Draft guidance on preparing inventories of methoxychlor

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1. Introduction[1]

1.1 Methoxychlor under the Stockholm Convention

In May 2019, the European Union and its Member States submitted a proposal to list methoxychlor in Annex A to the Stockholm Convention. The proposal (UNEP/POPS/POPRC.15/4, UNEP, 2019b) was reviewed by the Persistent Organic Pollutants (POPs) Review Committee at its fifteenth meeting held in October 2019. The Committee concluded that methoxychlor fulfilled the screening criteria in Annex D and, by decision POPRC-15/3, agreed to prepare a risk profile in accordance with Annex E to the Convention.

At its sixteenth meeting, by decision POPRC-16/2, the POPs Review Committee adopted a risk profile for methoxychlor (UNEP/POPS/POPRC.16/9/Add.1, UNEP 2021) and decided that methoxychlor was likely, as a result of its long-range environmental transport, to lead to significant adverse human health and environmental effects such that global action was warranted.

At its seventeenth meeting, by decision POPRC-17/1, the POPs Review Committee adopted a risk management evaluation for methoxychlor (UNEP/POPS/POPRC.17/13/Add.1, UNEP, 2022) and decided, in accordance paragraph 9 of Article 8 of the Stockholm Convention on Persistent Organic Pollutants, to recommend to the Conference of the Parties to the Stockholm Convention that it consider listing methoxychlor in Annex A to the Convention without specific exemptions.

At its eleventh meeting in May 2023, after considering the risk profile and the risk management evaluation for methoxychlor as transmitted by the POPs Review Committee and taking note of the recommendation by the Committee, by its Decision SC-11/9, the Conference of the Parties amended part I of Annex A to the Stockholm Convention on Persistent Organic Pollutants to list methoxychlor without specific exemptions.

1.2 Purpose of the guidance

Under Article 7, paragraph 1 (a) of the Stockholm Convention (UNEP, 2020d), it is a mandatory requirement that all Parties develop and endeavour to implement a plan for the implementation of its obligations under the Convention. Furthermore, Article 15, paragraph 1 of the Convention requires each Party to report to the Conference of the Parties on the measures it has taken to implement the provisions of the Convention and on the effectiveness of such measures in meeting the objectives of the Convention.

To develop effective strategies for methoxychlor and the environmentally sound management of stockpiles and wastes containing this chemical, Parties need to acquire a full understanding of their national situation concerning its production, uses and releases. Such information can be obtained through an inventory of products and waste containing, consisting of or contaminated with methoxychlor and sites that may be contaminated with methoxychlor.

The critical issues in developing an emission inventory are two-fold: First the availability of accurate and detailed information needed in development of inventories; and second the approach adopted to ensure the inventory is i) robust and defensible and ii) comparable to work of other nations also developing inventories. Therefore, the development of guidance documentation to support this work is very valuable.

The purpose of this document is, therefore, to provide the necessary information and guidance to policy makers to enable them to fulfil their nation's obligations under the Stockholm Convention. Specifically, this guidance provides details on how Parties to the Stockholm Convention can develop inventories of methoxychlor to assist in the elaboration of a national implementation plan for methoxychlor.

The structure and organisation of the inventory is always dependent on local circumstances and priorities of the country. Therefore, this guidance is not prescriptive but rather provides ideas for tailoring the approach.

1.3 Other guidance documents to be consulted

The users of this guidance should also consult *General guidance on POPs inventory development*[2] and other guidance documents to support review and updating of national implementation plans available on the website of the

[1] This chapter has been adapted from the Guidance on preparing inventories of pentachlorophenol and its salts and esters (UNEP, 2019a).

[2] UNEP (2020b). General guidance on POPs inventory development. Revised from document UNEP/POPS/COP.9/INF/19/Add.1. Secretariat of the Basel, Rotterdam and Stockholm Conventions, United

Stockholm Convention.[3] Users may also wish to consult FAO guidance on pesticide inventories, including *The preparation of inventories of pesticides and contaminated materials* (FAO, 2010).[4]

1.4 Objective of the inventory

The main objective of the inventory is to obtain information needed for the implementation of Parties' obligations of the Stockholm Convention. More specifically, the objectives are to:

- Establish a country baseline with respect to methoxychlor import or production, formulation, use, stockpile, disposal and the presence of any contaminated sites;
- Provide the basis for development of a strategy in the National Implementation Plan (NIP) (i.e., identify the economic sectors that should be prioritized and the type of actions required for those sectors, including elimination of illegal trade);
- Report to the Conference of the Parties to the Stockholm Convention on progress made to eliminate methoxychlor through national reporting; and
- Identify areas where financial or technical support is needed (when resources are limited, to fulfil the obligations of the Convention).

The information obtained about methoxychlor through the inventory includes the following:

- Past and current production and/or formulation of methoxychlor at the national level;
- Uses of methoxychlor;
- Import/export of methoxychlor for use;
- Alternatives to methoxychlor available/used in the country;
- Waste management practices for methoxychlor products;
- Any stockpiles of methoxychlor or methoxychlor waste;
- Import/export of methoxychlor waste for environmental sound destruction or irreversible transformation; and
- Sites identified as being potentially contaminated with methoxychlor.

Information collected on the above will provide a broad understanding of the sources of methoxychlor, the scope of their impacts and the risks that they pose to human health and the environment in a country. The information is important for Parties to evaluate their compliance with obligations under the Convention concerning methoxychlor and identify areas where effective strategies and action plans for managing methoxychlor are needed to meet their obligations.

Information collected as part of the inventory will also provide a valuable basis for Parties to report to the Conference of Parties on measures taken to implement the provisions of the Convention and the effectiveness of such measures (reporting under Article 15).

The inventory process is usually iterative. In establishing the inventory of methoxychlor for the first time, Parties will also identify resources and technical capacity needed to further improve the accuracy of the inventory.

Nations Environment Programme, Geneva. Available at https://www.pops.int/Implementation/Publications/GuidanceManuals/tabid/3071/Default.aspx

[3] http://chm.pops.int/tabid/7730/Default.aspx.

[4] https://www.fao.org/3/i1724e/i1724e00.htm.

2. How to develop a methoxychlor inventory [5]

2.1 Introduction

Please refer to *General guidance on POPs inventory development* (UNEP, 2020b)[6] for general approach to developing national inventories. The guidance describes general process to be taken in making an inventory. In summary, the following steps are taken:

Step 1: Initiating the inventory development process

- Establishing a national inventory team
- Identifying relevant stakeholders
- Defining the scope of the inventory
- Developing a workplan
- Contacting the stakeholders

Step 2: Choosing data collection methodologies

- Indicative method
- Qualitative method
- Quantitative method

Step 3: Collecting and compiling data

- Tier I: Initial assessment
- Tier II: Main inventory
- Tier III: In-depth inventory

Step 4: Managing and evaluating the data

Step 5: Preparing the inventory report

A process flow chart is found in Appendix 1.

2.2 Step 1: Initiating the inventory development process

For a general description of Step 1, please refer to Chapter 2.2 of *General guidance on POPs inventory development* (UNEP, 2020b).

In initiating the inventory development process, Parties are advised to establish a multi-stakeholder national inventory team, and to clearly define the responsibilities of the members of the team developing the inventory to streamline the work.

To define the scope of the inventory, the national inventory team should identify relevant stakeholders who will be contacted for the information in the process. Potential sectors and stakeholders involved in the life-cycle of methoxychlor are listed in Table 1 below.

Table 1: Sectors and stakeholders involved in the production, use or impact of methoxychlor

Production	Stakeholders
General stakeholders	Ministry of environment and ministry of industry Ministry of agriculture and food Pesticides authority and/or registrar Ministry responsible for waste management

[5] This chapter has been adapted from the Guidance on preparing inventories of pentachlorophenol and its salts and esters (UNEP, 2019a).

[6] https://www.pops.int/TheConvention/POPsReviewCommittee/Guidance/tabid/345/Default.aspx.

Production	Stakeholders
	NIP coordinator and steering committee Basel Convention[7] focal point (and stakeholders in Basel) Rotterdam Convention[8] focal point (and stakeholders in Rotterdam) Custom authorities NGOs
Methoxychlor importation, production and/or formulation	Authorities granting importation and/or production permits Industry importing, manufacturing, formulating products Custom authorities
Distribution and sale of methoxychlor-containing products	Formulators, distributors, retailers Agricultural extension workers Agricultural cooperatives Agricultural/farmers' unions
Use of methoxychlor	Agricultural extension workers Agricultural cooperatives Agricultural/farmers' unions
End-of-life	Formulators, distributors, retailers (who take back containers) Recyclers, waste handlers Owners/operators of waste disposal facilities/sites Agricultural extension workers Agricultural cooperatives Agricultural/farmers' unions

2.3 Step 2: Choosing data collection methodologies

There are a number of different approaches that have been used for gathering information for POPs inventories, such as indicative methods, qualitative methods and quantitative methods. For more information on those methodologies, please refer to Chapter 2.3 of *General guidance on POPs inventory development* (UNEP, 2020b).

Questionnaires are valuable instruments for primary data collection in inventory programs. Based on contact and consultation meetings with stakeholders, questionnaires with explanatory notes can be developed and sent to the relevant stakeholders to gather the information needed to compile data for a Tier II or Tier III assessment. Appendix 2 provides sample questions that could be used to gather information on methoxychlor. Data may also be available in a national inventory of obsolete pesticide stocks.

2.4 Step 3: Collecting and compiling data

For general description of Step 3, please refer to Chapter 2.4 of *General guidance on POPs inventory development* (UNEP, 2020b).

An initial assessment (Tier I) is carried out to obtain an overview of the relevant uses and stakeholders to be contacted in the key sector under investigation. Tier I methods usually rely on available literature and statistics in

[7] The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (UNEP, 2020a), hereby referred to as "The Basel Convention", is an international treaty signed in 1998 that was designed to reduce the movements of hazardous waste between nations, and specifically to prevent transfer of hazardous waste from developed to less developed countries. As part of the wider work on 'POPs', the Basel, Rotterdam and Stockholm conventions share the same executive body.

[8] The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (UNEP, 2020c), hereby referred to as 'The Rotterdam Convention', is an international treaty signed in 1998 that was designed to promote shared responsibility and cooperative efforts among Parties in the international trade of certain hazardous chemicals in order to protect human health and the environment from potential harm and to contribute to their environmentally sound use, by facilitating information exchange about their characteristics, by providing for a national decision-making process on their import and export and by disseminating these decisions to Parties.

combination with calculations based on already existing information, such as the risk profile (UNEP/POPS/POPRC.16/9/Add.1, UNEP, 2021) and risk management evaluation (UNEP/POPS/POPRC.17/13/Add.1, UNEP, 2022) adopted by the POPs Review Committee.

The main inventory (Tier II) follows and is used to generate data on the main sectors through interviews and questionnaires to the national stakeholders, and further identify missing information. This could also include actions such as desk study on pesticides storage facility contents.

If needed, and resources are available, a more in-depth inventory (Tier III) can be initiated after the evaluation of the data gathered in the main inventory.

The inventory team should investigate whether the following data exist in the country:

- Former and current production or formulation of methoxychlor;
- Sectors using or formerly using methoxychlor;
- Products containing methoxychlor in use or previously used;
- Imports and exports of products and articles containing methoxychlor;
- Disposal practices for products and articles containing, consisting of, or contaminated with methoxychlor when they become wastes;
- Articles (i.e., containers) that contained methoxychlor that were recycled, the possible extent of recycling, and the types of articles produced from recycling, including the life-cycle of methoxychlor and its potential for releases;
- Stockpiles and wastes from current and former production, formulation and use in industries (countries that produced/produce methoxychlor or used/use methoxychlor); and
- Sites with activities that could have potentially contaminated the sites or environment with methoxychlor.

It is desirable to collect and compile the following numerical data in the inventory:

- Quantities of methoxychlor previously and currently produced, imported, traded nationally and exported;
- Quantities of methoxychlor currently or historically used in agriculture, commercial and domestic settings.
- Quantities of products containing methoxychlor (i.e., pesticide containers) recycled and quantities of products made from recycling;
- Quantities of waste generated containing, consisting of, or contaminated with methoxychlor, including quantities of waste sent to recycling, including total amount of waste produced, taking into account previously accumulated amounts, that have been managed in an environmentally sound manner
- Number of storage sites for waste containing consisting of, or contaminated with methoxychlor.

Data collection approaches will vary from country to country based on the data gathered in steps 1 and 2; these include the use of estimations, statistical data, industry provided data and possibly measurement.

The focal sectors to be investigated in the national inventory fall under following key areas:

- Methoxychlor production and formulation;
- Methoxychlor sales and extent of use in agriculture, commercial and domestic settings;
- Used methoxychlor containers collected, recycled and disposed of; and
- Identification of contaminated sites and hot spots.

2.5 Step 4: Managing and evaluating the data

For general description of Step 4, please refer to Chapter 2.5 of *General guidance on POPs inventory development* (prescriptive) (UNEP, 2020b).

The compiled data (draft inventory) should be assessed by stakeholders and possibly by an external expert. Depending on the feedback, further information may need to be gathered.

2.6 Step 5: Preparing the inventory report

The final stage of the inventory is preparation of the inventory report. This report includes results of inventories of all key sectors investigated by the country compiled in a single document.

The essential elements of the report are:

- Objectives and scope;
- Description of data methodologies used and how data were gathered, including all the assumptions and conversion factors adopted as a result of expert judgment;
- Final results of the inventory for each sector considered a priority for the country (see Appendix 3 for a possible format);
- Results of the gap analysis and limitations identified for completion of the inventory;
- Further actions (e.g., stakeholder involvement, data collection strategies) to be taken to complete the inventory and recommendations.

Other information (e.g., stakeholder list) can be included in the report depending on national preferences.

3. Information on methoxychlor

3.1 Production of methoxychlor

3.1.1 Description of the characteristics of methoxychlor

The following information taken from the risk profile (UNEP/POPS/POPRC.16/9/Add.1, UNEP, 2021) provides a brief overview of the physical data for methoxychlor.

Table 2: Chemical identity of methoxychlor

Common name **IUPAC name** **CAS chemical name**	Methoxychlor 1,1'-(2,2,2-trichloroethane-1,1-diyl)bis(4-methoxybenzene) 1-methoxy-2-[2,2,2-trichloro-1-(4-methoxyphenyl)ethyl]benzene
Other names	1,1-bis(4-chlorophenyl)-2,2,2-trichloroethanol and 1-(2-chlorophenyl)-1-(4-chlorophenyl)-2,2,2-trichloroethanol (*p, p'*- and *o,p'*-isomer) (US EPA, 1998)
CAS registry number	72-43-5; 30667-99-3; 76733-77-2; 255065-25-9; 255065-26-0; 59424-81-6; 1348358-72-4 (non-exhaustive list)
Synonyms and trade names	1,1-Bis(*para*-methoxyphenyl)-2,2,2-trichloroethane 2,2-Bis(*para*-methoxyphenyl)-1,1,1-trichloroethane 2,2-Di-*para*-anisyl-1,1,1-trichloroethane *para,para'*-Dimethoxydiphenyltrichloroethane Dimethoxy-DDT Dimethoxy-DT Di(*para*-methoxyphenyl)trichloromethyl methane DMDT *para,para'*-DMDT ENT1716 Higalmetox Methoxychlore Maralate Marlate OMS 466 *para,para'*-Methoxychlor Metox Methoxy-DDT Prentox 1,1,1-Trichloro-2,2-bis(*para*-methoxyphenyl)ethane 1,1,1-Trichloro-2,2-di(4-methoxyphenyl)ethane

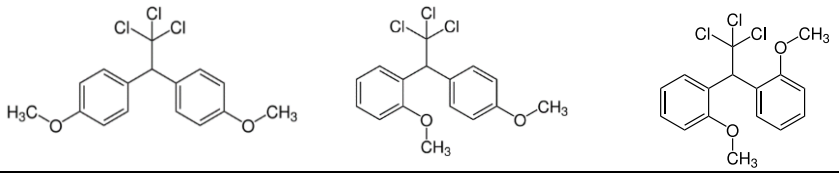
	1,10-(2,2,2-Trichloroethylidene)bis(4-methoxy-benzene) Ethane, 1,1,1-trichloro-2-(*o*-methoxyphenyl)-2-(*p*-methoxyphenyl)- 2,4'-Methoxychlor *o,p*-Methoxychlor *o,p'*-Methoxychlor Benzene, 1,1'-(2,2,2-trichloroethylidene)bis[2-methoxy- Benzene, 1-methoxy-3-[2,2,2-trichloro-1-(4-methoxyphenyl)ethyl]- Benzene, 1,1'-(2,2,2-trichloroethylidene)bis[3-methoxy-
Molecular formula	C16H15Cl3O2
Molecular weight	345.65 g/mol
Structural formulas (examples)	

Table 3: Selected physical and chemical properties of methoxychlor

Property	Value	References
Physical state at 20°C and 101.3 kPa	Solid (pale-yellow powder)	ATSDR, 2002
Melting/freezing point (MP)	87°C *(experimental)* 129.34°C *(EPI Suite, MPBPVP v1.43 estimate, Mean or weighted MP) (within applicability domain (parametric))*	Lide, 2007 US EPA, 2012
Boiling point (BP)	346°C *(experimental)* 377.87°C *(EPI Suite, MPBPVP v1.43 estimate, Adapted Stein & Brown method) (within applicability domain (parametric))*	US EPA, 2012 US EPA, 2012
Vapour pressure	5.56 x 10^{-3} Pa at 25°C *(EPI Suite, MPBPVP v1.43 estimate, modified grain method; input experimental MP and BP, temp 25°C) (within applicability domain)*	US EPA, 2012
Henry's Law constant	2.03 x 10^{-7} atm.m^3/mol at 25°C (or 2.06 x 10^{-2} Pa.m^3/mol) *(experimental) (in HENRYWIN validation set and calculated from Altschuh et al. (1999) study)* 9.75 x 10^{-8} atm.m^3/mol (or 9.88 x 10^{-3} Pa.m^3/mol) (*EPI Suite HENRYWIN v3.20 estimate, Bond method)(within applicability domain)*	Altschuh *et al.*, 1999 US EPA, 2012
Water solubility	0.04 mg/L at 24°C *(experimental, 99% purity)* 0.10 mg/L at 25–45°C *(experimental, shake flask-UV)* 0.12 mg/L at 25°C *(experimental, in WSKOW training set)* 0.302 mg/L at 25°C *(EPI Suite, WSKOW v1.42 estimate) (within applicability domain)*	Verschueren, 1996 Richardson and Miller, 1960 Zepp *et al.*, 1976 US EPA, 2012
Organic carbon normalized adsorption coefficient (log Koc)	4.9 *(experimental, in KOCWIN training set)* 4.43 *(EPI Suite, KOCWIN v2.00 estimate, MCI method) (within applicability domain)*	Schüürmann *et al.*, 2006 US EPA, 2012

Property	Value	References
Octanol/water partition coefficient (log Kow)	5.08 *(experimental, in KOWWIN training set)* 5.67 *(EPI Suite, KOWWIN v1.68 estimate) (within applicability domain)*	Karickhoff *et al.*, 1979 US EPA, 2012
Octanol/air partition coefficient (log Koa)	10.48 (*experimental, GC retention time method*) 10.16 *(EPI Suite, KOAWIN v1.10 estimate; log Kow and Henry's Law constant experimental values as input) (within applicability domain (parametric))*	Odabasi and Cetin, 2012 US EPA, 2012
Air/water partition coefficient (log Kaw)	-5.08 *(EPI Suite, KOAWIN v1.10, calculated from experimental Henry's Law Constant)*	US EPA, 2012

3.1.2 Intentional production and trade of methoxychlor

Methoxychlor is an organochlorine pesticide (OCP) which has been used as an insecticide effective against a wide range of pests on, for example field crops, vegetables, fruits, ornamentals, livestock and pets, as well as for general nuisance pests such as mosquitos and flies. Methoxychlor has been used both in commercial agricultural settings, as well as in domestic environments. Based on information from the United States of America (USA), where the production of methoxychlor peaked in the late 1970s to early 1980s, it has been estimated that the maximum global production around this time was 8 000 tonnes/year. Like in the USA, where production of methoxychlor steadily decreased up until it was completely phased out by 2004, the production and use of methoxychlor has been phased out or banned in many countries for almost 20 years. As a result, the global use is believed to have declined sharply. No reliable information on the current production or use of methoxychlor at a global scale has been found in the public domain (UNEP/POPS/POPRC.17/13/Add.1, UNEP, 2022).

3.2 Uses of methoxychlor

Methoxychlor has been used as a replacement for DDT, a structural analogue. In veterinary practices, methoxychlor was used as an ectoparasiticide. Methoxychlor has been used as an insecticide against a wide range of pests, including houseflies and mosquitos, cockroaches, chiggers, and various arthropods commonly found on field crops, vegetables, fruits, stored grain, livestock, and domestic pets. Methoxychlor was also used against the elm bark-beetle vectors of Dutch elm disease. Methoxychlor may have been applied to large areas such as beaches, estuaries, lakes, and marshes for control of fly and mosquito larvae by aerial application. Other uses include the spray treatment of barns, grain bins, mushroom houses, and other agricultural premises and the spraying or fogging of garbage containers, sewer manholes, and sewage disposal areas. In the USA, approximately 28% of methoxychlor was used for home and garden purposes, 15% for industrial and commercial purposes, and 57% for agricultural purposes. Pesticide workers usually dissolved methoxychlor in a petroleum-based liquid and applied it as a spray, or they mixed it with other chemicals and applied it as a dust. Methoxychlor has been formulated as wettable powders, dusts, emulsifiable concentrates, ready-to-use products (liquids), and pressurised liquids. Methoxychlor has been widely used in combination with other insecticides, including gamma-HCH and diazinon (UNEP/POPS/POPRC.17/13/Add.1, UNEP, 2022).

3.3 Methoxychlor in stockpiles, products and waste

There is little information on stockpiles, products and waste containing, consisting of or contaminated with methoxychlor. Apart from by Egypt that indicated that they disposed of 1,000 tons of obsolete pesticides out of country, no information on stockpiles of methoxychlor was submitted through the Annex F request for information (UNEP/POPS/POPRC.17/13/Add.1, UNEP, 2022).

The PesticideInfo database[9] lists over 2,000 products that contain methoxychlor; however, it gives no indication of the current status of use (UNEP/POPS/POPRC.17/13/Add.1, UNEP, 2022).

[9] Pesticide Action Network. Methoxychlor. PesticideInfo. https://www.pesticideinfo.org/chemical/PRI4098 (accessed 2024-02-25).

The US EPA Toxics Release Inventory (TRI) explorer database reports disposals and releases of methoxychlor in the USA from 2003 onwards. In 2019, 1,567 pounds (equivalent to 710kg) of methoxychlor were reported as "on-site and off-site disposed of or otherwise released", with a peak of 14,000 pounds (equivalent to 6,350 kg) disposed of or otherwise released in 2017. These disposals and releases, which have been to RCRA Subtitle C landfills that are authorized under the Resource Conservation and Recovery Act (RCRA) to accept hazardous waste for disposal, reflect stockpiles of methoxychlor in the USA The TRI data should, however, be used with some caution since only certain types of facilities are required to report; therefore, the information may not be exhaustive. (UNEP/POPS/POPRC.17/13/Add.1, UNEP, 2022).

3.4 Sites potentially contaminated by methoxychlor

Contaminated sites, particularly at former manufacturing or formulation sites, are of potential concern. The link between manufacturing of methoxychlor and emissions to the environment has not been documented and it is thought to be released to the environment mainly as a result of its application to crops and livestock as a pesticide. Remediation of contaminated sites could be necessary where methoxychlor has been used widely as a pesticide; however, no information has been found or provided to indicate the extent or number of such sites globally. Methoxychlor has been identified in 46 soil and 11 sediment samples collected from 58 of 1,613 National Priorities List (NPL) hazardous waste sites in the USA (UNEP/POPS/POPRC.17/13/Add.1, UNEP, 2022).

3.5 Summary of potential emission sources

Table 4 below provides an overview of the potential key sources for methoxychlor to environment. Care should be taken when reviewing this table as potential key sources will vary on a nation-by-nation basis and some sources may not be relevant for a given nation.

Table 4: Summary of key emission sources for methoxychlor [10]

Intentional production, trade and use	
Potential Source	**Current or no longer used**
Production of technical methoxychlor	Unknown
Formulation of products containing methoxychlor	Unknown
Distribution and sale of products containing methoxychlor	Unknown
Agricultural, veterinary, and commercial use of methoxychlor	Unknown
Domestic (home/residential) use of methoxychlor	Unknown
Disposal of containers	Unknown
Other sources of environmental release	
Potential Source	**Major or minor**
Accidental release (spills)	Minor
Contaminated sites	Minor

3.6 Inventory of methoxychlor based on production, use, and waste

3.6.1 Introduction

This chapter provides a detailed overview of all potential emission sources using a life-cycle approach. This covers the manufacture of technical methoxychlor, formulation of products for sale to end users that contain methoxychlor, use of methoxychlor in field, protected or domestic settings, recycling and disposal of used containers, and identification of stocks unused or obsolete stocks and their disposal. It also includes comments on potential hot spots and need to identify and inventory these sites.

[10] Under the Stockholm Convention methoxychlor was added to Annex A (elimination) with no specific exemptions. However, for those Parties that have made a declaration in accordance with paragraph 4 of Article 25 and have not yet ratified, accepted, approved or accessed the amendment, the obligations of Annex A with respect to methoxychlor do not apply. This means that it is also possible for uses to be ongoing (at least in the short to medium term).

3.6.2 The intentional production of methoxychlor

Manufacture and formulation of methoxychlor

Methoxychlor was first synthesised in 1893. It is produced commercially by the condensation of anisole with chloral in the presence of an acidic condensing agent. The manufacture of methoxychlor could result in releases of methoxychlor, including soil contamination.

Technical grade methoxychlor or pesticides that are purchased in bulk may be formulated and repackaged prior to sale to end users. These facilities could be sources of releases of methoxychlor to the environment.

No emission rates for methoxychlor during production or formulation have been identified. Guidance is available for estimating releases from organic chemical manufacturing in several countries as part of reporting to national pollutant release and transfer registries.[11] Methoxychlor is one of the substances subject to reporting under the US Toxics Release Inventory.[12]

The intent of the assessment of manufacturing and formulation activities is to obtain information on annual and total quantities of methoxychlor manufactured and/or formulated in the country, if it is ongoing or has ceased, estimates of releases to air, water, and soil and quantities of waste generated, and identify if any of the sites where these activities occurred is contaminated. Environmental monitoring data, if available, can highlight potential contamination and help in setting priorities for action.

Distribution and sale of products containing methoxychlor

Various actors are involved in the distribution network for pesticides, including importers, exporters, manufacturers, formulators, distributors, and retailers. These may be government agencies, private sector companies and/or agricultural cooperatives. They can provide information on quantities traded. These facilities will hold stocks of methoxychlor, some of which may be obsolete or improperly stored. These sites also have the potential to be contaminated. Data from these facilities can be collected through questionnaires and/or site visits.

The unauthorised distribution and sale of methoxychlor products is more difficult to assess. However, there may be some documentation available from past investigative reports. Inspections of retail markets and distribution facilities and in-person surveys with users by community or labour organisations could be used to obtain some data on the extent of use of unauthorised products.

The output of the assessment of distribution and sale are annual and total quantities of methoxychlor imported, exported, and sold in the country. It may identify sites where stocks of methoxychlor are held as well as sites that may be contaminated.

3.6.3 The intentional use of methoxychlor

Agriculture

Methoxychlor products have been used in field, protected agricultural, and veterinary applications. The objective is to obtain information on use patterns of methoxychlor – where, on what crops/animals and how much. This information is useful in assessing the need for, and training on, alternatives.[13] It may also identify areas where contamination has occurred. If environmental monitoring data are available, these can be used to guide priorities for intervention. Figure 1 illustrates how the field use of pesticides results in movement of methoxychlor into different environmental compartments. The US Environmental Protection Agency has developed air emission factors for pesticide applications should there be a need to estimate the release of methoxychlor into the air from outdoor spraying activities.[14]

[11] For example: Australia's Emission estimation technique manuals http://npi.gov.au/reporting/industry-reporting-materials/emission-estimation-technique-manuals; EMEP/EEA air pollutant emission inventory guidebook 2023 https://op.europa.eu/en/publication-detail/-/publication/ef079eba-7de9-11ee-99ba-01aa75ed71a1/language-en; US EPA's AP-42 – Compilation of Air Emissions Factors https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emissions-factors.

[12] https://www.epa.gov/toxics-release-inventory-tri-program/tri-listed-chemicals.

[13] See Appendix 4 for a list of possible alternatives.

[14] US EPA (1994) Emission Factor Documentation for AP-42 Section 9.2.2 Pesticide Application. https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-fifth-edition-volume-i-chapter-9-food-and-0.

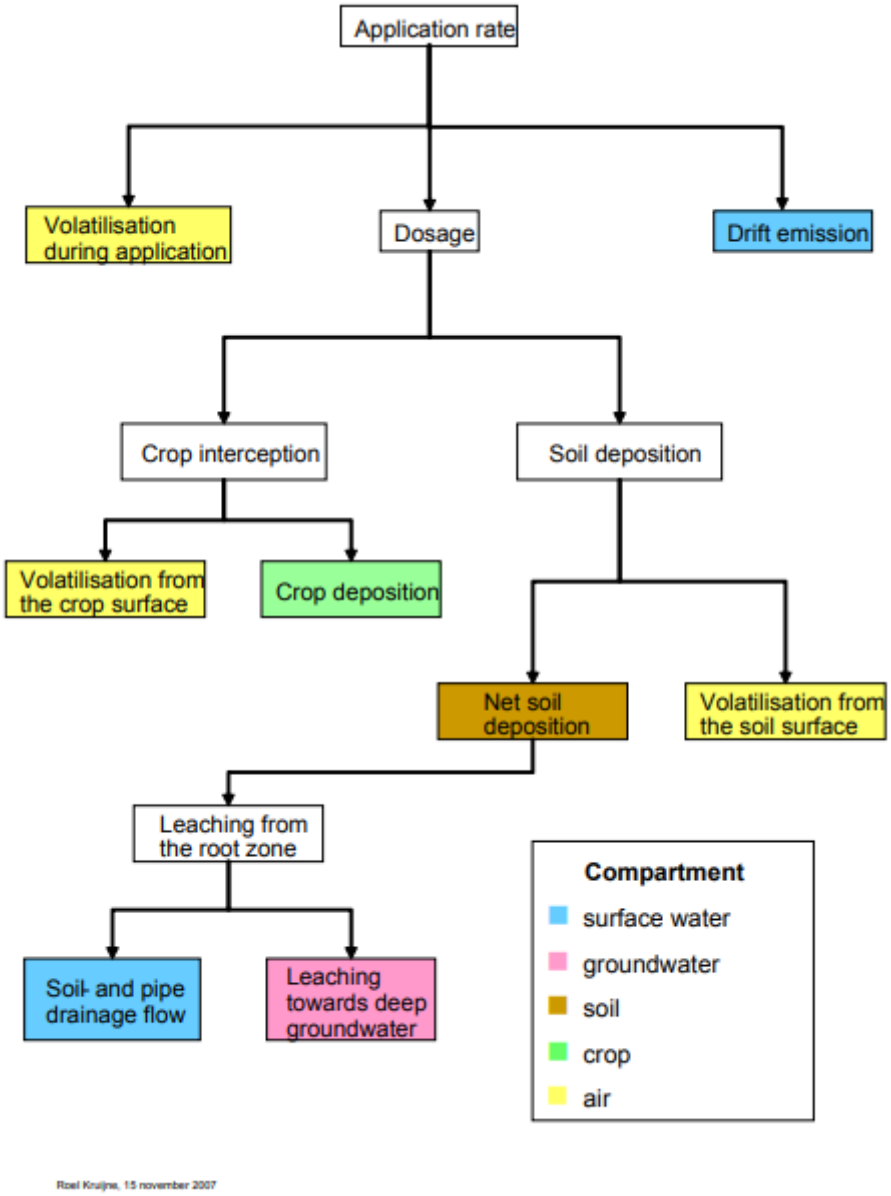


Figure 1: Environmental pathways for field applications of pesticides (Source: van der Linden et al., 2008)

Domestic or commercial

Some products containing methoxychlor have been registered for domestic (home or residential) or commercial use. Information on these products may only be readily available from retailers. However, an awareness campaign aimed at the consumer would contribute to the collection and appropriate disposal of methoxychlor containing products.

3.6.4 Methoxychlor waste

Sources of wastes containing, consisting of or contaminated with methoxychlor include wastes generated during manufacturing and formulation (refer to 3.6.2), used containers, obsolete stocks, and materials contaminated due to spills. The aim is to obtain information on the extent of recycling of pesticide containers that would have contained methoxychlor products, appropriate disposal of these containers, amounts of existing stocks of methoxychlor that have or may become obsolete and will need to be disposed of, and if possible, an estimate of the quantities of soil that have been contaminated and may need to be remediated.

3.6.5 Hot spots

A hot spot is an area that is contaminated and has high concentrations of pesticides including methoxychlor. These areas may need to be secured to prevent exposure and, in the long run, decontaminated and remediated. The FAO Environmental Management Tool Kit for Obsolete Pesticides (Cobban et al., 2020) outlines a process to identify these sites and to prioritize them for assessment and management.

Sites that may have been contaminated with methoxychlor include pesticide production and formulation facilities, sites where mixing or formulation occurred, pesticide storage sites (current and former), including stocks held by farmers and other end-users, waste disposal sites including pesticide burial locations. Sites where methoxychlor was applied may have high residues. Government records, industry and distribution operators, and non-governmental organizations (NGOs) may have information on hot spots. Information on potential hot spots could be obtained through inspections of retail markets and distribution facilities and in-person surveys with users by community or labour organisations. An awareness campaign aimed at the consumer could also encourage the reporting of potentially contaminated sites.

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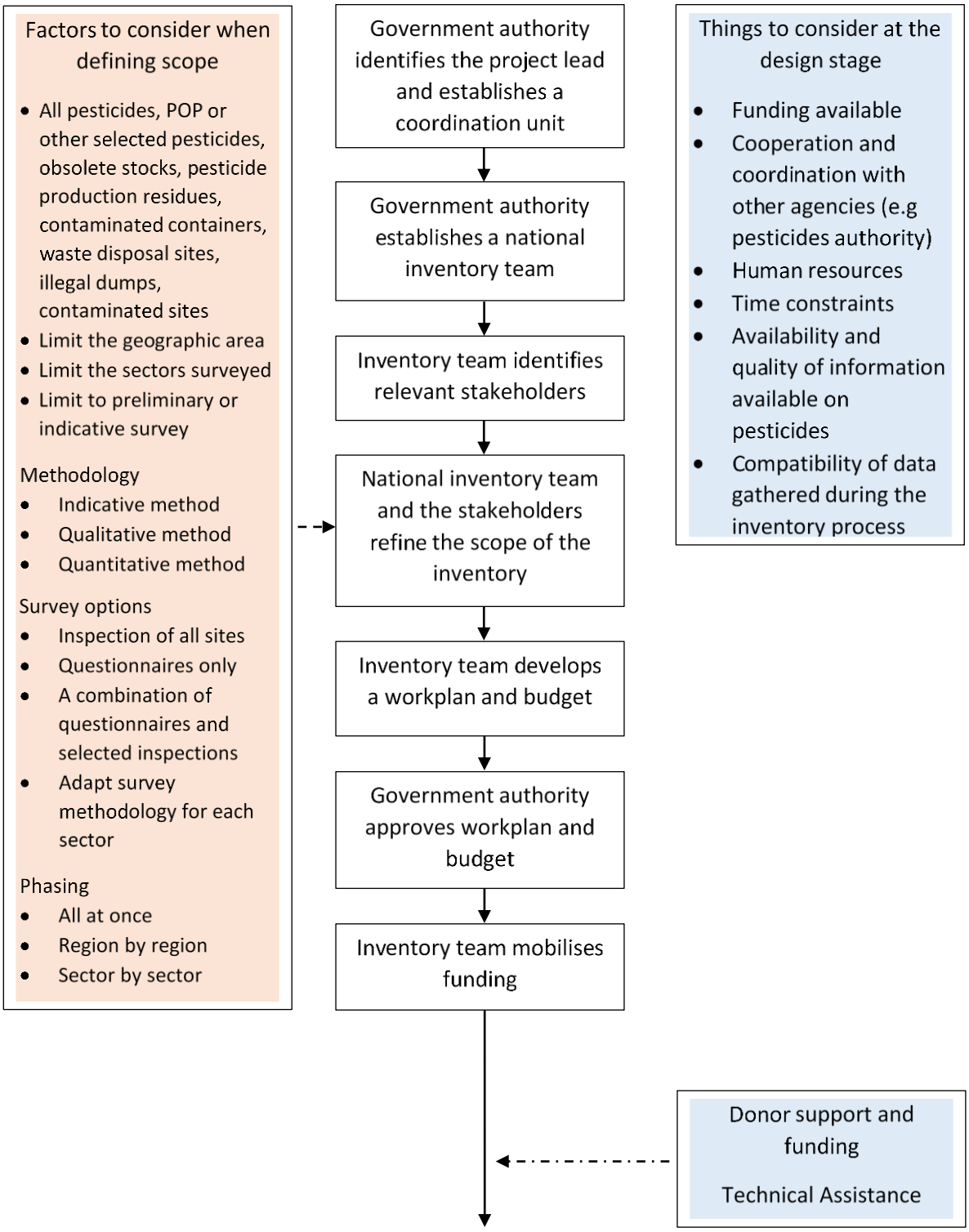
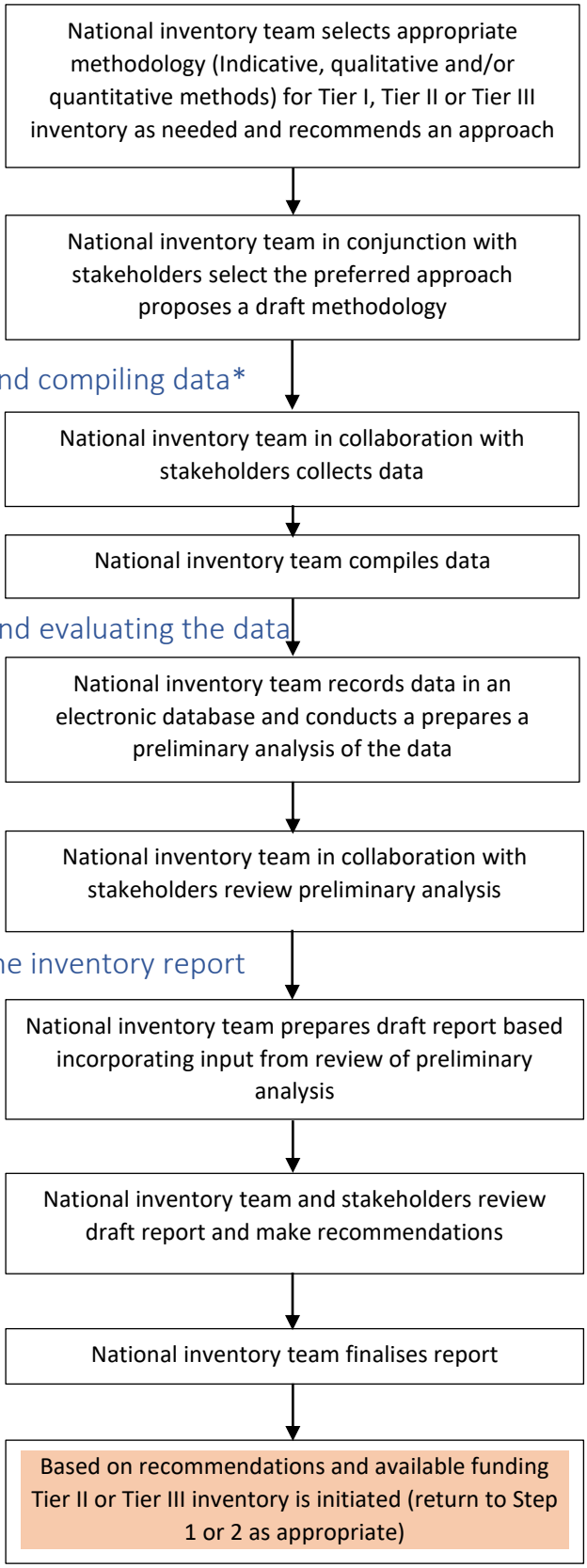
Appendix 1. Steps in the inventory process

Adapted from FAO (2010) The Preparation of Inventories of Pesticides and Contaminated Materials

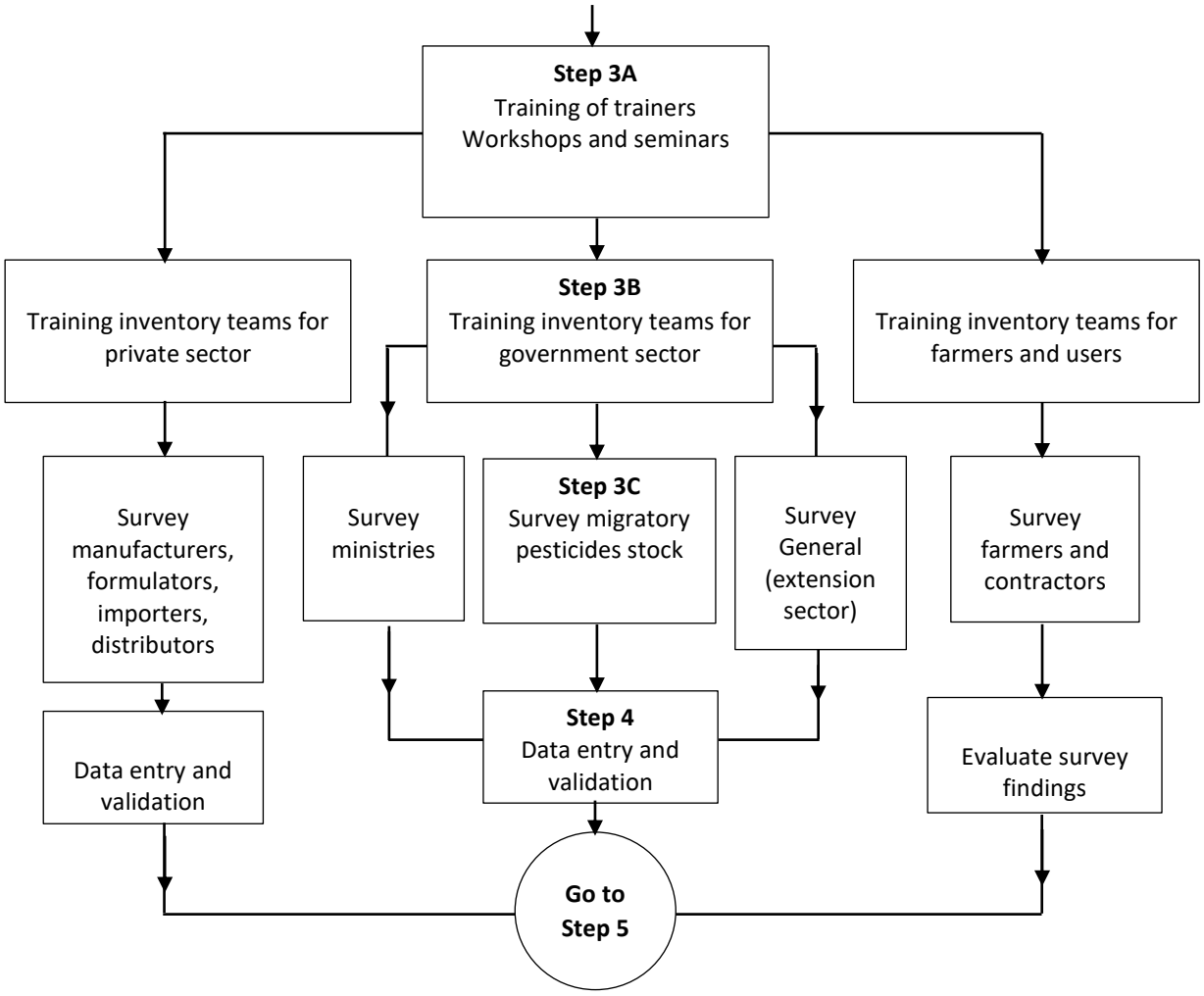
Step 1 Initiating the inventory development process



Step 2: Choosing data collection methodologies



* Details for Steps 3 and 4



Appendix 2. Questionnaire for compiling information on the production, formulation and import/export of methoxychlor and products containing methoxychlor and methoxychlor waste

Persistent organic pollutants (POPs) are toxic chemicals that adversely affect human health and the environment. They persist for long periods of time in the environment and can accumulate in the food chain and finally contaminate people. The Stockholm Convention is a global treaty which supports the phase out of POPs.
In 2023 methoxychlor was listed as POPs in Annex A, with no exemptions.

Therefore, the government is assessing the current production, formulation, import, export and use of methoxychlor to determine what actions will be needed to comply with the requirements of the Convention and develop a national implementation plan.

The following survey has been developed to gather relevant information from producers, formulators, importers and exporters of methoxychlor, products containing methoxychlor, and/or waste containing, consisting of, or contaminated with methoxychlor.

Name of establishment Registration number	
Address	
Name of respondent	
Position	
Telephone/Mobile	
Email	
Signature/date	

This questionnaire is divided in 4 sections

Section A: General

Section B: Production and formulation

Section C: Import and export

Section D: Distribution and retail sale

Section E: Use of methoxychlor

Section F: Recycling, stocks, contaminated sites

Please fill in the section(s) below which are relevant for your activity domain (manufacturer/importer/user/recycler/waste manager etc.).

Section A: General

1. **Are you aware that methoxychlor is listed as POPs in the Stockholm Convention and all production and use of methoxychlor will be banned?**
   - ☐ Yes
   - ☐ No

2. **Please indicate if you:**

   - ☐ Never produced, formulated, imported and/or exported methoxychlor or products containing methoxychlor
   - ☐ Currently produce methoxychlor

- ☐ Have stopped the production of methoxychlor in _____year
- ☐ Are planning to stop the production in _____month/year

- ☐ Currently formulate products containing methoxychlor
- ☐ Have stopped the formulation of methoxychlor products in _____year
- ☐ Are planning to stop the formulation in _____month/year

- ☐ Currently import methoxychlor or products containing methoxychlor
- ☐ Have stopped importing methoxychlor or products containing methoxychlor in _____year
- ☐ Are planning to stop importing in _____month/year

- ☐ Currently export methoxychlor or products containing methoxychlor
- ☐ Have stopped exporting methoxychlor or products containing methoxychlor in _____year
- ☐ Are planning to stop exporting in _____month/year

- ☐ Currently import waste containing, consisting of or contaminated with methoxychlor
- ☐ Have stopped importing waste methoxychlor in _____year
- ☐ Are planning to stop importing in _____month/year
- ☐ Currently export waste containing, consisting of or contaminated with methoxychlor
- ☐ Have stopped exporting methoxychlor waste in _____year
- ☐ Are planning to stop exporting in _____month/year

Section B: For <u>producers and formulators</u> of methoxychlor

3. Since when have you produced methoxychlor and/or formulated products containing methoxychlor?

_____

_____

_____

_____

4. List the products you have produced or formulated?

	Trade name	**Concentration of methoxychlor (%)**
Technical methoxychlor		
Products for agricultural use*		
Products for domestic use*		

***** Add rows as needed

5. **Please fill the table below on the quantities of methoxychlor produced or formulated**

Year*	**Produced** Tonnes of methoxychlor	**Formulated** Tonnes of methoxychlor
2024 (estimate)		
2023		
2022		
2021		
2020		

***** Add rows as needed

If you have ceased production of methoxychlor or formulation of products containing methoxychlor

Year production ceased	**Total amount produced (all years)** Tonnes of methoxychlor	**Total amount formulated (all years)** Tonnes of methoxychlor

6. **Please elaborate on your method of production.**
   Is it a closed loop process?
   - ☐ No
   - ☐ Yes

Section B-I: Environmental management

7. **Do you produce any waste during production or product formulation that may contain methoxychlor?**
   - ☐ No
   - ☐ Yes

   If yes:

Year*	**Total quantity of wastes (tonnes) that contain methoxychlor**	**Type of waste** (e.g. effluent, containers)	**How treated/handled** (e.g. incinerated, landfilled, treated, discharged)

***** Add rows as needed

8. **Please elaborate on the waste management of waste from production and use.**
   a. **What wastes are generated from methoxychlor production/formulation and how are they managed?**

   b. **Do you contribute to the end-of-life management and treatment of methoxychlor products you sold? How?**

9. **Does your facility carry out any routine monitoring for methoxychlor releases?**
   - ☐ No
   - ☐ Yes

   If yes:

Emission monitoring data as emission rates / annual totals	Emissions to air (g/m^2)	
	Emissions to water (g/l)	
	Emissions to waste (kg/tonne)	
	Annual emissions to air kg	
	Annual emissions to water kg	
	Annual quantities of methoxychlor in waste as kg	

10. **Have you ever conducted an environmental audit? If yes, please elaborate more (date, internal, external, consultancy firm, ...)**

11. **Has your facility conducted any environmental sampling for methoxychlor?**
   - ☐ No
   - ☐ Yes

   If yes:

Year*	**Site**	**Medium** (e.g. air, water, soil)	**Results** (Concentrations found)

***** Add rows as needed

12. Do you have ISO 14001?

- ☐ No
- ☐ Yes
- ☐ Similar certificate

Section C: Import and export of methoxychlor and/or its waste

13. Please fill the table below on the imported or exported quantities of methoxychlor or products containing methoxychlor and/or waste containing, consisting of or contaminated with methoxychlor

Year*	**Imported** Tonnes of methoxychlor	**Exported** Tonnes of methoxychlor	**Imported** Tonnes of methoxychlor waste	**Exported** Tonnes of methoxychlor waste
2024 (estimate)				
2023				
2022				
2021				
2020				

***** Add rows as needed

13 a) If you have **ceased** import or export of methoxychlor, products containing methoxychlor, and/or methoxychlor waste

Year import /export ceased	**Total amount imported** Tonnes of methoxychlor	**Total amount exported** Tonnes of methoxychlor	**Total amount imported** Tonnes of methoxychlor waste	**Total amount exported** Tonnes of methoxychlor waste

Section D: Distribution and Retail Sale

14. List the products you have distributed

Trade name*	**Concentration of methoxychlor (%)**	**Year**	**Amount sold (litres)**

***** Add rows as needed

15. List the products you have sold?

Trade name*	Concentration of methoxychlor (%)	Year	Amount sold (litres)

***** Add rows as needed

Section E: Use of methoxychlor

16. Have you used product containing methoxychlor?

- ☐ No
- ☐ Yes
- ☐ Don't know / Not sure

If yes:

17. What did you use it for?

- ☐ Control mites
- ☐ Control other pests
- ☐ Don't know / Not sure

18. Where did you use it?

- ☐ In the field
- ☐ In a greenhouse or other protected setting
- ☐ Around the home
- ☐ Don't know / Not sure

19. On what did you use it?

- ☐ Vegetables
- ☐ Fruits
- ☐ Cotton
- ☐ Tea
- ☐ Ornamental plants (e.g. flowers, trees)
- ☐ Other – specify:
- ☐ Don't know / Not sure

20. When did you use it?

Year*	Product name (if known)	Once	Twice	Three or more times	Don't know / not sure
2023		☐	☐	☐	☐
2021		☐	☐	☐	☐
2020		☐	☐	☐	☐
No longer used		☐	☐	☐	☐

* Add rows as needed

Section F: Recycling, stocks, contaminated sites

21. Do you recycle/reuse any methoxychlor containers?

- ☐ No
- ☐ Yes

If yes:

Year*	Number of containers reused	Number of containers recycled

***** Add rows as needed

22. Do you dispose of methoxychlor containers?

- ☐ No
- ☐ Yes

If yes:

Year*	Number of containers disposed of	Method of disposal

***** Add rows as needed

23. Do you have any stocks of methoxychlor?

Date*	Manufacturer	Product name	Registration number	Container size	Number of containers	Total volume	Condition**
							☐ Good ☐ Obsolete
							☐ Good ☐ Obsolete
							☐ Good ☐ Obsolete

* Add rows as needed

** Indicate if the condition is good, or if the stock is obsolete (no longer suitable for use because of damaged container, expired product, banned, or other reason). If some of the stock is good and another part obsolete, use two rows.

24. Are you aware of any sites that may be contaminated with methoxychlor?

- ☐ No
- ☐ Yes, If yes:

Location (Address)*	Description	Investigation report(s) available

* Add rows as needed

Appendix 3. Sample format for summary inventory tables

The following tables are possible summary tables for the national methoxychlor inventory. Information could be collated at the regional/provincial level if desired and the collated to the national level. Quantity used could be categorised (e.g.: Open field application, Greenhouse/protected agriculture, Commercial, Residential/home use)

Year	Quantity (kg active ingredient) Manufactured	Quantity (kg active ingredient) Imported	Quantity (kg active ingredient) Exported	Quantity (kg active ingredient) Sold	Quantity (kg active ingredient) Used
Total					

Year	Number of containers sold	Number of containers recovered and recycled	Quantity of methoxychlor waste produced (kg)	Quantity of methoxychlor waste disposed of in an environmentally sound manner (kg)
Total				

Year	Number of contaminated sites/hotspots	Size/area of hotspot	Estimated quantity of waste (kg)	Estimated quantity of methoxychlor in waste (kg)	Remediated? Yes/no
Total					

Appendix 4. Selected alternatives to methoxychlor

The table below lists potential alternative pesticides identified in the risk management evaluation. More information on these can be found in the Draft guidance on alternatives to methoxychlor (UNEP, 2024).

Name of active substance	CAS number
Biopesticides	
Bacillus cereus	68038-62-0
Bacillus thuringiensis, subspecies israelensis (Bti)	68038-71-1
Beauveria bassiana	63428-82-0
Metarhizium anisopliae	67892-13-1
Biochemical pesticides	
Abamectin	71751-41-2
Azadirachtin	11141-17-6
Chemical pesticides	
Acetamiprid	135410-20-7
Bifenthrin	82657-04-3
Chlorfenapyr	122453-73-0
Clothianidin	210880-92-5
Cyfluthrin	68359-37-5
Cypermethrin	52315-07-8
DEET	134-62-3
Deltamethrin	52918-63-5
Dinotefuran	165252-70-0
Doramectin	117704-25-3
Eprinomectin	123997-26-2
Esfenvalerate	66230-04-4
Fenvalerate	51630-58-1
Fluvalinate / Tau-fluvalinate	69409-94-5 / 102851-06-9
Imidacloprid	138261-41-3
Ivermectin	70288-86-7
Moxidectin	113507-06-5
Nitenpyram	150824-47-8
Permethrin	52645-53-1
Tefluthrin	79538-32-2
Thiacloprid	111988-49-9
Thiamethoxam	153719-23-4