes, adopting sustainable practices, and implementing pollution control technologies. By improving technology, polluters can reduce their environmental impact and minimize their contribution to environmental degradation.

In conclusion, the polluter-pay principle is an important tool for promoting environmental sustainability. By ensuring that the costs of environmental remediation are borne by the polluters who cause harm, we can encourage responsible environmental stewardship and protect our shared natural resources for the benefit of all.

Tightening up environmental management. Encouraging public participation in environmental supervision is essential. National and local environmental bulletins should be regularly published, detailing urban air and water quality in key basins. Additionally, an "Environmental Hotline" and written and individual complaint systems should be established to facilitate feedback from the public. As required by The Public Participation in Environmental Impact Statement, stakeholders should be given the

opportunity to voice their concerns through public hearings regarding specific projects that impact public environmental rights and interests, as well as construction projects that have severe environmental consequences.

The Constitution of China clearly states that "the nation protects and improves the living environment and the ecological environment, prevents and controls pollution and other public hazards." China has formulated 9 environmental protection laws such as *Environmental Protection Law*, *Law on Water Pollution Prevention and Control*, *Law on Marine Environmental Protection*, *Law on Air Pollution Prevention and Control*, *Environmental Impact Assessment Law*, *Clean Production Promotion Law* and *Law on Prevention and Control of Radioactive Pollution*, 15 nature conservation laws, and more than 50 administrative regulations such as *Provisional Regulation on Promoting Industrial Structure Adjustment*, *Regulation on Construction Projects Management for Environmental Protection*, *Detailed Rules on Implementation of the Water Pollution Prevention and Control Law*, *Regulation on Management of Pollutant Emission Fee Collection and Use*, *Regulation on Protection of wild Plants* and *Regulation on Safety Management of Agricultural Transgenetic Organisms*. It has also issued regulatory documents such as: *the State Council's Decision on Implementing the Scientific Development Concept and Strengthening Environmental Protection*, *the State Council's Opinions on Accelerating Development of Circular Economy*, *the State Council's*

Notification on Recent Work for Constructing the Energy Saving Society, and *the Notification on Accelerating Structural Adjustment of Industries with Surplus Energy Generation*. Ministries under the State Council, local People's Congress and local governments have formulated and promulgated more than 660 rules and local regulations for implementation of national environmental protection laws and regulations, according to their mandates.

Table 2-1 Departmental regulations on management of environmental protection

Name	**Issuing department**	**Effective Date**	**Relevance to environmental protection**
Detailed Rules for Water Pollution Control Law	Ministry of Ecology and Environment	2000	Supervision and administration of the prevention and control of water contamination
Measures for the Automatic Monitoring and Management of Pollution Sources	Ministry of Ecology and Environment	2005	Supervision and management of the automatic monitoring system for key pollution sources
Measures for the Prevention and Control of Environmental Pollution Caused by Electronic Waste	Ministry of Ecology and Environment	2008	To supervise and manage the disassembly, utilization and disposal of electronic waste
Measures for Public Participation in Environmental Protection	Ministry of Ecology and Environment	2015	Encourage public participation in environmental protection in an orderly manner following the law
Measures for the Administration of Environmental Protection Archives	Ministry of Ecology and Environment	2017	To supervise and guide the management of environmental protection archives
The Classification List of Management for Pollutant Discharge Permits for Stationary Pollution Source	Ministry of Ecology and Environment	2019	Discharge application
Measures for the Environmental Management and Registration of New Chemical Substances	Ministry of Ecology and Environment	2021	Environmental management registration of the research, production, import, processing and use activities of new chemical substances
Management Measures for Ecological Environment Standards	Ministry of Ecology and Environment	2021	Establishment, implementation, filing and evaluation of ecological and environmental standards

2.1.2 Documents in the field of agriculture and rural development

China had listed HCB, chlordane, mirex, aldrin, dieldrin, endrin and heptachlor in documents related to chemicals such as the *General Appellation of Pesticides* (GB4839-1998), the *Name List of Hazardous Goods* (GB12268-2005) (item 1 toxic goods in category 6), *Annex I Poisonous Chemicals banned or Strictly Restricted (Group 1)* in the *Regulation on Management of Import of Chemicals for the First Time and Import and Export of Poisonous Chemicals*, and carried out control and management on them as poisonous chemicals. Regarding pesticide POPs in Annex A of the convention, China has established the following policies and regulations.

Production: the *Guiding Catalogue of Industrial Structure Regulation (2005)* includes HCB, chlordane and mirex in the elimination category as obsolete products.

Use: the *Regulation on Safe Use of Pesticides* issued in 1982 classifies toxaphene and chlordane as pesticides with medium toxicity, and stipulates that they shall not be used on certain plants such as fruit trees, vegetables, tea plants, traditional Chinese medicine, tobacco, coffee, pepper and citronella. Chlordane can only be used for mixing into cereal feedstuff, to prevent and control underground pests. The *Public Notice No. 199* issued by the Ministry of Agriculture listed toxaphene, aldrin and endrin as "pesticides clearly banned from use". The *Cosmetics Sanitation Standard*

(GB7916-1987) stipulates that HCB and endrin are banned from use as cosmetics components. HCB was put in the *List of Medicament Banned from Use* related to meat and poultry in 2002. Article 10 of the *Regulation on Termite Prevention and Control in Urban Houses* amended in 2004 points out that medicaments whose production is approved by relevant agencies should be used for prevention and control of termites in urban houses.

Import and export: the *Pesticide Varieties Banned and Strictly Restricted from Use in China* attached to the *Notification of the General Administration of Customs on Issues Related to Exemption of the Value Added Tax in Import of Pesticides and Technical-Grade Pesticides* issued on September 3, 2001, includes all pesticide POPs. The No. 29 and No. 65 notifications of the State Environmental Protection Administration have complemented the list of management on import and export of pesticide POPs in Annex A of the convention. Dieldrin has been listed in the category 6 poisonous goods in the *Classification and Indication of Hazardous Chemicals in Common Use* (GB13690-92).

Environmental monitoring: the *Technical Route on Environmental Monitoring* effective on June 13, 2003, includes heptachlor as one of the items in general monitoring of surface water. The *Guideline on Construction of Diseases Prevention and Control Center Laboratories at*

the Province, Prefecture and County Levels includes heptachlor as a pesticide monitoring item.

Food standard: the *Maximum Pesticide Residue Limit in Foods* (GB2763-2005) stipulates the residue limits of aldrin, dieldrin and heptachlor in grains, vegetables, meat and eggs.

As part of its pursuit of green development, the Chinese government is committed to improving the rural ecological environment and controlling agricultural non-point source pollution. Various policies and regulations have been put in place, including the *Opinions on Accelerating Ecological Progress*, the *Guidance on Improving Rural Habitat Environment*, the *Three-Year Action Plan for Rural Habitat Environment Improvement*, the *Notice on Issuing the Action Plan of Agricultural and Rural Pollution Control Battle*, and the *Opinions on Implementing Rural Revitalization Strategy*. These policies and regulations demonstrate China's continuous efforts to improve its policy system for rural ecological environment governance.

Table 2-2 Departmental regulations on management of agriculture

Name	**Issuing department**	**Effective Date**	**Relevance to agriculture management**
Regulations for the Safe Use of Pesticides	The former Ministry of Agriculture, Animal Husbandry and Fishery, Ministry of Health	1982	Management related to the use of POPs
Measures for Management on Soil Environment of	Ministry of Agriculture, Ministry of Ecology and Environment	2017	To supervise and management activities related to

Cultivate Land (Trial)			pollution prevention and control of soil pollution on cultivate land
Measures for Management on Imported Veterinary Drugs	Ministry of Agriculture, General Administration of Customs	2007	To supervise and management activities related to imported veterinary drugs
Measures for Safety License of Feeds and Feed Additives	Ministry of Agriculture	2012	To standardize the production of feeds and feed additives
Measures for Pesticide Registration	Ministry of Agriculture	2017	Standardize pesticide registration, including the production, operation, and use
Regulations on the Administration of Restricted Use of Pesticides	Ministry of Agriculture	2002	Provisions have been made for the application, review, approval, and issuance of pesticide restrictions

2.1.3 Documents related to chemicals management

Chinese authorities have issued a circular on further promoting the nationwide battle to prevent and control pollution. The circular, jointly released by the Communist Party of China Central Committee and the State Council, outlines key targets for enhancing the country's ecological environment, including a continuous reduction in the total discharge of major pollutants by 2025. To achieve this, the Ministry of Ecology and Environment, in collaboration with five other government departments, has

developed the *List of Key Controlled New Pollutants* (2023), which mainly originate from the production and use of toxic and harmful chemicals. This list was compiles after a technical feasibility and economic and social impact assessment based on the environmental risks and regulatory practices associated with toxic and harmful chemicals. Appropriate environmental risk control measures, such as prohibition, restriction, and emission control, must be adopted for new pollutants listed in this list by relevant national regulations. The ecological environment, industry and information technology, agriculture and rural areas, commerce, market supervision and administration, and customs departments at all levels must reinforce the control and management of these new pollutants by their respective responsibilities and legal obligations.

The *Environmental Protection Law is a comprehensive law* on environmental protection. Article 33 of the law is directly related to POPs management, which stipulates that "production, storage, transportation, sale and use of poisonous chemicals and goods containing radioactive substances must abide by related national stipulations to prevent environmental pollution". The *Law on Water Pollution Prevention and Control*, the *Law on Air Pollution Prevention and Control*, the *Law on Marine Environmental Protection*, the *Law on Environmental Impact Assessment*, and the *Law on Solid Wastes Pollution Prevention and Control* all stipulate pollution prevention and control requirements from different

perspectives, which can be used for POPs management. Currently, China does not have any law or regulation specifically addressing POPs.

The regulation closest to the management of intentionally produced POPs is the *Regulations on Safety Management of Hazardous Chemicals* issued by the State Council in 2002, which makes stipulations on production, sale, use, import and export, as well as monitoring and control of key hazardous substances. Intentionally produced POPs are within the scope of the regulation.

Production: According to the *Regulations on Safety Management of Hazardous Chemicals*, a license system is applied to the production and sale of hazardous chemicals. In order to implement the system, related agencies issued the *Measures for the Administration of Operating Licenses for Hazardous Chemicals* in 2002, the *Implementation Measures for Safety Production License of Hazardous Chemical Production Enterprises* in 2004, and the *Implementation Measures for Safety License of Hazardous Chemicals Construction Projects* in 2006. In the field of pesticides production management, the *Regulation on Pesticides Management* published in 1997 and later revised in 2001 specifies the country's license system for pesticides production.

Use (Production sites): Management on use (production sites) of hazardous chemicals mainly follows provisions set in the *Regulations on Labor Protection in Workplaces Using Toxic Substances* issued in 2002,

the *Provisions on Safe Use of Chemicals in Workplaces* issued in 1996, and criteria set in the *Limits on Occupational Contact of Harmful Factors in Workplaces* (GBZ2-2002).

Import and export: Following articles in international conventions and trade rules such as the *London Guidelines for the Exchange of Information on Chemicals in International Trade* and the *Rotterdam Convention*, China implements an import and export registration system. It promulgated the *Regulations on Environmental Management of the First Import of Chemicals* and the *Import and Export of Toxic Chemicals* in 1994, the *Detailed Rules on Registration for Environmental Management on the First Import of Chemicals and the Import and Export of Toxic Chemicals* in 1995, and *the List of Toxic Chemicals Strictly Prohibited from Import and Export* in 2005, which includes DDT, hexachlorobenzene, chlordane and mirex. In December 2005, the *No. 116 Notice on the List of Goods Prohibited from Import* (the Sixth Group) and the *33 List of Goods Prohibited from Export* (the Third Group) was promulgated, in which dieldrin, endrin, PCBs and Dioxins were added in the *List of Goods Prohibited from Import*; and aldrin, dieldrin, endrin, heptachlor, toxaphene, PCBs and Dioxins were added in the *List of Goods Prohibited from Export*.

Packaging: China implements a management system in which packages and containers for hazardous chemicals are produced in designated locations. It issued the *Management Measures on Production of Packages*

and Containers for Hazardous Chemicals in Designated Enterprises in 2002. Related criteria include the *Classification and Code of Dangerous Goods* (GB6944-2005), the *General Rules for Precautionary Label of Hazardous Chemicals* (GB/T15258-1999) and the *Packaging Labels of Hazardous Chemicals* (GB190-1990).

Storage: Relevant enterprises should build storage facilities meeting the requirements set in the *General Rules on Storage of Commonly Used Hazardous Chemical Goods* (GB15603-1995). For construction, renovation and enlargement of such facilities, the Chinese government adopts a strict approval system and promulgated the *Measures for Safety Examination of Hazardous Chemicals Production and Storage Construction Projects*

Transportation: The Chinese government has formulated related regulations on railway, waterway and highway transportation. It has promulgated the *Management Regulations on Railway Transportation of Hazardous Goods*, the *Regulations on Waterway Transportation of Hazardous Goods*, and the *Regulations on Road Transport of Hazardous Goods*, as well as the the *General Technical Conditions on Transportation Packaging of Hazardous Goods* (GB12463-90).

Dioxin management: China has formulated and implemented Dioxin release control standards on a few sectors, such as waste incineration. For release reduction and control of Dioxins, technical requirements and

technical guidelines can be developed according to the *Environmental Impact Assessment Law*, the *Clean Production Promotion Law*, the *Regulations on Environmental Management of Construction Projects*, etc. so as to achieve the convention implementation goals.

POPs-containing wastes: China lists POPs-containing wastes in the *National Catalogue of Hazardous Wastes* and conducts management according to the *Law on the Prevention and Control of Environmental Pollution by Solid Wastes, the Measures for Prevention and Control of Environmental Pollution Caused by Abandoned Hazardous Chemicals*, and the *Technology Policy for the Prevention and Control of Pollution Caused by Hazardous Wastes*. For business activities related to POPs-containing wastes, the *Measures on Hazardous Wastes License Management* is followed. For import and export of POPs-containing wastes, provisions stipulated in the *List of Goods Prohibited from Import*, the *Provisional Regulations on Wastes Import Management for Environmental Protection*, the *Measure for Manifest Management on Transfer of Hazardous Wastes* and the *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal* are followed. In order to prevent POPs-containing wastes from polluting the environment, the Chinese government has promulgated the *Measures on Prevention and Control of Environmental Pollution Caused by Abandoned Hazardous Chemicals*, formulated and implemented a series of standards,

including the *Standard on Hazardous Wastes Identification*, the *Standard for Pollution Control on Hazardous Waste Storage*, the *Pollution Control Standard for Landfilling of Hazardous Wastes*, and the *Pollution Control Standard for Hazardous Wastes Incineration*.

POPs contaminated sites: The *Measures on Prevention and Control of Environmental Pollution Caused by Abandoned Hazardous Chemicals*, promulgated and implemented in 2005, stipulates that hazardous chemicals production, storage and use enterprises shall report the environmental rehabilitation plans to environmental protection agencies above county level for approval. It will also realize environmental rehabilitation of the contaminated sites within the time limit prescribed by the environmental protection agencies in the case that they change the production line, stop production, close down or dissolve and in the case that the sites have been polluted.

The *Regulations on Pesticide Management* makes stipulations on production, import and export, sale and use of pesticides, and establishes corresponding management systems including the pesticides registration system and the pesticides production permit system, which are applicable for the management of pesticide POPs

Table 2-3 Departmental Regulations on Management of Hazardous Chemicals

Name	**Issuing department**	**Effective Date**	**Relevance to POPs management**
Measures for the Administration of Operating	The former State Administration of Work	2012	Management of business

Licenses for Hazardous Chemicals	Safety		licenses related to POPs
Implementation Measures for Safety Production License of Hazardous Chemical Production Enterprises	The former State Administration of Work Safety	2011	Management of the qualifications of enterprises engaged in POPs production
Measures for Management on Registration of Hazardous Chemicals	The former State Administration of Work Safety	2012	POPs registration management
Implementation Measures for Safety Use License of Hazardous Chemicals	The former State Administration of Work Safety	2012	Safety check of POPs production and storage enterprises
Regulations on Environmental Management of the First Import of Chemicals and the Import and Export of Toxic Chemicals	State Environmental Protection Administration, General Administration of Customs, The former Ministry of Foreign Trade and Economic Cooperation	1994	Import and export management related to POPs
Regulations for Management of Pesticides	State Council of the PRC	1997	Management related to the use of POPs
Regulations on Prevention of Termites in Urban Housing	Ministry of Construction	1999	
Management Regulations on Railway Transportation of Hazardous Goods	Ministry of Railways	1996	Management related to the transportation of POPs
Regulations for Safety Supervision Management of Railways Transportation of Hazardous Goods	Ministry of Transport	2022	
Regulations for Management of Road Dangerous Freight	Ministry of Transport	2013	
List of Hazardous Chemicals	The former State Administration of Work Safety	2015	Includes POPs

The List of National Hazardous Wastes	Ministry of Ecology and Environment	2021	
Measures for the Administration of Hazardous Waste Business Licenses	State Council of the PRC	2004	Safety check of POPs collection, storage, and disposal

2.1.4 Documents related to the health sector

As the competent department for health administration, the National Health Commission is responsible for several tasks, including drafting guidelines and policies on health affairs, participating in the formulation of relevant health laws and regulations, and putting forward development plans for the healthcare system. Additionally, the Commission formulates health technical rules and standards, supervising their implementation.

The Commission is also responsible for the overall planning and coordination of health resource allocation nationwide and guiding the implementation of health plans in different regions. It organizes health education throughout the country, formulates prevention plans for diseases that cause serious harm to human health, and coordinates comprehensive prevention and control measures for serious diseases. The Commission also publicizes lists of infectious diseases that must be quarantined and monitored.

Regarding POPs management, the National Health Commission is responsible for formulating relevant health standards, monitoring POPs residues in food, evaluating the threats of POPs to human health, and

conducting related supervision and enforcement. The Commission manages the safe use of POPs in disease prevention and develops measures for the prevention and control of poisoning.

Food safety: The *Trustworthy Food and Drug Project* of the State Council and the *Action Plan for Food Safety* of the National Health Commission have definitely decided to include food pollutants across the country in their plans and to conduct monitoring of such POPs as DDT, PCBs and Dioxin. The *National Standards for Maximum Residue of Pesticides in Food Safety* (GB 2763-2021) includes 564 pesticides (428 registered pesticides in China, 66 prohibited pesticides, 87 prohibited pesticides not registered, 44 low-risk pesticides exempted from the formulation of limits). Among these, 548 pesticides have limited value, and there are 10,092 pesticides with maximum allowable residue limits.

Human health: In 2004, the Ministry of Ecology and Environment, with the support of Canadian Trust Funds of the World Bank and in collaboration with the National Health Commission, initiated the project "Case Study of POPs Toxicity to Women and Children". The project involved assessing the impacts of DDT and PCBs on women and children by conducting surveys to determine their exposure levels to these pollutants in some typical regions in China. The study aimed to understand the toxicity of POPs on the health of women and children.

2.2 Analysis and evaluation of the system of regulations and technical standards

The safety management system for hazardous chemicals established pursuant to the *Regulations on Safety Management of Hazardous Chemicals* is a basic management system to regulate existing industrial and commercial chemicals in the market currently in China. The Regulations: set up a national framework system for the management of chemicals involving multiple departments with each responsible for a particular field of work; covers the whole process from the production, operation, storage, transport and use to waste disposal of hazardous chemicals; and establishes management systems regarding listing of hazardous chemicals, chemical safety specification, chemical safety labeling, the review, permit and safety evaluation of economic activities related to hazardous chemicals, registration of hazardous chemicals, first aid for hazardous chemical accidents, etc.

China has established a pesticide safety management system aimed at regulating this category of high-risk chemicals. The *Regulations on Pesticide Management* regulated the pesticide registration system, the pesticide production permit system, pesticide distribution permit system and the management system for safe use of pesticides.

China has also established special laws and standards with regard to everyday chemicals, like cosmetics, as well as food additives. These laws

and standards clearly forbid or limit the use of toxic or harmful chemicals in food and provide limits for the use or content of a variety of harmful chemicals in food and cosmetics.

Its industrial macro-control system also plays a regulating role in the production and use of existing chemicals in the market. The Chinese government promulgates, on a regular basis, the policies related to national industrial and product restructuring, such as the *Provisional Regulations on Promoting the Industry Restructuring* and the *Guiding Catalogue of Industrial Structure Regulation*, etc., which set out limitations on or phase-out of a variety of existing high-toxicity and high-risk chemicals including DDT, hexachlorobenzene, chlordane, mirex, PCBs and other POPs chemicals.

In order to implement related international conventions, China has established a management system for the import and export limitation of some toxic chemicals of international concern, in terms of import and export management. This system includes, for instance, the *Regulations on Environmental Management of the First Import of Chemicals and the Import and Export of Toxic Chemicals* promulgated in 1994 and the *List of Toxic Chemicals Banned or Severely Restricted in the People's Republic of China* promulgated later, both covering the toxic chemicals that the Rotterdam Convention and the Stockholm Convention require to be controlled.

Compared with the developed countries, the development of POPs monitoring technology in the water environment in China is still relatively backward. Nevertheless, the relevant water environment quality standards such as *Standards for Drinking Water Quality* (GB5749-2006), *Water Quality Standards for Drinking Water Sources* (CJ3020-93), *Environmental Quality Standards for Surface Water* (GB3838-2002) and *Quality Standards for Ground Water* (GB/T 14848-93) stipulate the concentration limits of POPs, including DDT, polychlorinated biphenyl, pentachlorophenol.

In recent years, at the technical and method level of water sampling, the Ministry of Ecology and Environment has issued *Water Quality-Guidance on Sampling Techniques* (GB 12998-91), *Water Quality Sampling-Technical Regulations of the Preservation and Handling Samples* (GB 12999-91), *Water Quality-Guidance on Sampling Techniques from Lakes, Nature, and Man-made* (GB/T 14581-93), *Water Quality- Guidance on Sampling Techniques of Rivers* (HJ/T 52-1999), *Technical Specifications Requirements for Monitoring of Surface Water and Waste Water* (HJ/T 91-2002), *Technical Specifications for Environmental Monitoring of Groundwater* (HJ/T 164-2004), and *Water Quality-Guidance on Sampling Techniques* (HJ 494-2009). These technical specifications or guidance for water sampling specify the design of sampling sites, sampling equipment, sampling containers, sampling steps, sampling records, testing items,

analysis methods, data collation, quality assurance, etc.

There are several technologies available for detecting persistent POPs, including GC, SPME-HPLC-MS, GC-HRMS, and PD-GC-ECD. In China, GC or GC-MS methods are commonly used for detecting POPs pollutants in the water environment. However, these methods require complicated sample pretreatments such as dissolution, derivatization, extraction, enrichment, and chromatographic separation before mass spectrometric analysis. When dealing with samples with complex matrices like municipal wastewater or lake effluent, the pretreatment process becomes more complex and susceptible to matrix interference, leading to poor recovery and accuracy. Additionally, physical or chemical changes in the pretreatment process can cause significant interference in determining trace POPs in water samples. In 2019, the Ministry of Ecology and Environment issued *Technical Guidelines for Eco-environmental Health Risk Assessment-General Principles* (HJ 1111-2020). These guidelines provide a basic framework for the environmental risk assessment of chemical substances and specify the technical requirements, basic sites, and report preparation requirements for assessing the environmental risk of chemical substances.

2.3 Target POPs

China's current standards for monitoring persistent organic pollutants are mainly four categories (respectively, organochlorine pesticides, PCBs, brominated flame retardants and dioxins), a total of 26 standards, involving 32 kinds of persistent organic pollutants.

Table 2-5 POPs monitored in different core media

Standards No.	**Chemicals**	**Air**	**Water**	**Chemicals**	**Air**	**Water**
HJ/T 74—2001 HJ 810—2016 HJ 909—2017 HJ 621—2011 HJ 639－2012 HJ 478－2009 HJ 77.1—2008 HJ 1070—2019 HJ/T 74—2001 HJ 1227—2021 HJ 699—2014 HJ 164—2020 HJ/T 164—2004 GB 5749—2022 HJ/T 39—1999 HJ 1079—2019 HJ/T 66—2001 HJ 1224—2021 HJ 901－2017 HJ 900－2017 SL 497—2010 HJ 904－2017 HJ 903－2017 HJ 902－2017 SL 497—2010 HJ 1270—2022	PCBs	√	√	Tetra/penta-BDE	√	√
	HCB	√	√	Hexa/hepta-BDE	√	
	DDTs	√	√	Deca-BDE	√	√
	Chlordanes	√		HexBBs	√	
	Heptachlors	√	√	Endosulfan	√	√
	Aldrin	√	√	PCNs	√	
	Endrin	√	√	HCBD	√	√
	Dieldrin	√	√	PCP	√	
	Mirex	√	√	Dicofol	√	√
	Toxaphene	√	√	PFOS	√	√
	α-/β-/γ-HCH	√	√	PFOA	√	√
	PeCBz	√	√	HBCD	√	
	PCDDs	√	√	Chlordecone	√	√
	PCDFs	√		dl-PCBs	√	√

2.4 Basic information and activities involved in POPs monitoring

Article 16 of the Stockholm Convention mandates that the effectiveness of the Convention shall be evaluated by the Conference of the Parties within four years of its entry into force and periodically thereafter. Additionally, the first meeting of the Conference of the Parties is required to set up arrangements that would permit comparable monitoring data collection on the presence and transport of chemicals listed in Annexes A, B and C in the global and regional environment.

At COP-3, a global monitoring plan was adopted to include air and human milk/blood as core media for monitoring the first 12 POPs listed in the Convention. The COP-3 also resolved that each party should complete the monitoring of baseline levels of POPs by 2008.

To fulfill the Convention obligations and implement NIP, China monitored the residual levels of POPs in atmospheric background points and human milk during 2007-2008, following the GMP.

The China General Environmental Monitoring Station and the Research Center for Eco-Environment Sciences developed a monitoring program for POPs in atmospheric background points for China's first compliance effectiveness evaluation. The Jiangsu Environmental Monitoring Center and the Chongqing Environmental Monitoring Center participated in PM10 POPs monitoring sampling in 11 atmospheric background points

nationwide and monitored 11 POPs in the atmosphere. The Chinese Center for Disease Control and Prevention organized the sampling of human milk of typical populations in 19 provinces, municipalities and autonomous regions and the monitoring of the residual levels of POPs in the above 11. The monitoring results indicated that the background air POPs concentrations in China are low and not significantly different from foreign background values. DDT (with degradation products) and HCB in human milk in some provinces are slightly higher than in foreign populations, but they do not pose a health risk. The First National Report on POPs Monitoring for Compliance Effectiveness Assessment was completed in 2008, and the report was submitted to the Stockholm Convention Secretariat on time.

The COP-4 resolved to conduct compliance effectiveness assessments every six years. The second compliance effectiveness evaluation was completed in 2015, six years after the first evaluation. At the COP-6, the Global Monitoring Plan and the Guiance on the Global Monitoring Plan for Persistent Organic Pollutants (Revised) were adopted, which expanded the number of monitored POPs to 23 species, with expanded core media, and the monitoring of PFOS in water was included in the plan.

From 2008 to 2014, the Foreign Environmental Cooperation Center organized the second effectiveness assessment POPs monitoring in China. The Chinese General Environmental Monitoring Station led the monitoring

of 15 POPs at the above 11 atmospheric background monitoring sites. After 2012, the monitoring sites and media for POPs in mainland China have expanded. Starting in 2012, the concentration levels of 15 types of POPs in the air were monitored at three urban sites and three rural sites. Starting in 2013, the concentration levels of PFOS in two nearshore marine areas and two lake bodies were monitored.The monitoring results showed that the concentration of POPs in air at the background points showed a fluctuating trend of low concentration levels, and no significant increase or decrease was found.

The Environmental Protection Department of the Hong Kong SAR conducted long-term regular POPs monitoring at two sampling sites in Hong Kong. The monitoring results showed that the levels of POPs in the air in Hong Kong were low. The Environmental Protection Bureau of Macao SAR conducted monitoring of POPs in the air and water bodies of Macao, and the monitoring results showed that DDT, hexachlorobenzene, chlordane and endosulfan were the main pollutants in the atmosphere.

From 2007 to 2008, a survey of POPs in huamn milk was conducted in 12 provinces and municipalities in China. Following this, the China National Center for Food Safety Risk Assessment monitored levels of PCBs and dioxins in human milk in 14 provinces, municipalities, and autonomous regions on the mainland from 2010 to 2011. The results indicated that the levels of PCBs and dioxins varied widely across different regions, and the

levels of POPs in human milk in mainland China in 2011 were slightly higher than in 2007.

In August 2014, the Ministry of Ecology and Environment of China and the Foreign Environmental Cooperation Center completed the second monitoring report, which was submitted to the Stockholm Convention Secretariat as scheduled.

Thanks to the strong leadership of the Ministry of Ecology and Environment of China, domestic monitoring departments and research institutes collaborated effectively to complete three compliance effectiveness assessments of POPs monitoring.

3. Methods of sampling, analysis and data handling

3.1 Air

Various methods for sampling and analysis for air POPs monitoring have been applied in China. The information is summarized in Table 3-1.

Table 3-1 Sampling, analytical method and QA/QC for monitoring programs (core media: Air)

Sampling	Analytical Method	Chemicals	QA/QC
global monitoring plan (GMP) method, using GMP PM10 cutting head medium flow samplers, all with a sample collection flow rate of 220 L/min and a sampling volume of at	HRGC/HRMS or GC/LRMS	● PCBs, HCB, DDTs, chlordanes, heptachlors, aldrin, endrin, dieldrin, mirex, toxaphene, a-/p-/y-HCH,	Yes

least 1900 m^3 (standard condition)		PeCBz ● PCDDs, PCDFs ● Tetra/penta-BDE, hexa/hepta- BDE, deca-BDE, HexBBs, endosulfan, PCNs, HCBD, PCP, PCA, dicofol, PCN	
	LC/MS/MS	PFOS, PFOA, HBCD, chlordecone	Yes

3.1.1 Experimental design

Sampling sites

The objective of the ambient air sampling network is to obtain representative data for assessing baselines and changes over time and space, as well a the regional and global transport of POPs. "Representative" refers to having an adequate number of sampling sites to draw general conclusions about POPs trends, rather than to account for regional heterogeneity. Achieving complete geographical coverage for a particular region or continent would be economically unfeasible and require extensive investigatory work to assess regional variability in air concentrations of POPs. The five types of sampling sites are described as follows:

Urban sites: These are monitoring stations set up in built-up areas of cities to assess overall air quality conditions and trends. The minimum number of urban assessment stations required is determined by the area and

population of the city. The representative range for each station is typically 500 meters to 4 kilometers, but it can be extended to several tens of kilometers in areas with low pollutant concentrations and small spatial variation.

Regional sites: These monitoring stations are established to assess regional air quality conditions and the transmission and impact of pollutants. The representative range for each station is typically several tens of kilometers.

Background sites: These monitoring stations are set up to measure ambient air quality background levels at a national or large regional scale. The representative range for each station is generally more than 100 kilometers.

Source impact sites: These monitoring stations are established to measure the impact of major stationary pollution sources, industrial parks, and other pollution source gathering areas on local ambient air quality. The representative range for each station is typically 100-500 meters, but it can be extended to 4 kilometers when considering the impact of higher point sources on ground concentration.

Traffic sites: These monitoring stations are set up to measure the impact of road traffic pollution sources on ambient air quality. They are representative of the range of people's daily life and activities in places affected by road traffic pollution emissions on both sides of the road and nearby areas.

Siting considerations

Available facilities at which other atmospheric composition measurements are made should be used whenever possible or feasible.

Positioning and installation of samplers should follow standard operating procedures for air sampling programs. A detailed description of all selected sites should be provided. More general criteria are given here:

• Regional representativeness: The location should be free from local influences of POPs and other pollution sources, and it should reflect the ambient air quality level and change pattern in a certain spatial range. It should also enable an objective evaluation of urban and regional ambient air conditions, the impact of pollution sources on ambient air quality, and the provision of public health guidelines for ambient air conditions;

• Comparability: The conditions for setting up the same type of monitoring sites should be as consistent as possible to ensure that the data obtained from each monitoring site are comparable;

• Integrity: The evaluation of ambient air quality in urban sites should take into account the city's natural geography, meteorology (free from strong systematic diurnal variations in local circulation imposed by topography), industrial layout, population distribution, and other characteristics. The layout of sampling sites should reflect the main functional areas of the city and the main air pollution sources of air quality status and change trends;

• Foresight: The deployment of monitoring sites should be considered in conjunction with urban and rural construction planning so that the identified monitoring sites can take into account future trends in urban and rural spatial patterns;

• Stability: Once the location of monitoring sites is determined, it should not be changed in principle to ensure the continuity and comparability of monitoring information;

• Ancillary measurements: For the super-sites, other atmospheric composition measurements and meteorological wind speed, temperature and humidity and a measure of boundary layer stability. For the passive sites, meteorological wind speed, temperature and humidity;

• Appropriate infrastructure and utilities: Electrical power (for pumped samplers), accessibility, buildings, platforms, towers and roads, with care to avoid sources of potential contamination;

• Passive sampling sites should also take advantage of the freedom to deploy samplers well away from infrastructure (buildings, roads) and human activity which could be potential sources of POPs contamination.

Site description should follow a standardized approach and should be documented with additional information such as digital photos of the sampling location and the surrounding region and a detailed description of

the surrounding area including identification of suspected or potential site sources (including approximate location relative to the sampling site).

Different site types have different layout requirements.

For urban sites, the following criteria should be followed:

- Monitoring points should be located in the built-up areas of each city and should be relatively evenly distributed to cover all built-up areas;
- The urban encrypted grid point measurement or model simulation calculation method should be used to estimate the overall average pollutant concentration in the built-up area of the city. The arithmetic average of pollutant concentrations of all urban points should represent the overall average pollutant concentration in the built-up area of the city;
- A single grid should not be larger than 2 km x 2 km. For cities with an area greater than 200 km^2, the grid density can be appropriately relaxed. Monitoring points should be set up at the center of each grid or at the intersection of grid lines to understand the overall concentration level and distribution pattern of pollutants in the built-up area of the city. Monitoring items should include the six basic items specified in GB3095-2012, and additional items can be added according to the monitoring purpose. The effective monitoring period should not be less than 15 days;
- Model simulation is a method that can be used to predict the

distribution of pollution and find reasonable monitoring points through the law of diffusion, migration, and transformation of pollutants;

- The average value of the pollutant concentration in the proposed new city point and the estimated average value of the overall city measured by urban encrypted grid points or model simulation in the same period should not have a relative error greater than 10%;
- The estimated values of the 30th, 50th, 80th, and 90th percentiles calculated from the overall average value of the city measured by urban encrypted grid points or model simulation should have a relative error within 15% of the average value of pollutant concentrations of the proposed new city points and the overall estimated values of the city for the same period;
- The minimum number of monitoring points for ambient air quality evaluation in each city should be in accordance with Table 3-2. The minimum number of monitoring points is determined based on the built-up urban population and the built-up area, and the greater of the two is taken.

Table 3-1 Quantity requirements of urban points for ambient air quality evaluation

Urban population of the built-up area(10, 000 people)	Built-up area (km^2)	Minimum number of monitoring sites
< 25	<20	1
25-50	20-50	2
50-100	50-100	4
100-200	100-200	6

200-300	200-400	8
>300	>400	One monitoring sites shall be set up for every 50-60km^2 built-up area, and no less than 10 sites

Regional and background monitoring sites:

- Regional and background sites should be located far away from urban areas and major pollution sources. Ideally, regional sites should be situated more than 20 km away from urban areas and major pollution sources, while background sites should be more than 50 km away；
- Regional sites should be placed along the path of regional air circulation, taking into account the characteristics of atmospheric circulation in our country. They should reflect the state of regional air quality and the interactions between and within regions regarding the transport of pollutants；
- Background sites should be set in clean areas unaffected by human activities, serving as a reflection of the national-scale air quality background level；
- The altitude of regional and background sites should be appropriate. In mountainous areas, they should be located at high points to avoid local air pollution interference and meteorological conditions such as near-surface inversion layer. In gentle areas, they should be situated in relatively high and open locations to avoid air deposition depressions；

- The number of regional sites will be determined by the national environmental protection administration in accordance with the national plan, taking into account regional area and population factors. Localities can apply to increase the number of regional sites as needed for environmental management；
- The number of background sites will be determined by the national environmental protection administration in accordance with the national plan；
- For nature reserves, scenic spots, and other areas outside urban areas that require special protection, priority should be given to the area represented by the monitoring sites when setting up regional and background sites.

Source impact sites:

- Pollution monitoring sites should be located in areas with high concentrations of pollutants that could affect human health and in areas where major stationary sources of pollution significantly impact ambient air quality.
- For emission-intensive sources and major pollution projects, monitoring sites should be located in the dominant wind direction and the second dominant wind direction (typically in the most polluted season) downwind of the maximum landing concentration zone to capture the maximum pollution characteristics.

- For industrial parks with multiple fixed pollution sources, monitoring sites should be located in the leading wind direction and the second leading wind direction (typically in the most polluted season) downwind of the industrial park boundary, taking into account the emission intensity of the largest sources of pollution and the maximum landing concentration of pollution projects.
- Additional pollution monitoring sites may be set up by local environmental protection departments based on monitoring needs, and real-time monitoring information should be made available.
- The number of pollution monitoring sites should be determined by the local environmental protection department in coordination with environmental monitoring agencies, based on the needs of environmental management.

Traffic sites:

- Set roadside traffic sites on the downwind side of the traffic lane, taking into account the traffic flow and terrain/building distribution on both sides of the lane. The distance of the sampling port from the edge of the road should not exceed 20 meters.
- The local environmental protection administrative department should set up roadside traffic sites for monitoring purposes and release real-time monitoring information.

- Determine the number of roadside traffic sites needed for environmental management in the region in collaboration with local environmental monitoring agencies.

3.1.2 Sampling and sample handling

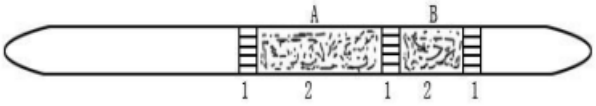
Air sampling requires the following capacities: (1) active and passive air samplers, (2) trained station personnel to operate and maintain the high-volume samplers, (3) meticulous reparation of clean sampling media in the laboratories performing the extraction procedures and hemical analysis. Sampling methods and QA/QC procedures should, as far as possible, be adopted from existing air monitoring programmes for POPs, but they will need to be adapted to and validated for the specific conditions, concentration levels and temperature at the sampling sites.

To monitor POPs in the air, the Chinese monitoring program uses the method of "Isotope Dilution High Resolution Gas Chromatography-High Resolution Mass Spectrometry for the Determination of Polychlorinated Dibenzo-p-Dioxins and Dibenzofurans in Ambient Air and Waste Gas" (HJ77.2-2008) to detect PCDD/Fs in the air. For PCBs, both DL-PCBs and indicator PCBs are detected separately. The detection of PCBs in the air follows the method of "Determination of Polychlorinated Biphenyls in Water, Soil, Sediment, and Tissue by High-Resolution Gas

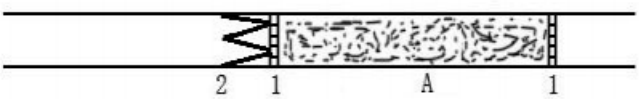
Chromatography-High-Resolution Mass Spectrometry" (EPA1668A) by the United States Environmental Protection Agency (USEPA).

Adsorption tube sampling method

The adsorption tube sampling method is a suitable method for collecting samples of gaseous pollutants, such as mercury and volatile organic compounds. The sampling system mainly consists of a sampling pipeline, a sampler, an adsorption tube, and other components. Adsorbent tubes are typically made of ordinary glass, quartz, or stainless steel, and contain various types of adsorbents. The type of adsorbent, particle size, filling method, filling volume, and adsorbent tube specifications need to meet the requirements of relevant monitoring method standards. Common solid adsorbents include activated carbon, silica gel, organic polymers, and other materials. The structure of typical adsorbent tubes is depicted in Figures 3-1 and 3-2.



1-Glass wool, 2-Activated carbon, A-100 mg activated carbon, B-50 mg activated carbon
Figure 3-1 Activated carbon adsorption tube



1-Stainless steel mesh / filter film, 2-spring sheet, A-solid adsorbent
Figure 3-2 Polymer material adsorption tube

Before sampling, it is necessary to check whether the selected sampling equipment is functioning properly. The sampling time needs to be set, and

the flow rate must be adjusted to meet the specified requirements. During the sampling process, the absorption temperature must be controlled, and appropriate measures should be taken. The sampling process should be recorded on time, including the start and end times, flow rate, as well as temperature, air pressure, and other parameters. The recording content should be complete and standardized. After the sample collection is complete, the sample should be sealed and placed into a sample box to prevent damage from impact or violent vibration during transportation. The samples should be transported and stored in a way that avoids direct sunlight. Samples that require preservation at low temperatures should be refrigerated appropriately during transportation to prevent sample deterioration. Samples should be promptly delivered to the laboratory and analyzed as soon as possible. If they cannot be analyzed promptly, they should be properly stored according to the standard requirements of the monitoring method for each item. The analysis should be completed within the validity period of the sample.

Membrane adsorbent sampling method

The membrane adsorbent sampling technique is a suitable method for collecting semi-volatile organic compounds, including polycyclic aromatic hydrocarbons, from environmental samples. The sampling system comprises a particle cutter, membrane holder, flow measurement and control components, sampling pump, temperature and humidity sensor,

pressure sensor, microprocessor, and gaseous pollutant trapping device. Prior to sample collection, it is crucial to ensure that the sampling frame and seals are free from contamination and damage.

To adhere to standard monitoring requirements, the adsorbent should be placed in the sampling cylinder, which is covered with clean aluminum foil for backup. Additionally, the filter membrane must undergo pre-treatment via high-temperature cauterization before use, following the monitoring method's specific requirements. The sampling cartridge should be inserted into the sampler's sampling cartridge holder, as outlined in the instrument manual, ensuring proper sealing.

After sampling, remove the sampling cartridge from the sampling frame and wrap it in clean aluminum foil before placing it into a sample preservation cartridge, sealing it, and labeling it appropriately. The sampling records, transport, and preservation procedures should refer to the sorbent tube sampling method.

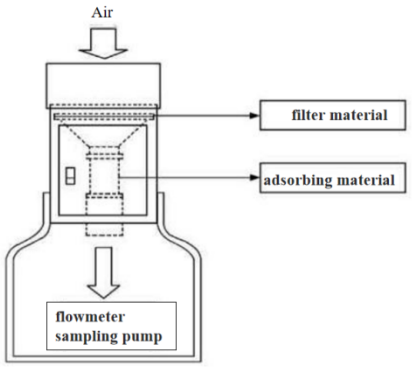


Figure 3-3 Ambient air dioxin sampling device

Sample extraction

Adding extraction internal standard：In general, an extraction internal standard should be added before sample extraction. If the sample extraction solution needs to be split for use (such as when the expected concentration of dioxin-like compounds in the sample is too high and needs to be controlled, or when the sample needs to be reserved for storage), the amount of extraction internal standard added should be appropriately increased.

Sample extraction：Firstly, place the filter membrane in a Soxhlet extractor and extract with toluene for 16-24 hours. Secondly, place the PUF in a Soxhlet extractor and extract with acetone for 16-24 hours. Finally, concentrate the above two extraction solutions separately, convert the solvent to n-hexane, and then combine and purify them as the analytical sample.

3.1.3 Analysis

Isotope dilution HRGC-HRMS (High Resolution Gas Chromatography-High Resolution Mass Spectrometry) is a technique used for the quantitative analysis of trace levels of organic compounds in complex matrices. In this technique, a known amount of isotopically labeled internal standard is added to the sample before extraction or purification, which is then subjected to gas chromatography and mass spectrometry analysis.

During the analysis, the isotopically labeled internal standard and the

analyte compete for the same detector, and the relative intensities of their respective mass spectra are used to determine the concentration of the analyte in the sample. Isotope dilution HRGC-HRMS is a highly sensitive and accurate method for the quantification of trace organic compounds, and is widely used in environmental monitoring, food safety, and pharmaceutical analysis. Detailed procedures are described in the HJ 77.2－2008.

3.1.4 QA/QC and Data Treatment

A critical aspect for any air monitoring program is to implement and document a quality assurance and quality control (QA/QC) program. This is key to ensuring the credibility of the data and that it can be used to establish long-term trends and that it can be evaluated in terms of its comparability with results from other programs and sampling approaches. When using the HRGC-HRMS method for analysis, the data processing steps typically include peak identification, qualitative and quantitative analysis, recovery confirmation, and determination of the detection limit. These steps can be performed using the following procedures:

- Peak identification: Identify and confirm the peaks of interest based on their retention time and mass spectrum.
- Qualitative analysis: Compare the mass spectra of the peaks with reference spectra to confirm the identity of the compound.

- Quantitative analysis: Use the isotope dilution method to determine the concentration of the target compound in the sample.
- Recovery confirmation: Spike known amounts of the target compound into the sample and compare the measured concentration with the spiked concentration to confirm the recovery rate.
- Determination of the detection limit: Determine the detection limit of the target compound by analyzing samples with known low concentrations or by using statistical methods.

Overall, the data processing steps should follow established protocols and be conducted in a consistent and rigorous manner to ensure accurate and reliable results.

3.2 Human milk

To monitor POPs in human milk, the Chinese monitoring program follows the *Guidelines for Organization, Sampling and Analysis of Human Milk on Persistent Organic Pollutants* (WHO) for human milk analysis. The sampling and analysis of POPs in breast milk involve the use of liquid-liquid extraction, solid-phase extraction, and high-resolution gas chromatography-mass spectrometry (HRGC/MS). The selected POPs for breast milk monitoring include polychlorinated biphenyls (PCBs), organochlorine pesticides (OCPs), and polybrominated diphenyl ethers (PBDEs).

Various methods for sampling and analysis of human milk POPs monitoring have been applied in China. The information is summarized in Table 3-3.

Table 3-3 Sampling and Analytical Method, and QA/QC for monitoring programs (core media: Human Milk)

Sampling	Analytical Method	Chemicals	QA/QC
WHO Protocol	HRGC-HRMS	PCDDs, PCDFs, *dl*-PCBs	Yes
	GC-MS	OCPs	Yes

3.2.1 Sampling and sample preparation methodology

Human milk have been used as markers of exposure of humans to a number of POPs for several decades and are core media for POPs biomonitoring under the Stockholm Convention. Both these sample media show comparable temporal trends in a particular population because they integrate environmental exposure as well as dietary exposure related to different consumption habits. Furthermore, they provide relevant information on POPs transfer to infants and potential health effects. To this end, only POPs concentrations in human milk and human maternal blood from first time mothers are considered comparable under the GMP (see details below).

In the implementation of the survey, the following principles should be followed:

• Breastfeeding should be protected, promoted and supported;

• The health benefits of breastfeeding to both mother and baby should be clearly and consistently communicated;

• Sampling of milk should not be an undue burden on the mother nor should it compromise the nutritional status of the infant.

A summary of the guidelines is provided below.

A national coordinator should be selected and be responsible for the overall planning and implementation of the survey in the country, assisted by health, laboratory and administrative staff.

Selection criteria for donating mothers: first child mother, 3-4 weeks after the birth, breastfeeding one child only. The most important criterion to be met is for donors to be first time mothers.

Number of donors: In order to get statistically reliable data, an appropriate number of individual donors must be recruited to provide samples for the survey. As a first approximation, a minimum of 50 individual samples is recommended for each country. Equal aliquots of these individual samples are mixed to form a representative composite sample ("pooled sample"). The power of the survey can be increased by the inclusion of more than 50 individual samples and is encouraged. It is recommended to collect one representative individual sample per one million citizens. In particular, countries with populations greater than 50 million should include at least

one additional participant per one million population over 50 million. Countries with populations well over 50 million (or with sufficient resources) are encouraged to prepare a second pooled sample (or more) if feasible.

Strategies for selecting donors: Given the time constraints for sample collection, interviewing of potential donors should take place at post-natal or well-baby clinics. The stratification of participants should follow the same principles as in the previous survey.

Glassware for collection of samples: Sterilized glassware will be provided to participating countries for the collection of the individual samples and the preparation of the pooled sample by the WHO/UNEP reference laboratory, CVUA Freiburg.

Collection of samples: It is recommended that sampling being carried out between three to eight weeks (21 days to two months) after delivery. At the time of sample collection, individual interviews should be used to complete the information in the participant questionnaire. At least 50 ml of milk in total should be collected. The sample should be collected directly to the collecting jar and stored in the freezer until it can be shipped.

Preservation of collected samples: The samples shall be preserved via freezing (storage in the refrigerator at about 4 °C for a maximum of 72

hours, or for a longer time period in the freezer at -20 °C) or by addition of potassium dichromate.

Sample analysis: After the collection of 50 individual samples (50 ml each), the following procedures are applied:

• **Preparation of the pooled sample:** To prepare the pooled sample, each individual milk sample shall be homogenized by shaking for 5 minutes: The 50 ml sample will be split into two portions of 25 ml each: One bottle of 25 ml will constitute the national individual sample and remain in the country (see point 2 below); the second 25 ml are put into a 2000 ml glass bottle to prepare the pooled sample (50 x 25 ml = 1250 ml pooled sample);

• **Individual samples**: Individual 25 ml of human milk can be stored by the country (see above) for the analysis of selected POPs according to national capability.

Any remaining milk from individual samples should be pooled and sent to the WHO Global Human Milk Bank through the WHO reference laboratory.

Each individual and pooled sample should be labelled with a unique identification code. The storage and shipment of all samples should be deep-frozen.

3.2.2 Analysis of Pooled Samples

The pooled sample are analysed by the State Institute for Chemical and Veterinary Analysis of Food (CVUA) in Freiburg, Germany, for the POPs listed in the Stockholm Convention (parent compounds and relevant transformation products). This laboratory was appointed as the WHO/UNEP Reference Laboratory for this study, having met all the requirements established by WHO at the Fourth Round for the Interlaboratory Calibration of PCDD, PCDF and PCB levels in human milk and having been selected as the EU Reference Laboratory for Dioxins and PCBs in Feed and Food and as the EU Reference Laboratory for Pesticides in Food of Animal Origin and Commodities with High Fat Content. The Reference Laboratory follows a rigorous quality control program to guarantee the accuracy and reliability of the results obtained in the study. The laboratory runs this program daily in the routine testing for PCDD, PCDF and PCB and POP agrotoxics, primarily on foodstuff samples. The pooled samples shall be accompanied by the completed summary of information.

3.3 Water

Various methods for sampling and analysis of water POPs monitoring have been applied in China. The information is summarized in Table 3-4.

Table 3-4 Sampling and Analytical Method, and QA/QC for monitoring programs (core media: Water (PFOS))

Sampling	Analytical Method	Chemicals	QA/QC
Collected with Water Sampler	LC/MS/MS	PFOS, PFOA	Yes

3.3.1 Experimental design

Sampling locations

The following recommendations should be considered when selecting sampling locations:

• Clearly define the project objectives and the monitoring site selected;

• Collect relevant data such as hydrological information, presence of industrial facilities and wastewater treatment plants, population density, etc.;

• Adjust the distance from shore based on the site-specific conditions and ensure that the water sampled is from a mixed zone;

• Select locations that are easily accessible by limnological or oceanographic vessels capable of deploying water sampling equipment or from land-based sites such as bridges.

The number of vertical sampling sets on a monitoring cross-section and the number of sampling sites on each vertical should comply with Table 3-5 and Table 3-6, respectively, while the layout of sampling sites on the vertical of a lake (reservoir) should follow Table 3-7. In addition, sampling activities should adhere to the guidelines specified in the aforementioned tables.

Table 3-5 Setting of the number of sampling vertical

Width	Number	Considerations

≤50 m	One (middle thread of channel)	1. Middle thread of channel should avoid the contaminated zone. Vertical should be added to measure the contamination zone. 2. If it can be proved that the water quality of the cross-section is uniform, only the middle thread of channel is allowed. 3. Vertical must be set according to this table when pollutant fluxes are to be calculated at this cross-section.
50 m～100 m	Two (obvious water flow near the left and right banks)	
＞100 m	Three (left, middle and right)	

Table 3-6 Setting of the number of sampling sites on the sampling vertical

Depth	Number	Considerations
≤5 m	One site on the upper layer	1. The upper layer refers to 0.5 m below the surface of the water. When the water depth is less than 0.5 m, the upper layer is at 1/2 depth 2. The lower layer is 0.5 m above the bottom of the river. 3. The middle layer is 1/2 water depth. 4. Sampling should be done at 0.5 m below the ice during freezing, and at 1/2 of the water depth when the water depth is less than 0.5 m. 5. Sampling sites must be set according to this table when pollutant fluxes are to be calculated at this cross-section.
5 m～10 m	Two sites on both upper and lower layer	
＞10 m	Three sites on upper, lower and middle layer	

Table 3-7 Layout of sampling sites on the vertical of lake (reservoir)

Depth	Stratified condition	Number	Considerations
≤5 m		One site (0.5 m below the water surface)	1. Stratification refers to the stratification conditions of the water temperature. 2. If the water depth is less than 1 m, set up in 1 / 2 water depth. 3. When there is sufficient data to confirm the uniformity of the vesrtical water quality, the number of points can be reduced as appropriate.
5 m～10 m	No stratification	Two sites (0.5 m below water surface, 0.5 m above water bottom)	
5 m～10 m	Stratification	Three sites (0.5m below the water surface, 1 / 2 thermocline, 0.5m above the water bottom).	
＞10 m		Except for 0.5m below the water surface and 0.5m above the water bottom, set 1 / 2 by each thermocline	

Siting considerations

The monitoring cross-sections should macroscopically reflect the water quality of the water system or the region in general. Each cross-section's specific location must reflect the pollution characteristics of the

environment in the region while obtaining sufficient representative environmental information with the minimum number of cross-sections. The feasibility and convenience of actual sampling must also be considered. To set up monitoring cross-sections:

- For the river basin or water system, establish a background cross-section, control cross-section (several), and estuary cross-section. For the administrative area, establish a background cross-section (for the river system's source) or entry cross-section (for the crossing river) or control cross-section, control cross-section (several), and estuary cross-section or exit cross-section. At the downstream of each control cross-section, set up a reduction cross-section if the river cross-section has sufficient length (at least 10km).
- Set up the control monitoring cross-section according to the functional area of the water body, and at least one monitoring cross-section should be in the same functional area of the water body.
- Avoid dead water regions, backwater regions, and sewage outfalls when selecting the cross-section location. Choose a suitable straight river, stable riverbed, smooth flow, and wide water with no rapid stream or shoal.
- Ensure that the monitoring cross-section is consistent with the hydrologic current surveying cross-section to combine water quality monitoring and water quantity monitoring using its hydrologic

parameters.

- The deployment of monitoring cross-sections should be forward-looking, consider the socio-economic development and the actual situation and needs of monitoring work.
- Set the estuary cross-section at a position that reflects the water quality of the river entering the sea and is close to the sea.
- Set the number of monitoring cross-sections according to actual needs to grasp the quality of the water environment, taking into account the spatial and temporal distribution of pollutants and understanding of the law of change. Optimize the number of cross-sections, vertical and measuring sites to obtain the best representative monitoring data.

Sampling frequency

According to the actual situation of different water functions, hydrological factors, pollution sources, and pollutant emissions, efforts are made to obtain the most representative samples with the lowest sampling frequency and the most time representativeness, which not only meet the requirements for reflecting water quality status but are also practical. The sampling frequency should be balanced between practical considerations such as cost and logistics, while still ensuring that the samples collected are statistically validated for the monitoring purpose. Both temporal and spatial sampling designs need to have sufficient resolution to capture variations accurately. Grab samples of surface water can be used to identify

temporal and regional variations, and the sampling frequency should be high enough to filter out short-term variability, such as precipitation events.

- Monitoring should be carried out according to the frequency determined by the monitoring plan. Routine monitoring of surface water environmental quality can be conducted monthly.
- If the river characteristics of the cross-section change significantly due to natural reasons or human interference within the month, intensive monitoring can be carried out.
- The sampling frequency can be reduced for indicators that were not detected every month in the previous year.
- For background cross-sections or sections with stable water quality of Class I or II in the previous year, the sampling frequency can be reduced, such as sampling according to hydrological cycles or seasons.
- For monitoring cross-sections affected by tides, rising and falling tide water samples should be collected and tested separately. Rising tide water samples should be collected when the water surface is rising, and falling tide water samples should be collected when the water surface is falling. When evaluating only the surface water environmental quality, only falling tide water samples can be collected.
- Sample at monitoring cross-section on the state controlled water system, river, lake and reservoir 6 times a year (once every single month);

- Sample at background cross-section of the drainage system once a year.

For the frequency of the sampling of PFOS in water it is recommended to:

- Sample at a selected site 4 times a year (same site and with the same method);
- Carefully determine the sampling occasions depending on optimal conditions, preferably consistent between years (e.g., 2 times high- and 2 low-water stage, although avoiding drought conditions or freezing conditions.

3.3.2 Sample Collection

Details of recommended sampling procedures under the GMP can be found in a guidance for monitoring PFASs in water for the GMP :

• Active/grab sampling is the recommended method;

• Use, e.g., NIskin™ or other remotely activated water samplers, or simply hand-dipping;

• Avoid sampling the surface;

• For sampling use a 500 mL wide mouth HDPE bottle;

• Use HDPE sampling and storage containers (sampling bottles, test tubes, vials etc.);

• All material should be rinsed with methanol before usage;

• Analysis volume is typically 50 mL-500 mL and should be determined by the analytical laboratory;

• To avoid cross contamination the sample bottles should only be used once;

• Take two samples, one for analysis and one for later confirmation if needed;

• Store the samples in the fridge until analysis;

• It is recommended to perform a pilot sampling to establish the levels and practice the sampling.

For PFOS and other PFASs it is recommended that containers (sampling bottles, test tubes, vials etc) should be of high density polyethylene (HDPE) material to avoid sorption to the material l (Berger et al. 2011; Ullah et al. 2012). If the goal is to include analyses of other PFAS compounds, PTFE material should be avoided (e.g., it is often used to line the interior of samplers such as Niskin™, GoFlo™ bottles and tubing, as that is a source of PFOA and PFNA(Yamashita et al. 2004). To minimize contamination sources use the strategy of clean-hands/dirty hands while sampling, i.e. be two persons taking the sample, one is holding the sample equipment (clean-hands) and one person do the sampling (dirty hands). Sample caps should also be checked to confirm that they have HDPE liners.

Sampling volume is determined by the analytical laboratory and should be adapted to expected PFOS levels and analytical capacities. The instrumental limit of detection is the main factor limiting the sensitivity and the volume should be enough to reach quantification levels.

Sampling volume for PFOS and other PFASs is typically 100-500 mL. It should be determined by the analytical laboratory and adapted to expected PFOS levels and analytical capacities. The instrumental limit of detection is the main factor limiting the sensitivity and the volume should be enough to reach quantification levels.

Sampling should be done below the surface to avoid possible surface film contamination. NIskin™ or other water samplers which area activated by dropping a "messenger" to close the sampler at a prescribed depth are idea for lakes and larger rivers/estuaries. Hand sampling in which HDPE bottles are uncapped under the surface (~0.5 m) is adequate for shallower water bodies. Wide mouth bottles are best for rapid filling of the container. A small headspace should be left before capping to avoid bottle breakage if samples are frozen.

Recently, a novel device for the onsite large-volume SPE (LVSPE) was developed (Schulze et al., 2017). It is an automated device for the unattended and representative sampling according to international standards (e.g. (ISO, 2006)) and combines of SPE with a pre-filtration cartridge to separate suspended particulate matter (SPM) from the water phase.

Measurement of PFOS in water indirectly by deploying passive samplers remains an option for future (Lohmann 2017). To date no passive sampler suitable for routine monitoring of PFOS under GMP is available, although

some promising research results have been published recently (Kaserzon et al., 2012, 2013, 2014, 2019). In spite of these shortcomings, passive samplers of PFASs could in future be an alternative method in situations where the classical monitoring approaches have insufficient low limits of detection or low frequency spot sampling fails.

3.3.3 Analytical considerations

Principles for selecting analytical methods

- National or industry certified standard methods are preferred (GB 3838).
- When the laboratory is not equipped to use standard analytical methods, it can also use the method system published by the Department of Supervision and Management of the former State Environmental Protection Administration.
- In the monitoring of certain projects without standard or unified analytical methods, other equivalent analytical methods such as ISO, U.S. EPA and Japanese JIS method systems can be used, but they should be qualified by verification. The detection limit, accuracy and precision should be able to meet the quality control requirements.

Quality control procedures are required for the collection of environmental water samples for the following reasons to:

- Monitor the effectiveness of sampling methodology;

- Demonstrate that the various stages of the sample collection process are adequately controlled and suited to the intended purpose, including adequate control over sources of error such as sample contamination, loss of analyte, and sample instability. To achieve this quality control, procedures should provide a means of detecting sampling error and hence a means of rejecting invalid or misleading data resulting from the sampling process;
- Quantify and control the sources of error which arise in sampling. Quantification gives a guide to the significance that sampling plays in the overall accuracy of data.

3.4 Others

Data handling under the Global Monitoring Plan is responsibility of the members of individual Regional Organization Groups (ROGs) and the Global Coordination Group (GCG).

GMP data generated and provided need to be comparable, validated and harmonized and capable of revealing trends over time in emissions and/or exposure to contaminants of concern, in China.

Details of data policy, data to be reported, data quality, data flow, and storage facilities, data analysis recommended procedures can be found in *Guidance on the Global Monitoring Plan for Persistent Organic Pollutants* (2021).

4 Specific POPs monitoring methods of analysis and data handling

Since the 1960s, lipophilic POPs (typically chlorinated and more recently also polybrominated substances) have been determined using gas chromatography (GC) techniques with electron capture detection (ECD), initially using packed columns. Today the separation has been improved by the use of capillary columns and the selectivity by the use of mass spectrometric detectors (MS). These techniques can also be applied to the volatile perfluorosulfamido compounds which are included in the list of PFOS related compounds in Annex B of the Stockholm Convention. However, the analysis of PFOS and related anionic PFCs these compounds typically requires the use of liquid chromatographic separation and mass selective identification and quantification (LC/MS). Therefore, a general differentiation between GC and LC methods needs to be made; although the same QA/QC criteria have to be applied to both techniques.

Table 4-1 Methods of POPs analysis in China

Chemicals	Analytical methods	Minimum detectable concentration	Reference
OCPs	GC; GC/MS	4~200 ng/L; 0.5~1.6 ng/L	GB 7492—87 （1）
PAHs	HPLC	ng/L	GB 13198—91
All Phenols	GC	0.03 mg/L	GB13197—91 （1）
PCBs	GC/MS	0.6~1.4 ng/L	（1）

Note:（1）*Methods for Monitoring and Analysis of Water and Wastewater (Fourth Edition)*, China Environmental Science Press, 2002.

4.1 Detection of dioxin and PCBs

China uses the method of Ambient air and flue gas Determination of polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) Isotope dilution HRGC-HRMS (HJ77.2-2008) to detect PCDD/Fs in the air. For PCBs, both DL-PCBs and indicator PCBs are detected separately. The detection of PCBs in the air follows the method of "Determination of Polychlorinated Biphenyls in Water, Soil, Sediment, and Tissue by High-Resolution Gas Chromatography-High-Resolution Mass Spectrometry" (EPA1668A) by the USEPA. Before sampling, stable isotope-labeled markers of 2, 3, 7, 8-PCDD/Fs, DL-PCBs, and indicator PCBs are added to the laboratory PUF for sample recovery. Isotope internal standards of 2, 3, 7, 8-PCDD/Fs, DL-PCBs, and indicator PCBs are added before laboratory sample processing. The target substances are extracted using the Soxhlet extraction method with toluene as the solvent or the ASE method with a mixture of n-hexane and dichloromethane as the solvent. The extract is then purified successively through acidic silica gel columns, composite silica gel columns, and alumina columns. After the purified product is dried, isotope injection standards are added, and the sample is analyzed using high-resolution gas chromatography-high-resolution mass spectrometry.

4.2 Detection of organochlorine pesticides

For the detection of OCPs other than DDT and PCBs, China adopts the method described in EPA1699 of the USEPA, which is used for the

analysis of agricultural pesticides in water, soil, sediment, biological solid, and biological tissue. PUF and filter membranes are extracted, and a standard solution of 13C-labeled OCPs is added, followed by purification with Florisil and elution with hexane/acetone. After nitrogen evaporation and addition of the internal standard solution, gas chromatography-high-resolution mass spectrometry is used for analysis. For DDT, a method developed by domestic laboratories is employed. Stable isotope-labeled analogs of indicator DDT congeners (P26, P50, and P62) are added to PUF and filter membranes, which are then extracted using a mixture of hexane and dichloromethane by accelerated solvent extraction. The extract is then purified using acidic silica and composite silica gel columns, followed by stable isotope dilution-gas chromatography-triple quadrupole tandem mass spectrometry for analysis of indicator DDT congeners.