

SUPPLY CHAIN ANALYSIS OF PESTICIDES IN THE MALDIVES

IMPLEMENTING SUSTAINABLE LOW AND
NON-CHEMICAL DEVELOPMENT *IN* SIDS
[ISLANDS]



MINISTRY OF
TOURISM AND
ENVIRONMENT



ISLANDS
Indian Ocean

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List of Abbreviations

ADR	European Agreement concerning the International Carriage of Dangerous Goods by Road
CIF	Cost, Insurance, Freight
CIP	Chemical Import Permit
DGR	Dangerous Goods Regulations
eFaas	Maldives national digital identity system
ERA	Environmental Regulatory Authority
FAO	Food and Agriculture Organization of the United Nations
GEF	Global Environment Facility
GHS	Globally Harmonized System of Classification and Labelling of Chemicals
HPA	Health Protection Agency
HS	Harmonized System
IATA	International Air Transport Association
IMDG	International Maritime Dangerous Goods
IPM	Integrated Pest Management
ISLANDS	Implementing Sustainable Low and Non-Chemical Development in SIDS
ISO	International Organization for Standardization
LCA	Life Cycle Analysis
MCS	Maldives Customs Services
MEDT	Ministry of Economic Development and Trade
MFDA	Maldives Food and Drug Authority

MNDF	Maldives National Defence Force
MAAW	Ministry of Agriculture and Animal Welfare
MoD	Ministry of Defence
MoH	Ministry of Health
MoTE	Ministry of Tourism and Environment
MoTCA	Ministry of Transport and Civil Aviation
MSDS	Material Safety Data Sheets
NGOs	Non-Governmental Organisations
PCOs	Pest Control Operators
PIC	Prior Informed Consent
POPs	Persistent Organic Pollutants
PPE	Personal Protective Equipment
RWMF	Regional Waste Management Facility
SCA	Supply Chain Analysis
SFP	Storage Facility Permit
SIDS	Small Island Developing States
SOEs	State Owned Enterprises
UNDP	United Nations Development Programme
URA	Utility Regulatory Authority
US EPA	United States Environment Protection Agency
WAMCO	Waste Management Corporation Limited
WHO	World Health Organization

1 Executive Summary

The study, Supply Chain Analysis of Pesticides in the Maldives, has been undertaken as part of the project Implementing Sustainable Low and Non-Chemical Development in SIDS (ISLANDS), implemented by the Ministry of Tourism and Environment (MoTE). This report analyses the performance and resilience of the pesticide supply chain, assessing across the scope of import, storage, transport and distribution, consumption and disposal of pesticides. The study reveals that pesticide mismanagement in the status quo exposes Maldivian communities and ecosystems to ongoing, preventable risks.

While robust regulations are in place, challenges remain in implementation, enforcement, data integration, and infrastructure across the supply chain. To effectively safeguard communities and the environment from the potential risks associated with pesticide use, a comprehensive and phased approach to reform is recommended. This includes 20 actionable measures aimed at enhancing import safety, clarifying regulatory frameworks, strengthening stakeholder capacity, and ensuring safe disposal practices

Current State: Fragmented Oversight, Escalating Risks

The Maldives' pesticide supply chain; spanning import, storage, distribution, use, and disposal; suffers from poor inter-agency coordination, implementation, and limited user awareness. The key gaps identified are:

1. Limited institutional capacity to ensure safe and compliant importation of hazardous chemicals.
2. Lack of testing infrastructure to verify pesticide quality and residues
3. Untrained users, including farmers, migrant workers, and households
4. Improper storage, transport, and disposal, threatening public health, and natural systems.

Key Insights

1. *Systemic gaps persist across the pesticide supply chain:* Fragmented regulatory oversight leads to inconsistent enforcement. Limited tracking and training compound risks across the system.
2. *Environmental, health, and compliance risks are rising:* Mismanagement and lack of awareness expose workers, communities and the natural environment to adverse impacts of pesticide use. Hazardous substances remain in use.
3. *A credible and actionable reform agenda is available:* Existing laws and infrastructure provide a strong foundation for systemic reform.

Gaps Across Supply Chain

Table 1-1 Gaps Across Supply Chain

Stage	Key Issues
Importation	No unified classification system; hazard verification not mandatory; Customs and Makudi systems are not integrated.
Storage	Infrequent inspections; no national registry; poor facility compliance outside ISO-certified warehouses.
Distribution	Informal, often unsafe land and sea transport; no shipment-level traceability.
End-Use	Most users untrained; safety data not accessible; PPE rarely used; health surveillance absent.
Disposal	Expired stockpiles unmanaged; waste mixed with general garbage; incineration infrastructure inactive.

Strategic Recommendations

Twenty integrated reforms address these challenges, grouped into six priority areas:

A. Strengthen Regulatory Frameworks

1. Standardize definitions and categorization of pesticides across all legal instruments, the Makudi Portal, and Customs systems.
2. Fully implement the Agricultural Pesticide Control Act (2019) and Regulation (2021).
3. Harmonize data between the Makudi Portal and Maldives Customs Services (MCS).
4. Require verified hazard data (e.g., GHS, WHO, FAO) for all new substance registrations and import permits.
5. Establish digital verification protocols for labels and SDS in the Makudi Portal.

B. Improve Import Safety and Testing Capacity

6. Strengthen MCS' capability for detecting hazardous pesticides at ports of entry.
7. Establish interim testing agreements with accredited regional labs.
8. Retrofit and accredit a national laboratory for pesticide testing and residue analysis.

C. Enhance Storage, Distribution, and Traceability

9. Strengthen storage regulations and create a storage facility registry linked to Makudi.
10. Inspect vehicles and vessels used for pesticide distribution.

11. Implement a comprehensive stock and movement tracking system for pesticides nationwide.

D. Support Safe and Inclusive End-Use

5. Empower women in agriculture and household pesticide use through targeted training and gender appropriate PPE access.
6. Communication strategies must be designed to accommodate varying literacy levels and cultural contexts to ensure accurate comprehension and consistent application of safety protocols, including PPE use, among migrant workers and other pesticide handlers.
7. Integrate existing health services nationwide through a unified, user-friendly digital infrastructure and coordinated governance framework to support health monitoring, medical assistance, and incident reporting.

E. Promote Sustainable Practices

12. Expand Integrated Pest Management (IPM) and organic certification efforts.

F. Improve Waste Management and Governance

8. Use data to identify high-risk locations for waste and strengthen local collaboration on pesticide waste management.
9. Implement Basel Convention complaint program for the environmentally sound export of pesticide waste.
10. Train and engage Local Councils in residential island pesticide oversight.
11. Streamline the regulatory framework and clarify inter-agency roles.
12. Develop and implement a comprehensive pesticide research framework in partnership with national and regional institutions.

Cross-Cutting Recommendations

Successful reform depends on the following cross-cutting actions:

- Conduct a legal and institutional audit to remove duplication of agency mandates
- Appoint a lead coordination body to manage multi-agency implementation
- Retrofit Makudi to serve as the centralized digital tracking and compliance platform
- Establish formal collaboration agreements with regional laboratories
- Invest in research through the existing academia in the country and international partners
- Strengthen capacity across Customs, MAAW, ERA, and local councils

Implementation and Enforcement

The report proposes clear standards across six domains as follows:

Table 1-2 Standards proposed across domains

Area	Proposed National Standards
Storage	Licensing, fire safety, ventilation, waste segregation, facility inspection
Usage	PPE mandates, IPM promotion, certified applicators, health surveillance
Labelling	GHS-aligned, multilingual labels with SDS and safety instructions
Transport	Compliant vessels/vehicles with spill kits, signage, and trained handlers
Disposal	Segregation at source, incineration, hazardous waste export protocols
Wastewater	Runoff containment protocols based on site-specific risk

The Enforcement Plan outlines:

- New pesticide licensing and oversight unit under MAAW
- Centralized pesticide registry and mandatory digital reporting
- Residue testing program (quarterly sampling)
- Public awareness campaigns and farm-level inspections
- Certification programs and lab expansion through international support

Trade-Off Analysis: Feasibility vs. Impact

Each recommendation has been assessed for its strategic value and implementation trade-offs:

Table 1-3 Summary of trade-off analysis

Recommendation Type	Key Benefits	Potential Trade-Offs
Standardize definitions & data	Enables integrated compliance, analytics and minimize the risk of misinterpretation.	High initial coordination cost
Enforce Act and Regulation	Closes regulatory gaps; enhances safety	Requires urgent resourcing and training
Import safety & testing	Reduces exposure to risk from hazardous pesticides	Requires investment, external partnerships, and lab capacity
End-user empowerment	Improves health and usage outcomes, especially for women and migrants	Requires multilingual outreach and subsidies
Waste management & export	Reduces environmental harm; enables legal disposal	Logistically complex; dependent on international cooperation

Conclusion

The Maldives has a legally sound but operationally underutilized pesticide management framework. By implementing the proposed 20-point reform package anchored in global best practice and supported by targeted investments in coordination, testing, data systems, and community engagement, the government can decisively reduce risk, uphold international obligations, and protect people and nature across the atolls.

2 Introduction

The Government of Maldives, in partnership with United Nations Development Programme (UNDP) Maldives and funded by the Global Environment Facility (GEF), is executing the project “Implementing Sustainable Low and Non-Chemical Development in SIDS (ISLANDS)”. This initiative, implemented by the Ministry of Tourism and Environment (MoTE), is part of the broader “Indian Ocean Child Project” involving four Small Island Developing States (SIDS): Maldives, Union of Comoros, Mauritius, and Seychelles. The primary objective of the project is to prevent and manage hazardous chemicals and materials, such as Persistent Organic Pollutants (POPs) and Mercury, while promoting circular economy practices to safeguard human health and the environment.

In the Maldives, this project aims to enhance institutional mechanisms and capacity for the management of hazardous waste. A crucial component of this effort is a comprehensive supply chain analysis of pesticides in the Maldives.

2.1 Context and Background

The Maldives, a geographically dispersed Small Island Developing State (SIDS), is experiencing a growing dependence on chemical imports, including pesticides, as part of its shift from traditional agriculture to more commercialized farming systems. Despite agriculture accounting for only 1.3% of the national GDP¹, it plays a critical role in ensuring food security and sustaining livelihoods in the islands. The sector’s intensification, driven by factors such as conventional monocropping, increasing pest pressures as well as lack of know-how has contributed to the growing import and use of agrochemicals, particularly pesticides.

Most pesticide imports are chemical-based, and their increased application, primarily through foliar spraying, poses significant threats to human health and the environment due to runoff, groundwater contamination, and occupational exposure². Despite the existence of legal instruments such as the Agricultural Pesticide Control Act (Act No. 21/2019) and Hazardous Chemical Regulation (2019/R-1057), implementation and monitoring remain inconsistent, and awareness among farmers and pesticide handlers is limited.

This assessment of the pesticide supply chain in the Maldives is a critical component of ongoing national efforts to establish a sound chemical management framework. It builds

¹ ADB (2020) *Maldives: Economy and Country Data*. Available at: <https://www.adb.org/countries/maldives/data>.

² Acharya, L. K., Paramaguru, P. K., Tripathi, K., Bhoi, T. K., Seth, P. and Birah, A. (2025) ‘Pesticide contamination in groundwater: processes, risks, and mitigation strategies’, *Discover Agriculture*, 3(1), pp. 152, Zhou, W., Li, M. and Achal, V. (2025) ‘A comprehensive review on environmental and human health impacts of chemical pesticide usage’, *Emerging Contaminants*, 11(1), pp. 100410.

on previous national initiatives including the Maldives National Chemical Profile³ and the Baseline Assessment on National Use of Chemicals and Associated Risks⁴. Both reports emphasize the absence of an overarching chemical management law, limited institutional coordination, and the fragmented nature of regulatory oversight; challenges that continue to impede effective lifecycle management of pesticides.

Given the Maldives' environmental vulnerability, ranging from low elevation and limited land, to fragile coral reef ecosystems, the improper handling, transport and disposal of pesticides represent not just local health risks but threats to biodiversity and food chain integrity. The use of potentially carcinogenic substances such as Diazinon, Malathion, and Permethrin; still found within the country, further exacerbates these risks.

From a development perspective, the Maldives' reliance on pesticide imports also intersects with global trade and compliance obligations. As a party to the Rotterdam and Stockholm Conventions, the country has a responsibility to implement 'Prior Informed Consent' (PIC) procedures and limit the use of Persistent Organic Pollutants (POPs). However, compliance requires well-regulated supply chains, improved customs controls, a national registry of approved pesticides, and the capacity to monitor residues—capacities that are currently underdeveloped.

2.2 Purpose of the Supply Chain Analysis

The Supply Chain Analysis (SCA) has three main objectives: (1) to map the pesticide supply chain and identify inefficiencies and challenges; (2) to conduct a life cycle analysis to assess the environmental footprint of pesticides; and (3) to evaluate the social and economic impacts of pesticide use, focusing on stakeholder roles and interactions. The report aims to propose strategies for optimizing the pesticide supply chain while ensuring environmental and social sustainability.

Specifically, the analysis will:

- Identify the types and quantities of both agricultural and non-agricultural pesticides used in the Maldives.
- Map the processes of pesticide importation, transportation, utilization, and disposal.
- Identify regulatory checkpoints and documentation required by relevant authorities.
- Assess the environmental, social, and economic impacts of the pesticide supply chain.
- Evaluate inefficiencies and gaps in existing regulatory processes.

³ Ministry of Environment and Energy (2016) *Maldives National Chemical Profile 2016*, Maldives.

⁴ MECCT (2022) *Baseline Assessment on National Use of Chemicals*, Maldives.

- Provide recommendations and their trade-offs for optimizing the pesticide supply chain.

Ultimately, this analysis will contribute to the overarching goal of ensuring the safe and effective use of pesticides, minimizing risks to human health and the environment.

2.3 This Report

This report provides an analysis of the pesticide supply chain in the Maldives, covering importation, storage, distribution, application, and disposal. It examines regulatory frameworks, documentation processes, and lifecycle management to identify gaps and propose solutions that enhance interagency collaboration and ensure the safe and effective use of all forms of pesticides. The study incorporates an environmental, social, and economic risk assessment to evaluate the broader impacts of pesticide management practices.

2.3.1 Structure of the Report

The Report includes the following chapters:

Chapter 1	Executive Summary
Chapter 2	Introduction
Chapter 3	Overview of Pesticides in the Maldives
Chapter 4	Stakeholder Mapping and Analysis
Chapter 5	Legislative and Policy Framework
Chapter 6	Social, Environmental and Economic Impacts
Chapter 7	Life Cycle Analysis (LCA)
Chapter 8	Identification of Inefficiencies and Gaps
Chapter 9	Recommendations
Chapter 10	Trade-off Analysis
Chapter 11	Recommendations on Standards for the Application and Management of Pesticides
Chapter 12	Enforcement Plan for the Recommended Standards for Pesticide Management in the Maldives
Chapter 13	Conclusion
Annex I	Methodology

2.3.2 Supply Chain Stages

A supply chain encompasses the entire process of producing, delivering, and managing goods or services from the point of origin to the end consumer. It involves the coordinated flow of materials, information, and financial resources across multiple stages. The primary

goal is to ensure the efficient and sustainable movement of goods while meeting demand and minimizing waste.

In the context of goods like pesticides, a supply chain includes not only the physical handling of products but also regulatory compliance, monitoring, and management at each stage.

Stages of the supply chain examined and applied for the purposes of this report are:

- **Import:** The process of bringing goods into a country, involving customs clearance, adherence to import regulations, and certifications.
- **Storage:** The safekeeping of goods in dedicated facilities before they are distributed or used.
- **Transport and Distribution:** The transportation and delivery of goods from storage facilities to distribution points such as shops or end-users.
- **End-Use:** The final stage where goods are utilised by customers, industries, or organisations.
- **Disposal:** The process of discarding, stockpiling or treating unused, expired, or waste products

For production and export of pesticides, findings from literature review and stakeholder consultations show that Maldives does not manufacture pesticides nor export pesticides. Therefore, production and export stages of a typical supply chain are not included for this particular analysis of pesticides in the Maldives.

2.3.3 **Definitions related to Pesticide Management**

The following definitions are used throughout the SCA.

Pesticides: Any substance or mixture of substances of chemical or biological ingredients intended for repelling, destroying or controlling any pest, or regulating plant growth⁵.

This definition encompasses a wide range of substances used to manage pests, including:

- **Insecticides** (include acaricides, molluscicides and nematicides): Insecticides are substances used to kill or repel insects. It includes acaricides, molluscicides and nematicides, used to kill mites, snails and slugs, and nematodes, respectively.

⁵ FAO and WHO (2014): *International Code of Conduct on Pesticide Management*. Available at: <https://www.fao.org/fao-who-codexalimentarius/thematic-areas/pesticides/en/#c452840>.

- **Herbicides** (including defoliants and desiccants): Herbicides are substances used to destroy or inhibit the growth of plants, such as weeds. It includes defoliants, used to remove plant foliage, and desiccants, used to remove water from living plant tissue.
- **Fungicides**: Fungicides are substances that destroy or inhibit the growth of fungi.
- **Rodenticides**: Rodenticides are substances that kill, repel or control rodents.
- **Plant Growth Regulators**: Natural or synthetic substance used for controlling or modifying plant. growth processes without reducing nutritive value or causing severe phytotoxicity.

Other, less well-known pesticides include the following⁶:

- **Repellents** that repel pests, including insects (such as mosquitoes) and birds.
- **Algaecides** that kill and/or slow the growth of algae.

All of the above seven categories of pesticides have been considered in this report.

Biopesticides: Certain types of pesticides derived from such natural materials as animals, plants, bacteria, and certain minerals.⁷

Makudi Portal: a centralized online system, managed by the Ministry of Defence for the purpose of issuing permits to import chemicals, that can be accessed using the entity or individual's eFaas account (Maldives national digital identity system).

US EPA Toxicity Class: The U.S. EPA (Environmental Protection Agency) classifies pesticide toxicity into four categories based on acute hazards. These categories, I through IV, indicate increasing levels of toxicity, with Category I being the most toxic and Category IV being the least toxic.

WHO Hazard Class: WHO classifies pesticides into hazard classes based on their acute toxicity, with the goal of minimizing risks to human health. The WHO Recommended Classification of Pesticides by Hazard has three main numerical classes: Class I (extremely and highly hazardous), Class II (moderately hazardous), and Class III (slightly hazardous).

IARC Monographs Hazard Classification: to classify a substance according to the level of certainty that the substance can cause cancer. The classification is: Group 1 – Carcinogenic

⁶ US EPA (2024b) *Types of Pesticide Ingredients*: US EPA. Available at: <https://www.epa.gov/ingredients-used-pesticide-products/types-pesticide-ingredients>.

⁷ Ibid.

to Humans; Group 2a – Probably carcinogenic to humans; Group 2b – Possible carcinogenic to humans; Group 3 – Not classifiable as to its carcinogenicity to humans.

Following is a list of definitions from The International Code of Conduct on Pesticide Management⁸ published by FAO and WHO, of commonly used terms adopted for the report:

Active ingredient means the part of the product that provides the pesticidal action.

Application equipment means any technical aid, equipment, implement or machinery which is used for the application of pesticides.

Banned pesticide means a pesticide, all uses of which have been prohibited by final regulatory action, in order to protect human health or the environment. It includes a pesticide that has been refused approval for first-time use, or has been withdrawn by industry either from the domestic market or from further consideration in the domestic approval process, and where there is clear evidence that such action has been taken in order to protect human health or the environment.

Co-formulant means a non-active ingredient component of a formulated product.

Container means any object used to hold a pesticide product.

Disposal means any operation to recycle, neutralize, destroy or isolate pesticide waste, used containers and contaminated materials.

Distribution means the process by which pesticides are supplied through trade channels to local or international markets.

Extension service means the entities in a country which are responsible for the transfer of information, technology advice and training regarding the improvement of agricultural practices, including production, handling, storage and marketing of agricultural commodities.

Formulation means the combination of various ingredients designed to render the product useful and effective for the purpose claimed and for the envisaged mode of application.

Hazard means the inherent property of a substance, agent or situation having the potential to cause undesirable consequences (e.g., properties that can cause adverse effects or damage to health, the environment or property).

⁸ FAO and WHO (2014): *International Code of Conduct on Pesticide Management*. Available at: <https://www.fao.org/fao-who-codexalimentarius/thematic-areas/pesticides/en/#c452840>.

Highly Hazardous Pesticides means pesticides that are acknowledged to present particularly high levels of acute or chronic hazards to health or environment according to internationally accepted classification systems such as WHO or Globally Harmonized System of Classification and Labelling of Chemicals (GHS) or their listing in relevant binding international agreements or conventions. In addition, pesticides that appear to cause severe or irreversible harm to health or the environment under conditions of use in a country may be considered to be and treated as highly hazardous.

Integrated Pest Management (IPM) means the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human and animal health and/or the environment. IPM emphasizes the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms.

Integrated Vector Management (IVM) means the rational decision-making process for the optimal use of resources for disease vector control. It aims to improve efficacy, cost-effectiveness, ecological soundness and sustainability of disease vector control interventions for control of vector borne diseases.

Label means the written, printed or graphic matter on, or attached to, the pesticide or the immediate container thereof and also to the outside container or wrapper of the retail package of the pesticide.

Life cycle means all the stages a pesticide might pass through from production to its degradation in the environment after use, or its destruction as an unused product. The life cycle includes manufacture, formulation, packaging, distribution, storage, transport, use and final disposal of a pesticide product and/or its container.

Manufacturer means a corporation or other entity in the public or private sector (including an individual) engaged in the business or function (whether directly or through an agent or entity controlled by or under contract with it) of manufacturing a pesticide active ingredient or preparing its formulation or product.

Maximum Residue Limit (MRL) means the maximum concentration of a residue that is legally permitted or recognized as acceptable in or on a food or agricultural commodity or animal feedstuff.

Packaging means the container together with the protective wrapping used to carry pesticide products via wholesale or retail distribution to users.

Personal Protective Equipment (PPE) means any clothes, materials or devices that provide protection from pesticide exposure during handling and application. In the context of this Code, it includes both specifically designed protective equipment and clothing reserved for pesticide application and handling.

Pest means any species, strain or biotype of plant, animal or pathogenic agent injurious to plants and plant products, materials or environments and includes vectors of parasites or pathogens of human and animal disease and animals causing public health nuisance.

Pest Control Operator (PCO) means any person or company that apply pesticides as a profession.

Pesticide means any substance, or mixture of substances of chemical or biological ingredients intended for repelling, destroying or controlling any pest, or regulating plant growth.

Pesticide management means the regulatory and technical control of all aspects of the pesticide life cycle, including production (manufacture and formulation), authorization, import, distribution, sale, supply, transport, storage, handling, application and disposal of pesticides and their containers to ensure safety and efficacy and to minimize adverse health and environmental effects and human and animal exposure.

Product (or **pesticide product**) means the formulated product (pesticide active ingredient(s) and co-formulants), in the form in which it is packaged and sold.

Public Interest Group means (but is not limited to) scientific association, farmer group, citizens' organization, labour union and non-governmental environmental, consumer and health organization.

Public health uses of pesticides means pesticides that are used in the control of pests of public health significance. They include disease vector control pesticides, household pesticide products, and professional pest control pesticides (used by pest control operators in homes and public areas).

Registration means the process whereby the responsible national government or regional authority approves the sale and use of a pesticide following the evaluation of scientific data aimed at demonstrating that the product is effective for its intended purposes and does not pose an unacceptable risk to human or animal health or the environment under the conditions of use in the country or region.

Repackaging means the transfer of a pesticide from any authorized commercial package into any other, usually smaller, container for subsequent sale.

Residue means any specified substances in or on food, agricultural and other types of commodities or animal feed as well as in environmental media including soil, air and water resulting from the use of a pesticide. The term includes any derivatives of a pesticide, such as conversion products, metabolites, breakdown products, reaction products and impurities considered to be of toxicological or ecotoxicological significance. The term "pesticide residue" includes residues from unknown or unavoidable sources (e.g., environmental contamination) as well as known, authorized uses of the chemical.

Severely restricted pesticide means a pesticide virtually all use of which has been prohibited by final regulatory action in order to protect human health or the environment, but for which certain specific uses remain allowed. It includes a pesticide that has, for virtually all use, been refused for approval or been withdrawn by industry either from the market or from further consideration in the domestic approval process, and where there is clear evidence that such action has been taken in order to protect human health or the environment.

Specification means the parameters and criteria defining the physical appearance and physical and chemical properties of technical and formulated pesticides linked with hazard and risk profiles.

Toxicity means a physiological or biological property which determines the capacity of a chemical to do harm or produce injury to a living organism by other than mechanical means.

Trader means anyone engaged in trade, including export, import and domestic distribution.

Vulnerable groups mean persons that include pregnant and nursing women, the unborn, infants and children, the elderly, HIV/AIDS affected people and, when subject to high exposure to pesticides over the long term, workers and residents.

2.3.4 **Data Sources**

The Table 2.1 below gives details of the different datasets used for analysis in this report.

Table 2-1 List of datasets used in this report

#	Dataset	Year	Agency	Details
1	Pesticide import dataset	2019 – 2024	MCS	Includes details of pesticide imports in the Maldives. Dataset includes: <ul style="list-style-type: none"> - HS Codes - HS Description - Importer/exporter code - Importer name - Sector - Country of consignment - Unit - Quantity - CIF (MVR) - Rate
2	Substances dataset	2020 – 2024	MoD	Includes details of chemical permits applied via Makudi portal from 2020 – 2024. Variables

				<p>differ from year to year but common fields in all years includes:</p> <ul style="list-style-type: none"> - Substance name - Substance group - Import purpose - Total amount - Unit name
3	Approved Pesticide Registry	2024	MAAW	<p>List of approved pesticides in the Maldives. Includes details such as:</p> <ul style="list-style-type: none"> - Common name/ Active ingredient - Formulations - Concentration (%) - Pesticide Type - US EPA Toxicity Class - WHO Hazard Class - Host Plant/Area - Target Pest
4	Farmers Registry	2024	MAAW	<p>Lists the number of farmers by island and atoll</p>
5	Long Term Leased Agricultural Islands	2024	MAAW	<p>Lists long term leased agricultural islands by island and atoll</p>
6	Permitted Ports for Pesticide Imports	2024	MAAW	<p>Lists the 7 permitted ports for pesticide imports under the Agricultural Pesticide Control Act</p>

2.3.5 **Limitations and Assumptions**

In undertaking the SCA, there were some limitations as described below.

1. **Data availability and quality:** The pesticide import dataset and substances datasets exhibited inconsistencies across years. For the pesticide import dataset, these discrepancies included changes in HS codes and mixed measurement units with weight, volume, and count all applied across different records. These issues were subsequently verified with the MCS. The substance data on the other hand did not have HS codes, and had different pesticide groups, thereby making comparison hard between the two datasets. It also had different variables available for each year, leading to only having used the common fields (variables) in the data analysis. In some cases, only partial data sets (e.g., Makudi Portal data for 2024 only) could be reliably used for the analysis. Public health-related pesticide use data, including detailed breakdowns of insecticide use for vector control, were unavailable or incomplete. For the purpose of unit conversion, all pesticides were assumed to have the same density as water, allowing a 1:1 conversion of litres to kilograms.
2. **Limitations in the LCA:** The LCA of Diafenthiuron and Deltamethrin were constrained by limited Maldives-specific data on pesticide quantities, application methods, environmental fate, and long-term impacts. Most available studies originate from non-island or continental ecosystems, limiting the ability to assess impacts specific to tropical island environments like the Maldives. This is the case for nearly all the chemicals used in the Maldives.
3. **Lack of environmental monitoring data:** There is a general absence of continuous environmental monitoring for pesticide residues in soil, water, or biota in the Maldives. This prevented robust cumulative impact analysis and limited validation of assumptions regarding environmental and human health risks.
4. **Lack of data on stockpiling or disposal:** Data on disposal of unused or expired pesticides is lacking. No inventory or systematic monitoring of chemical waste streams was available, affecting the ability to assess disposal-related risks.
5. **Scope limitations:** The study scope was limited to the supply chain stages of importation, storage, distribution, end-use, and disposal. The production, repackaging and export stages were not analysed, as the Maldives does not manufacture pesticides nor repackage or export them.
6. **Limited stakeholder data:** While interviews with key informants and institutions were conducted, engagement with farmers, pest control operators, and household users at scale was beyond the study's scope, limiting the granularity of user behaviour insights.
7. **Limited local testing facilities:** The lack of a dedicated local pesticide residue testing laboratory limited real-time analysis and forced reliance on external studies for environmental fate and behaviour of pesticides.

Despite these limitations, the study provides an overview of the pesticide supply chain and identifies critical inefficiencies, gaps, and opportunities for strengthening pesticide management in the Maldives.

3 Overview of Pesticides in the Maldives

Pesticide usage in the Maldives is entirely reliant on imports, with no local chemical production.⁹ Pesticides are predominantly used in agriculture, tourism, and public health. Over the years, pesticide imports have risen significantly, driven by demand in agriculture and tourism.¹⁰ In agriculture, insecticides, fungicides, rodenticides, and plant growth regulators are extensively applied, often exceeding recommended frequencies, leading to environmental and health risks.¹¹ Tourism relies heavily on pesticides for pest control in resorts, while public health uses chemicals like Malathion for vector control during disease outbreaks.¹²

Figure 3.1 provides a simplified overview of the pesticide supply chain in the Maldives, illustrating the movement of products from importation to final disposal. The process begins with the import stage, where pesticides enter the Maldives under the permit system regulated through the Makudi Portal of the Ministry of Defence (MoD) and are cleared by Maldives Customs Service (MCS). At this stage, enforcement authorities are responsible for verifying compliance with registration requirements and approved use categories. Once cleared, consignments are directed to storage facilities, which may be licensed or non-licensed depending on the quantity of pesticides handled.

⁹ MECCT (2022) *Baseline Assessment on National Use of Chemicals*, Maldives, Ministry of Environment and Energy (2016) *Maldives National Chemical Profile 2016*, Maldives.

¹⁰ Ministry of Environment and Energy (2016) *Maldives National Chemical Profile 2016*, Maldives.

¹¹ MECCT (2022) *Baseline Assessment on National Use of Chemicals*, Maldives, Ministry of Environment and Energy (2016) *Maldives National Chemical Profile 2016*, Maldives.

¹² Ministry of Environment and Energy (2016) *Maldives National Chemical Profile 2016*, Maldives.

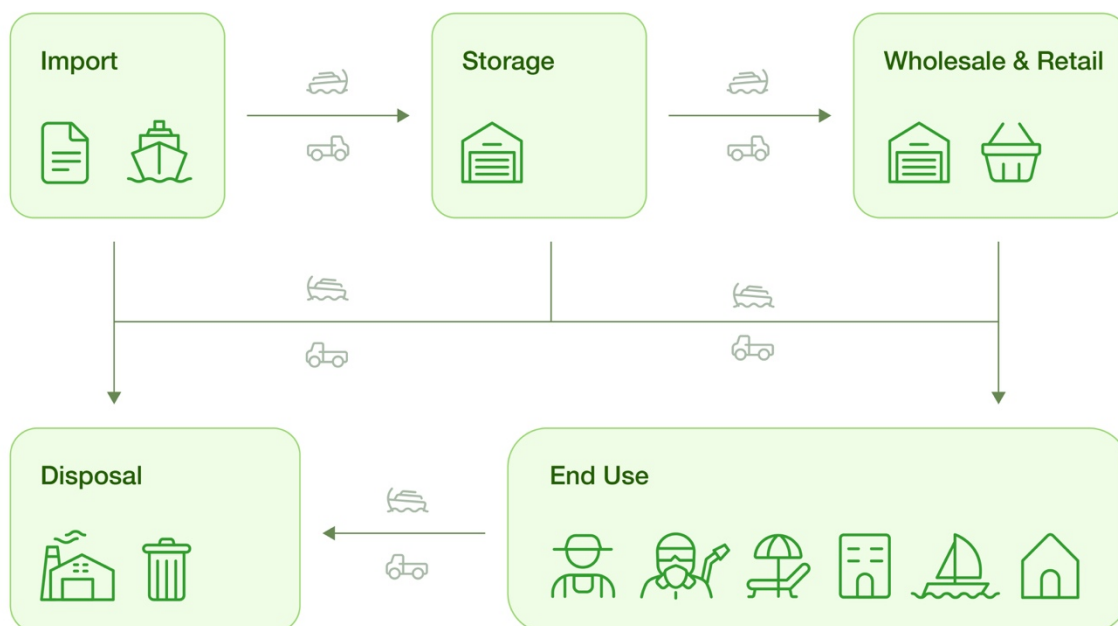


Figure 3-1 An illustration of the pesticide supply chain in the Maldives

Following storage, pesticides move into wholesale and retail distribution channels, supplying both bulk buyers and smaller end-users. In many cases, wholesalers also operate retail shops and function as PCO), creating overlaps between distribution and end-use. The end-use stage encompasses a wide range of applications in the Maldives, including PCO services, agricultural production by farmers and growers, household use, the tourism sector (resorts, guesthouses, and liveaboards), as well as national and local health programmes.

The supply chain concludes with the disposal stage, which covers expired pesticides, empty containers, and other pesticide waste. Seized consignments from the import stage are also directed to disposal. At present, most pesticide waste is stockpiled at island and regional waste management facilities rather than being incinerated.

The remaining sections of this chapter describes the details of the supply chain of pesticides in the Maldives at present, including breakdown of the types of quantities of pesticides imported to the Maldives, storage, wholesale and retail distribution, end-use and disposal.

3.1 Import

3.1.1 *Registration and Import of Pesticides*

The import of agricultural pesticides into the Maldives is governed by the Agricultural Pesticides Control Act (Law No 21/2019), which mandates that importers of pesticides to register with Ministry of Agriculture and Animal Welfare (MAAW). However, MAAW has highlighted that the Act has not yet been implemented, and entities currently only require a business registration to proceed with import permits.¹³

MoD regulates import of chemicals including pesticides under the Hazardous Chemical Regulation (2019/R-1057) through the Makudi Portal. Within the portal, chemicals are categorised into three groups:

1. Open List: Substances that may be imported without prior approval.
2. Controlled List: Substances that require specific authorization before import.
3. Closed List: Substances prohibited from import, except where exemptions are granted for military use.

For pesticides classified under the Controlled List, the following importation steps must be followed:

Step-by-Step Importation Process

1. Obtaining a Storage Facility Permit (SFP):
 - The importer must first obtain a permit for a suitable storage facility. This requires submitting an application to the Ministry of Defence (MoD), which then conducts an inspection to verify compliance with the requirements specified in the Hazardous Chemicals Regulation, including land use, ventilation, fire safety, and accessibility. The MoD provides the importer with a detailed inspection report outlining any required modifications. Once the facility has been brought into full compliance with the prescribed standards, a reinspection is carried out, after which the permit is issued.¹⁴

¹³ Stakeholder consultation meeting with MAAW, 20 Nov 2024

¹⁴ Stakeholder consultation meeting with MoD, 24 Nov 2024

2. Verification of Substance in the Portal:

- A list of registered substances is already available on Makudi Portal.
- If the substance to be imported is not listed, the importer must submit a *Substance Request Application* along with the relevant Material Safety Data Sheets (MSDS) for MoD approval.

3. Approval of New Substances:

- The MoD verifies and approves the New Substance.
- If approval from another regulatory agency is required, the MoD coordinates with the relevant authority before granting approval.
 - a. For agricultural pesticides, MAAW is the competent authority, and the approval is based on the *Approved Pesticide Registry*.
 - b. For public health related pesticides, the MoH is the authority for approval.

4. Applying for a Chemical Import Permit:

- Once the pesticide is registered, the importer must apply for a CIP for the specified quantity. For consignments below 200 kg, a Storage Facility Permit is not required; however, quantities exceeding this threshold must comply with all storage facility requirements.
- After verifying all documentation and obtaining a no-objection letter from relevant agencies (if applicable), the MoD issues the CIP.

5. Arrival and Customs Verification:

Upon arrival of the shipment, the MCS verifies in the Makudi Portal that a valid Chemical Import Permit has been issued. If approvals are incomplete or the required permits have not been obtained, MCS withholds the shipment until compliance is achieved. Shipments containing substances listed under the Closed List are subject to immediate confiscation.¹⁵

¹⁵ Stakeholder consultation meeting with MoD, 24 Nov 2024

3.1.2 **Types and Quantities Registered for Importing**

Pesticides registered for import are determined through Chemical Import Permit (CIP) applications submitted via the Makudi Portal.

The Makudi Portal provides the following substance groups options for registration:

1. Bio insecticide
2. Fungicide
3. Insecticide
4. Pesticide
5. Organic Fertiliser
6. Plant Growth Regulator
7. Cleaning and Hygienic
8. Refrigerant/ODS
9. Wetting agent
10. Organic fertilizer
11. Mineral or chemical
12. Other

The registration options also include the following sectors under the types of chemicals:

1. Health Sector
2. Construction
3. Food processing
4. Manufacturing

3.1.3 **Chemical Import Permits for Controlled Pesticides**

CIP applications for controlled pesticides can be analysed using data available from the MoD Makudi Portal. For the purposes of this assessment, only 2024 data have been considered, as data fields were inconsistent across previous years. The analysis focuses on the top ten approved CIP applications. For unit conversion, pesticide density has been assumed equivalent to that of water, allowing litres to be converted into kilogram.

Top ten CIPs in weight

MoD data for 2024 indicates that the applicants listed in Table 3.1 represent the top ten holders of CIPs for controlled pesticides, ranked by total weight. A total of 89 tonnes of CIP for pesticides were approved in 2024. Together they represent 96.7% of total 15 tonnes of CIPs of controlled pesticide groups to the Maldives.

Table 3-1 Top 10 CIP applicants by total weight of approved CIPs

#	Applicants of CIPs	CIPs issued in 2024	
		Weight (tonnes)	Percentage share of national import permits
1	Seagull Group Pvt Ltd	42	47%
2	Pest Ex Maldives Pvt Ltd	24	27%
3	Fari Maldives Pvt Ltd	6	7%
4	Prime Fertilizers Maldives Pvt Ltd	6	7%
5	Alividha Maldives Pvt Ltd	4	4%
6	Agrigro Pvt Ltd	2	2%
7	Rentokil Initial Maldives Pvt Ltd	1	1%
8	Pesterminators Pvt Ltd	1	1%
9	Classy Pool Pvt Ltd	1	1%
10	Universal Enterprises Pvt Ltd	1	1%

Table 3.2 presents the top ten controlled pesticides for which CIPs were requested in 2024, out of a total of 89 tonnes of controlled pesticides. Collectively, these account for 73.8% of all CIPs issued for controlled pesticides in 2024

Table 3-2 Top 10 CIPs for pesticides in Makudi portal, Source: MoD, 2025

#	Substance name	Weight in tonnes	% of total CIPs	Active ingredient	US EPA Toxicity Class ¹⁶	WHO hazard Class ¹⁷	Cancer Classification (IARC ¹⁸ and US EPA ¹⁹)	Pesticide type	Host plant/area	Target pests
1	Abamectin	22.74	25.4	Abamectin	II – moderately toxic, moderately irritating	II – moderately hazardous	IARC: Not evaluated. US EPA: Group E "evidence of non-carcinogenicity for humans.	Acaricide, Nematicide	Cotton, citrus, vegetables, and more	mites, thrips, leaf miners, and nematodes

¹⁶ Ministry of Agriculture and Animal Welfare (2022), 'Approved Agricultural Pesticide Registry', Updated in 29 December 2022.

¹⁷ Ibid

¹⁸ International Agency for Research on Cancer, World Health Organization, (Last updated 2025), 'IARC Monographs on the Identification of Carcinogenic Hazards to Humans', Available at: <https://monographs.iarc.who.int/list-of-classifications> (accessed on 25 September 2025).

¹⁹ US EPA, Branch, S.I.M. (2024a) *Chemicals Evaluated for Carcinogenic Potential*. Washington, D.C.

#	Substance name	Weight in tonnes	% of total CIPs	Active ingredient	US EPA Toxicity Class ¹⁶	WHO hazard Class ¹⁷	Cancer Classification (IARC ¹⁸ and US EPA ¹⁹)	Pesticide type	Host plant/area	Target pests
2	Imidacloprid 20% SL	9.72	10.8	Imidacloprid	III – slightly toxic, slightly irritating	II – moderately hazardous	IARC: Not evaluated. US EPA: Group E "evidence of non-carcinogenicity for humans."	Insecticide	Seed dressing and soil treatment and as foliar treatment of maize, vegetables, citrus fruit, pome fruit and stone fruit	sucking insects, termites, biting insects (rice weevil, Colorado beetle)
3	Profenofos EC	8.29	9.26	Profenofos	III – slightly toxic, slightly irritating	II – moderately hazardous	IARC: Not evaluated. US EPA: Group E "evidence of non-carcinogenicity for humans."	Insecticide, Acaricide, Miticide	Maize, vegetables, and other crops	lepidoptera and mites
4	Daconil SC	7.23	8.07	Chlorothalonil	I – highly toxic, highly irritating, II – moderately toxic, moderately irritating	U – Unlikely to present acute hazard in normal use	IARC: Group 2B – probable human carcinogen US EPA: B2 carcinogen	Fungicide	pome fruit, stone fruit, citrus fruit, bush and cane fruit, cranberries, strawberries, pawpaws, banana, mango, coconut palm, vegetable, cucurbits, maize, ornamentals, mushroom, turf	many fungal diseases
5	Erasedect 35 EC	4.8	5.36	Pyriproxyfen	III – slightly toxic, slightly irritating	U – Unlikely to present acute hazard in normal use	IARC: Not evaluated. US EPA: Group E no evidence for carcinogen	Insect Growth Regulator, Insecticide	Breeding sites	white fly, thrips, and public health insect pests

#	Substance name	Weight in tonnes	% of total CIPs	Active ingredient	US EPA Toxicity Class ¹⁶	WHO hazard Class ¹⁷	Cancer Classification (IARC ¹⁸ and US EPA ¹⁹)	Pesticide type	Host plant/area	Target pests
							icity to humans			
6	Starkle SG	4.13	4.62	Dinotefuran		III – slightly hazardous	IARC: Not evaluated. US EPA: Not likely to be carcinogenic to humans	Insecticide	Brassica, cucurbits, fruiting and leafy vegetables, grapes, ornamentals	
7	Chaindrite 1 WP LB	3.59	4.01	Bifenthrin	II – moderately toxic, moderately irritating	II – moderately hazardous	IARC: Not evaluated. US EPA: Group C – possible human carcinogen	Insecticide	Citrus, fruit, grapes, ornamentals and vegetables	coleoptera, diptera, heteroptera, homoptera, lepidoptera and orthoptera
8	Regent SC	2.41	2.69	Fipronil	II – moderately toxic, moderately irritating	II – moderately hazardous	IARC: Not evaluated. US EPA: Group C – possible human carcinogen		Crops and non-crops	soil and foliar insects (corn rootworm beetle larvae, Colorado potato beetle and rice water beetle)
9	Cypermethrin	1.6	1.79	Cypermethrin	III – slightly toxic, slightly irritating	II – moderately hazardous	IARC: Not evaluated. US EPA: Group C –	Insecticide	Crops and non-crops	chewing and sucking insects

#	Substance name	Weight in tonnes	% of total CIPs	Active ingredient	USEPA Toxicity Class ¹⁶	WHO hazard Class ¹⁷	Cancer Classification (IARC ¹⁸ and US EPA ¹⁹)	Pesticide type	Host plant/area	Target pests
							possible human carcinogen			
10	Carbar yl 85% WP	1.54	1.72	Carbar yl	II – moderately toxic, moderately irritating, III – slightly toxic, slightly irritating	III – slightly hazardous	IARC: Group 3 – Not classifiable as to its carcinogenicity in humans US EPA: Group C – possible human carcinogen	Insecticide, Plant Growth Regulator, Nematocide	Citrus fruit, vegetable, forage, forests, field crops, nuts, ornamentals, rangeland, turf, shade trees	lepidoptera, coleoptera, chewing and sucking insects

3.2 Supply of Pesticides

3.2.1 Types and Quantities of Pesticides Imported

The primary source of data on pesticide imports in the Maldives is the import dataset of the MCS.

Pesticides were manually categorized based on the available HS codes and product descriptions, as outlined in Table 3.3 below.

Table 3-3 HS Codes and Categories

#	Code	HS description	Category
1	3808920011	Fungicide	Fungicides
2	3808921000	Fungicides (used for agricultural purpose)	Fungicides
3	3808920014	Fungicides used for agricultural purpose	Fungicides
4	3808920011	Fungicides used other than for agricultural purpose	Fungicides
5	3808920011	Fungicides.	Fungicides
6	3808939000	Herbicides, algaecides and weed killer	Herbicides and algaecides
7	3808930011	Herbicides & algaecides.	Herbicides and algaecides
8	3808930011	Herbicides, algaecides and anti-sprouting products	Herbicides and algaecides
9	3808910015	Insect repellent	Repellent

#	Code	HS description	Category
10	3808919099	Insecticides and pesticides, nes	Insecticides
11	3808911010	Insecticides and pesticides used for agricultural purpose	Insecticides
12	3808911011	Insecticides and pesticides used for agricultural purpose	Insecticides
13	3808919011	Insecticides and pesticides used for agricultural purpose	Insecticides
14	3808910020	Insecticides and pesticides used for agricultural purposes	Insecticides
15	3808910011	Insecticides and pesticides, nes.	Insecticides
16	3808910012	Insecticides and pesticides, nes.	Insecticides
17	3808910013	Insecticides and pesticides, nes.	Insecticides
18	3808919098	Insecticides and pesticides, nes	Insecticides
19	3808911100	Insecticides used for killing or repelling mosquitoes (including mosquito coils)	Repellent
20	3808919010	Mosquito coil & mosquito repellent (used other than for agricultural purpose)	Repellent
21	3808910010	Mosquito coil & mosquito repellent.	Repellent
22	3808919098	Other insecticides and pesticides (used other than for agricultural purpose)	Insecticides
23	3808919099	Other insecticides and pesticides (used other than for agricultural purpose)	Insecticides
24	3808931000	Plant growth regulator	Plant growth regulator
25	3808930010	Plant growth regulator.	Plant growth regulator
26	3808990010	Rodenticides & similar products.	Rodenticide
27	3808990099	Rodenticides and similar products, put up for retail sale, nes.	Rodenticide
28	3808990010	Rodenticides and similar products, put up for retail sale, nes	Rodenticide
29	3808990099	Rodenticides and similar products, put up for retail sale, nes	Rodenticide

According to the dataset, the pesticides imported into the Maldives are classified into the following categories:

1. Insecticides
2. Herbicides
3. Fungicides
4. Rodenticides
5. Plant growth regulators
6. Repellents

7. Algaecides

The total value of pesticide imports, both overall and by type, could not be determined due to inconsistencies in measurement units across the records (kilograms, litres, and counts). Consequently, the analysis was limited to records expressed in kilograms and litres. Records expressed in counts were excluded, as the size or capacity of individual pesticide units could not be established. For the purpose of unit conversion, all pesticides were assumed to have the same density as water, allowing a 1:1 conversion of litres to kilograms.

Figure 3.1 illustrates the annual pesticide imports by weight to the Maldives from 2019 to 2024.

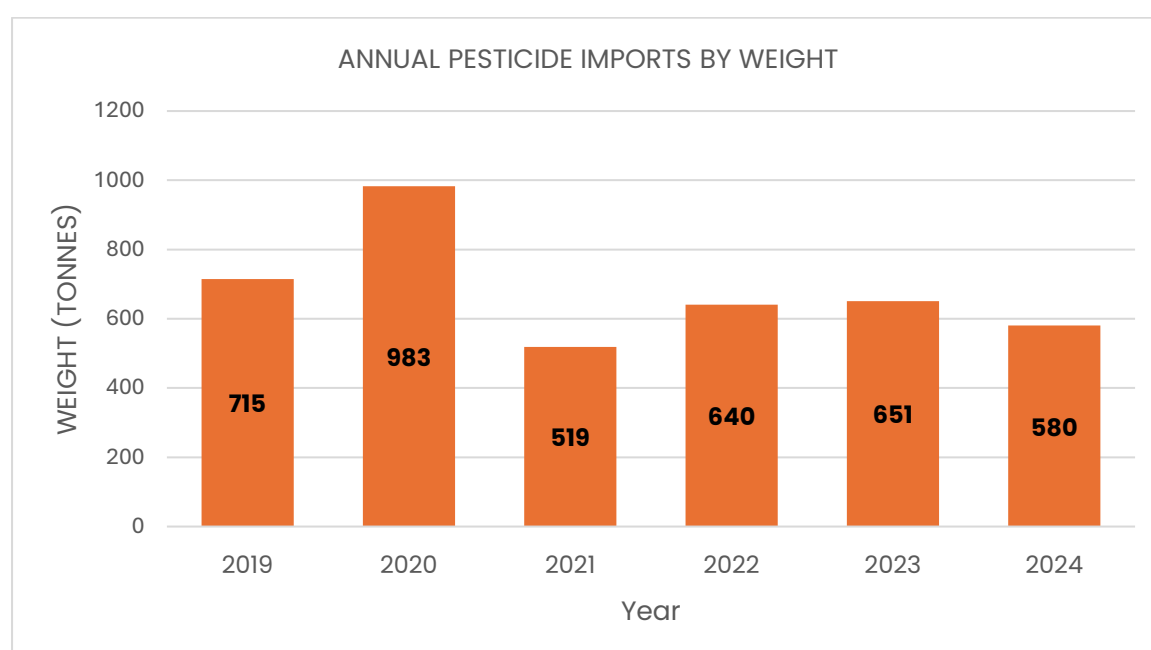


Figure 3-2 Annual Pesticide Imports 2019-2024 by weight, Source: MCS, 2025

Imports rose sharply from 715 tonnes in 2019 to 983 tonnes in 2020, likely reflecting precautionary stockpiling. They then declined to 519 tonnes in 2021, possibly due to surplus stocks and pandemic-related trade disruptions. By 2022, imports began to recover, and by 2024 had nearly returned to pre-pandemic levels.

Table 3-4 Breakdown of Annual Pesticide Imports, measured in tonnes by Category (2019-2024),
 Source: MCS, 2025

#	Categories	Imports by weight (tonnes)					
		2019	2020	2021	2022	2023	2024
1	Fungicides	10	4	14	47	3	4
2	Herbicides and algaecides	3	6	2	7	1	3
3	Insecticides	254	234	93	152	146	149
4	Plant growth regulator	36	1	1	6	6	50
5	Repellent	413	733	398	415	476	347
6	Rodenticide	6	5	12	14	18	28
Grand Total		722	983	519	640	651	580

Table 3.4 and Figure 3.2 show a detailed breakdown of pesticide imports by category. Between 2019 and 2024, repellents consistently represented the largest share of annual imports, while herbicides and algaecides accounted for the smallest volumes. Overall, these figures align closely with the Baseline Assessment on National Use of Chemicals and Associated Risks published in 2021.²⁰ The numbers of insecticides and herbicide categories are different, possibly due to a difference in categorising the data.

²⁰ MECCT (2022) *Baseline Assessment on National Use of Chemicals*, Maldives.

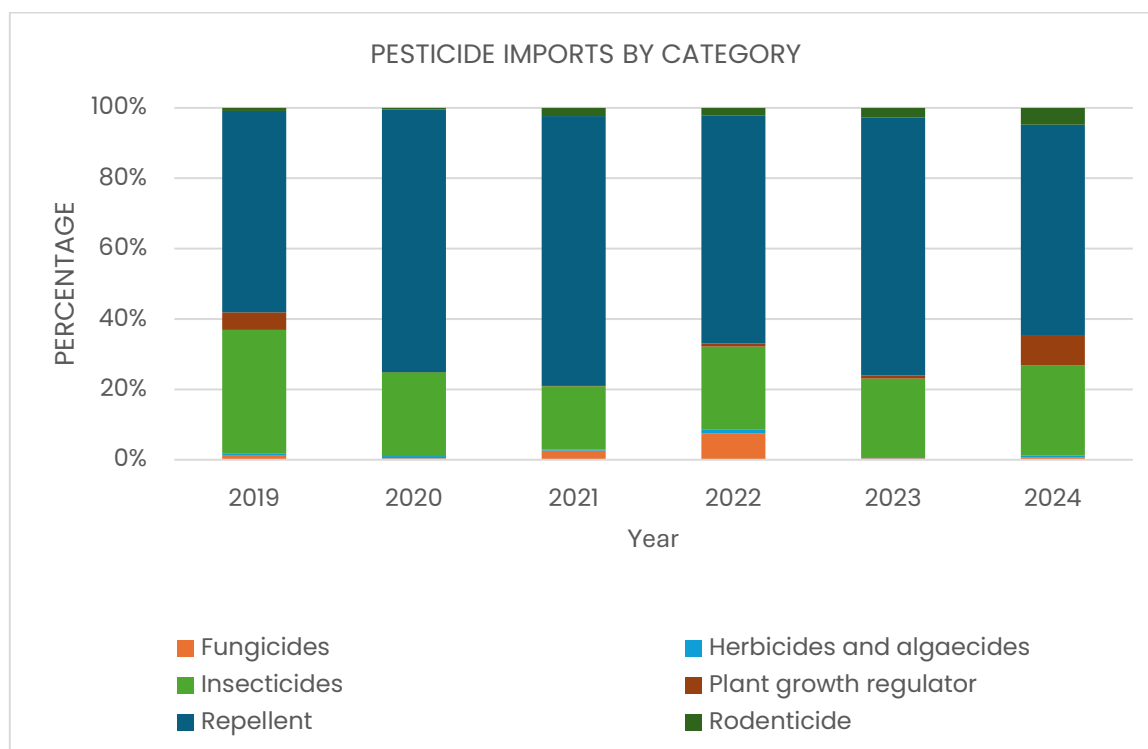


Figure 3-3 Annual Pesticide Imports by Category (% weight), Source: MCS, 2025

3.2.2 Countries of Import

The Maldives imported pesticides from 50 countries during the review period. Figure 3.3 highlights the principal supplier countries by import weight between 2019 and 2024.

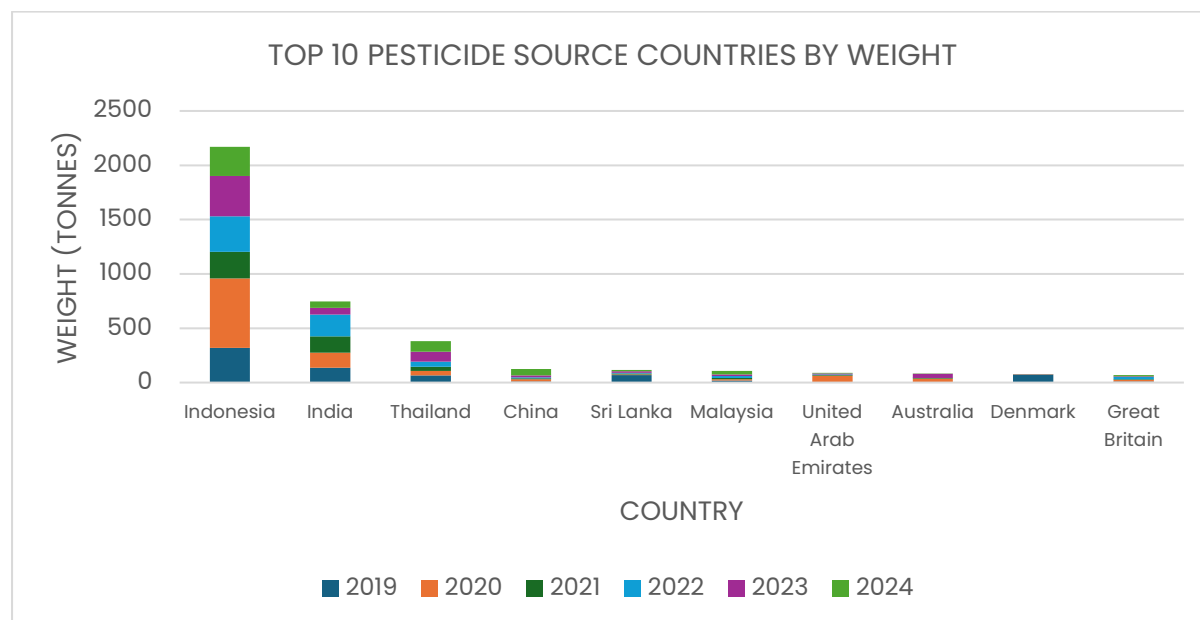


Figure 3-4 Top 10 pesticide source countries by total weight in tonnes (2019 – 2024), Source: MCS, 2025.

Between 2019 and 2024, Indonesia was the largest source of pesticide imports at 2,170 tonnes, followed by India at 747 tonnes. Together, these two countries accounted for the majority of imports, while the remaining eight countries formed a secondary tier of suppliers.

A detailed breakdown, presented in Table 3.5, shows that the top ten source countries collectively represented 97% of total imports. Key informant interviews further indicated that the top six supplier countries offered lower prices compared to other sources.²¹

²¹ Stakeholder consultation meetings with participants B1- B4 between 20 Dec 2024 – 30 Dec 2024

Table 3-5 Top 10 pesticide source countries by weight to the Maldives in 2019-2024, Source: MCS, 2025

#	Country	Import by weight (tonnes)					
		2019	2020	2021	2022	2023	2024
1	Indonesia	320	640	244	327	371	268
2	India	135	139	151	200	62	59
3	Thailand	66	40	39	47	90	99
4	China	10	22	6	11	16	60
5	Sri Lanka	68	8	9	4	16	11
6	Malaysia	20	12	11	17	15	33
7	United Arab Emirates	3	61	6	4	9	7
8	Australia	5	32	5	0	38	1
9	Denmark	75	0	0	0	0	0
10	Great Britain	9	17	6	21	5	11

3.2.3 Imports in Cost, Insurance, Freight (CIF) Value

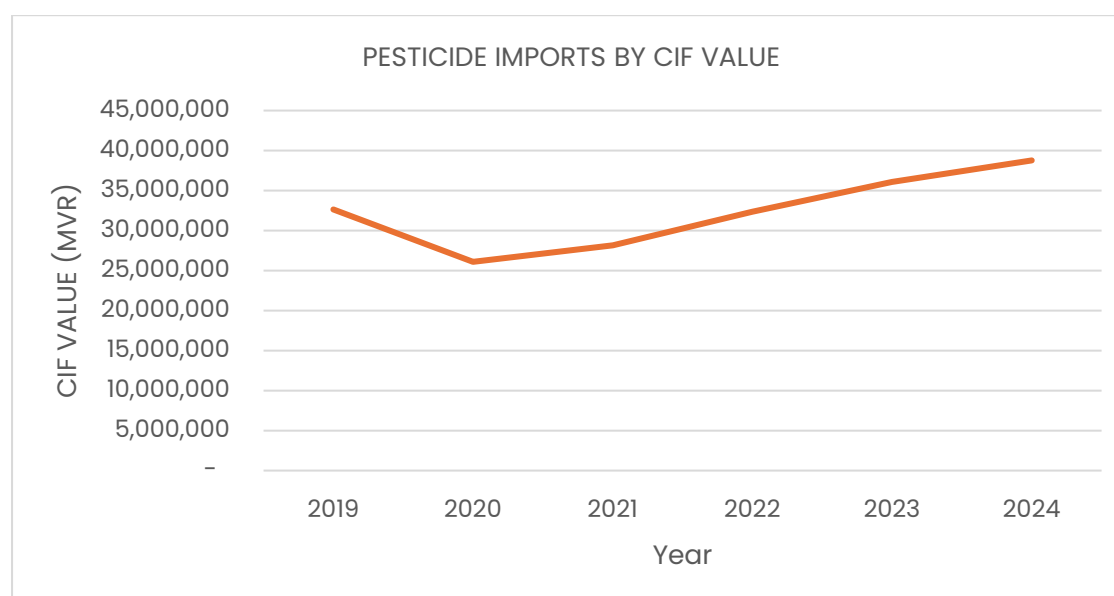


Figure 3-5 Imports in CIF value for 2019-2024, Source: MCS, 2025

Annual pesticide imports by CIF value have remained relatively stable throughout the years, except for a decrease in 2020, during the COVID-19 pandemic. The CIF values have returned to pre-pandemic levels by 2022 and are on the rise.

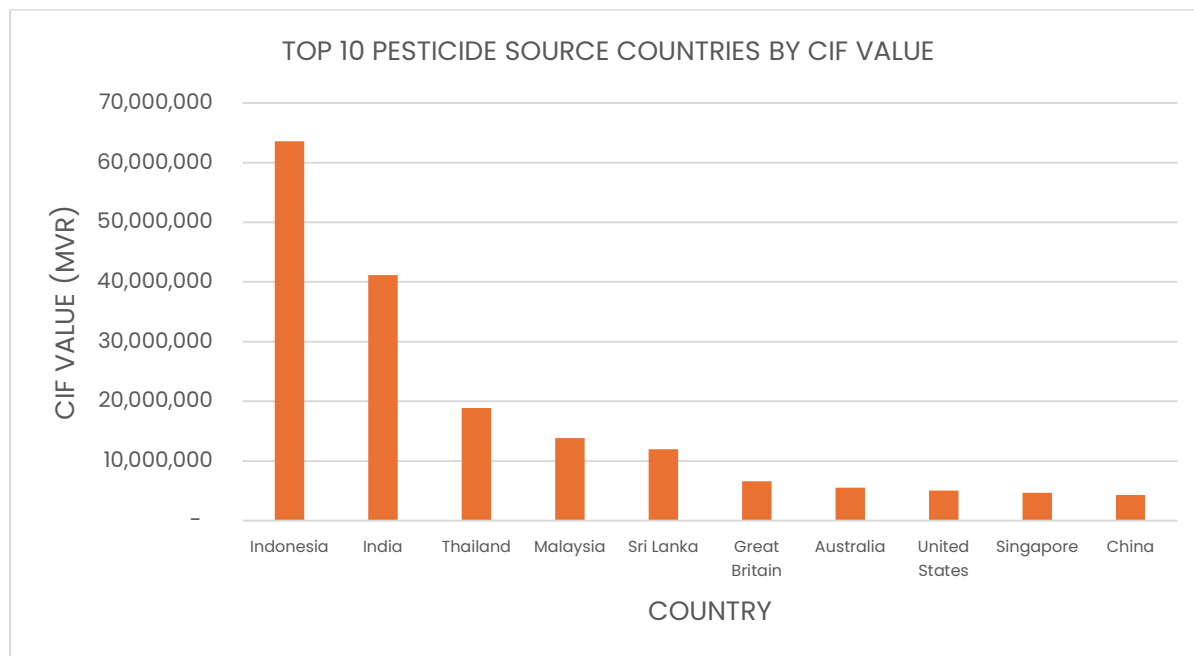


Figure 3-6 Top 10 pesticide sourcing countries by CIF value (2019 -2024), Source: MCS, 2025

Indonesia ranked as the leading source country by total CIF import value, with MVR 63,597,086 worth of imports recorded over the five-year period, as illustrated in Figure 3.5.

3.2.4 Top Ten Importers

The top ten importers of pesticides are shown in Table 3.6, which were determined using MCS data.

Table 3-6 Top 10 pesticide importers, 2019 – 2024, Source: MCS, 2025

#	Importer Name	Total pesticide imports by top ten importers	
		Weight (tonnes)	Percentage share of national pesticide imports
1	Lily Enterprise Pvt Ltd	714	17.42%
2	Ayami Traders Pvt Ltd	270	6.59%
3	Agrigro Pvt Ltd	223	5.44%
4	Frame Investment Pvt Ltd	194	4.73%
5	Haama	186	4.55%
6	Alihava Trading Company Pvt Ltd	127	3.11%
7	PestEX Maldives Pvt Ltd	126	3.09%
8	Aahiyaa Kuri	125	3.04%
9	Sarusana	114	2.78%
10	Agro Services Pvt Ltd	111	2.71%

Together, the top ten make up for 53.5 % of total pesticide imports by weight to the Maldives between 2019 and 2024.

3.2.5 Imports Across Sectors

Agriculture

Pesticides imported for agricultural purposes were identified based on imports granted duty exemptions for agricultural use.

Figure 3.6 presents the breakdown of pesticides imported for agricultural versus other purposes. Imports specifically for agricultural use represent only a small fraction of total pesticide imports into the Maldives.

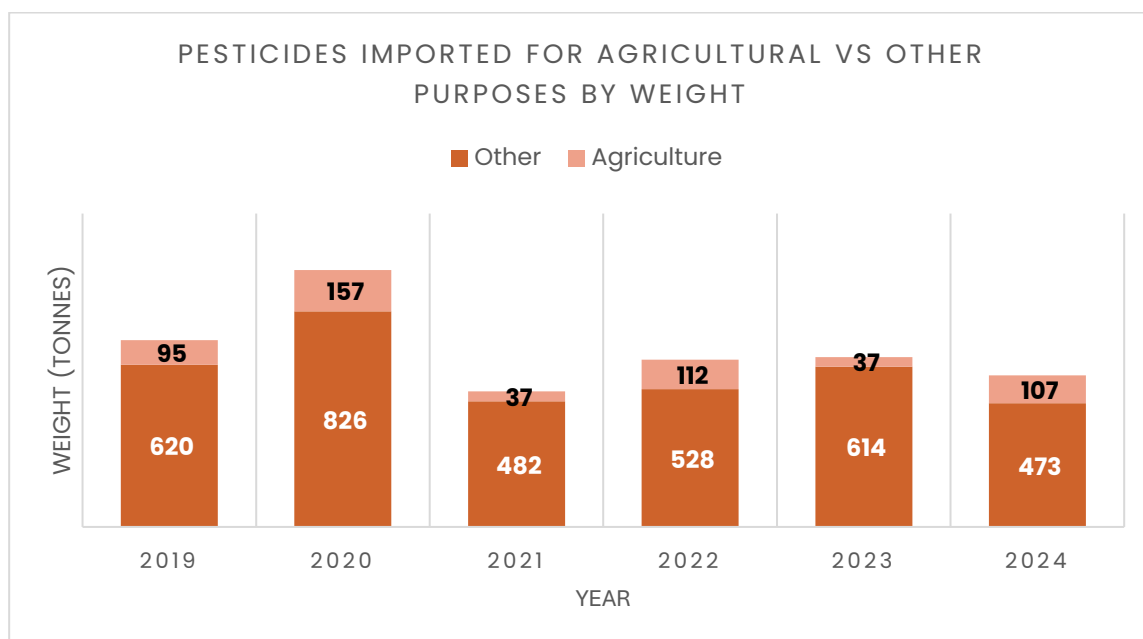


Figure 3-7 Annual pesticide imports by weight for agricultural vs other purposes, Source: MCS, 2025

Tourism

Pesticides imported by the tourism sector constitute only a small share of total pesticide imports into the Maldives. This may be attributed to the fact that many resorts outsource pest control services to private Pest Control Operators (PCOs).

Figure 3.7 illustrates the breakdown of pesticide imports by the tourism sector compared with other sectors

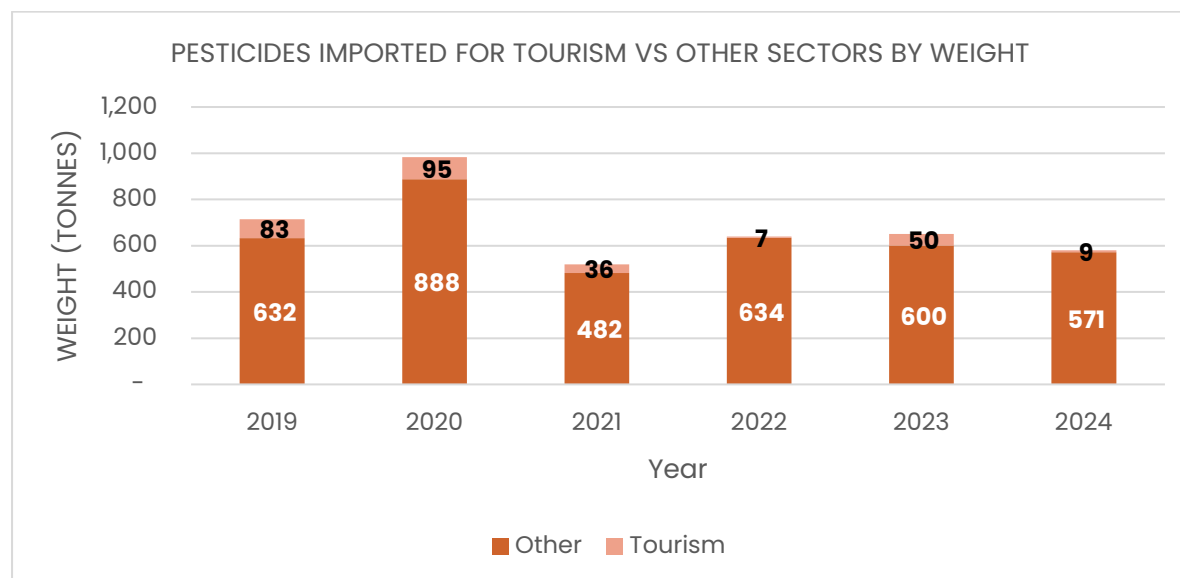


Figure 3-8 Annual pesticide imports by weight of tourism sector vs other sectors (2019-2024), Source: MCS, 2025

Public Health

While the currently available public data does not allow for determining the exact proportion of pesticides imported for public health purposes, quantities may be estimated using import permit records.

Common vector control pesticides can include²²:

1. Organosphosphates used for mosquito and fly control, often in fogging or residual sprays.
2. Pyrethroids used for mosquito nets, residual sprays, and space spraying.
3. Neonicotinoids used in baits and gels for cockroach and fly control.
4. Phenylpyrazoles used in household and public space crawling insect control and less commonly used in outdoor fogging.
5. Carbamates used in residual indoor spraying against cockroaches and other household pests.
6. Insect growth regulators used in larvaciding for mosquitoes and fly control.
7. Rodenticides used in baits, tracking powders, or pellets.
8. Others/Combination groups including botanical insecticides, pheromone-based attractants and combination formulations designed for specific use cases.

²² WHO (2021) *Global insecticide use for vector-borne disease control: a 10-year assessment (2010–2019)*, sixth edition. Geneva.

The substances dataset indicates that permits for these chemicals were requested and approved in the following amounts:

Table 3-7 Import permit quantities for possible public health related pesticides

#	Substance	Quantity (tonnes)	Active ingredient	US EPA toxicity class ²³	WHO Hazard class ²⁴	Cancer classification (IARC ²⁵ and US EPA ²⁶)	Use
A	Category: Organophosphates						
1	Malathion 50% EC	0.36	Malathion	III – Slightly toxic, slightly irritating	III – Slightly hazardous	IARC: 2A – Probably carcinogenic to humans US EPA: Suggestive evidence of carcinogenicity, but not sufficient to assess human carcinogenic potential	Adulticide (mosquitoes)
2	Malathion ULV	0.18	Malathion	III – Slightly toxic, slightly irritating	III – Slightly hazardous	IARC: 2A – Probably carcinogenic to humans US EPA: Suggestive evidence of carcinogenicity, but not sufficient to assess human carcinogenic potential	Adulticide (ULV fogging)

²³ Ministry of Agriculture and Animal Welfare (2022), 'Approved Agricultural Pesticide Registry', Updated in 29 December 2022.

²⁴ Ibid

²⁵ International Agency for Research on Cancer, World Health Organization, (Last updated 2025), 'IARC Monographs on the Identification of Carcinogenic Hazards to Humans', Available at: <https://monographs.iarc.who.int/list-of-classifications> (accessed on 25 September 2025).

²⁶ US EPA, Branch, S.I.M. (2024a) *Chemicals Evaluated for Carcinogenic Potential*. Washington, D.C.

#	Substance	Quantity (tonnes)	Active ingredient	US EPA toxicity class ²³	WHO Hazard class ²⁴	Cancer classification (IARC ²⁵ and US EPA ²⁶)	Use
3	Profenofos 40%+Cypermethrin 4%	1.01	Profenofos	III - Slightly toxic, slightly irritating	III - Slightly hazardous	IARC: Not evaluated. US EPA: Group E – Evidence of non-carcinogenicity for humans	Broad spectrum adulticide
4	Profenofos EC	8.29	Profenofos	III - Slightly toxic, slightly irritating	III - Slightly hazardous	IARC: Not evaluated. US EPA: Group E – Evidence of non-carcinogenicity for humans	Insecticide (less common in public health, more in agriculture)
B Category: Pyrethroids/Synthetic pyrethroids							
5	Deltamethrin 2.5% SC	0.25	Deltamethrin	II - Moderately toxic, moderately irritating	II - Moderately hazardous	IARC: 3 – not classifiable as to its carcinogenicity to humans US EPA: Suggestive evidence of carcinogenicity, but not sufficient to assess human carcinogenic potential	Residual spraying, mosquito nets
6	Deltamethrin EC	0.92	Deltamethrin	II - Moderately toxic, moderately irritating	II - Moderately hazardous	IARC: 3 – not classifiable as to its carcinogenicity to humans US EPA: Not likely to be carcinogenic to humans	Residual/space spray
7	Permethrin 25% EC	0.03	Permethrin	II - Moderately toxic, moderately irritating;	II - Moderately hazardous	IARC: 3 – not classifiable as to its carcinogenicity to humans US EPA: Not likely	Space spray

#	Substance	Quantity (tonnes)	Active ingredient	US EPA toxicity class ²³	WHO Hazard class ²⁴	Cancer classification (IARC ²⁵ and US EPA ²⁶)	Use
				III		to be carcinogenic to humans	
8	Permethrin 500 EC	0.05	Permethrin	II – Moderately toxic, moderately irritating; III – Slightly toxic, slightly irritating	II – Moderately hazardous	IARC: 3 – not classifiable as to its carcinogenicity to humans US EPA: Likely carcinogenic	Residual/space spray
9	Cypermethrin	1.59	Cypermethrin	III – Slightly toxic, slightly irritating	II – Moderately hazardous	IARC: Not evaluated US EPA: Group C – Possible human carcinogen	Residual spray (mosquitoes, flies, cockroaches)
10	Resigen	0.12	Pyrethroids (e.g. d- Allethrin + Permethrin)	Classification varies	Classification varies	IARC: Not evaluated US EPA: Allethrin: see Bioallethrin (not likely carcinogenic); Permethrin: likely carcinogenic	Mosquito space spray
11	Hextar Cyper 35	0.10	Cypermethrin 35%	III – Slightly toxic, slightly irritating	II – Moderately hazardous	IARC: Not evaluated US EPA: Group C – Possible human carcinogen	Residual/space spray
C Category: Neonicotinoids							
12	Mr. Fly (Imidacloprid 2%)	0.11	Imidacloprid	III – Slightly toxic, slightly irritating	II – Moderately hazardous	IARC: Not evaluated US EPA: Not likely to be carcinogenic to humans	Fly bait
13	Imidacloprid 20% SL	9.71	Imidacloprid	III – Slightly toxic, slightly irritating	II – Moderately hazardous	IARC: Not evaluated	Cockroach bait



#	Substance	Quantity (tonnes)	Active ingredient	US EPA toxicity class ²³	WHO Hazard class ²⁴	Cancer classification (IARC ²⁵ and US EPA ²⁶)	Use
						US EPA: Not likely to be carcinogenic to humans	
14	Imidacloprid 70% WG	0.00	Imidacloprid	III - Slightly toxic, slightly irritating	II - Moderately hazardous	IARC: Not evaluated US EPA: Not likely to be carcinogenic to humans	Cockroach bait
15	Imidacloprid RB	0.02	Imidacloprid	III - Slightly toxic, slightly irritating	II - Moderately hazardous	IARC: Not evaluated US EPA: Not likely to be carcinogenic to humans	Gel bait for cockroaches
16	Maxforce Fusion RB2, 15	0.00	Imidacloprid (typically 0.05-0.6%)	III - Slightly toxic, slightly irritating	II - Moderately hazardous	IARC: Not evaluated US EPA: Not likely to be carcinogenic to humans	Ant/cockroach bait
17	Cleanbait Power	0.28	Imidacloprid	III - Slightly toxic, slightly irritating	II - Moderately hazardous	IARC: Not evaluated US EPA: Not likely to be carcinogenic to humans	Cockroach bait
18	Dinotefuran 0.5%	0.04	Dinotefuran	Not stated	III - Slightly hazardous	IARC: Not evaluated US EPA: Not likely carcinogenic	Fly bait
19	Dinotefuran 1G/2% GR	0.00	Dinotefuran	Not stated	III - Slightly hazardous	IARC: Not evaluated US EPA: Not likely carcinogenic	Ant/cockroach bait

#	Substance	Quantity (tonnes)	Active ingredient	US EPA toxicity class ²³	WHO Hazard class ²⁴	Cancer classification (IARC ²⁵ and US EPA ²⁶)	Use
20	Eratox	0.00	Thiamthoxam	III – Slightly toxic, slightly irritating	II – Moderately hazardous	IARC: Not evaluated US EPA: Not likely carcinogenic	Possibly used for baits
D Category: Phenylpyrazoles							
21	Fipronil 5% SC	0.20	Fipronil	II – Moderately toxic, moderately irritating	II – Moderately hazardous	IARC: Not evaluated US EPA: Likely to be carcinogenic to humans	Cockroach/ant spray
22	Fipronil 50g/l EC	0.90	Fipronil	II – Moderately toxic, moderately irritating	II – Moderately hazardous	IARC: Not evaluated US EPA: Likely to be carcinogenic to humans	Cockroach/ant spray
23	Fipronil 0.3% GR	0.73	Fipronil	II – Moderately toxic, moderately irritating	II – Moderately hazardous	IARC: Not evaluated US EPA: Likely to be carcinogenic to humans	Baits for ants/cockroaches
24	Zordar	0.01	Emamectin Benzoate + Fipronil	Not stated	Not stated	IARC: Not evaluated US EPA: Emamectin benzoate: Not likely carcinogenic	Agri combo (possible public pest use)
E Category: Carbamates							
25	Propuxur	0.61	Propuxur	I – Highly toxic, severely irritating; II – Moderately toxic, moderately irritating;	II – Moderately hazardous	IARC: Not evaluated US EPA: Likely to be carcinogenic to humans	Indoor cockroach spray

#	Substance	Quantity (tonnes)	Active ingredient	US EPA toxicity class ²³	WHO Hazard class ²⁴	Cancer classification (IARC ²⁵ and US EPA ²⁶)	Use
				III - Slightly toxic, slightly irritating			
F	Category: Insect Growth Regulators						
26	NyGuardTM IGR Concentrate	0.01	Pyriproxyfen	III - Slightly toxic, slightly irritating	U - Unlikely to present acute hazard in normal use	IARC: Not evaluated US EPA: Group E – Evidence of non-carcinogenicity	Prevents mosquito /fly larvae from maturing
G	Category: Rodenticides						
27	Brodifacoum	0.22	Brodifacoum	I - Highly toxic, severely irritating	Ia- Extremely hazardous	IARC: Not evaluated US EPA: Classification not available	Rodent control
28	Recumin tracking power	0.04	Likely Coumatetralyl or similar	I - Highly toxic, severely irritating	Ib- Highly hazardous	IARC: Not evaluated US EPA: Classification not available(not listed in EPA registry)	Rodent monitoring & control
H	Category: Other/Combination						
29	Agita 10 WG	0.01	Thiamethoxam + (Z)-9-tricosene	Not stated	Not stated	IARC: Not evaluated US EPA: Thiamethoxam: Not likely carcinogenic	Fly bait (livestock areas)
30	Chaindrite extra strength crawling insect spray	0.34	d-Allethrin, Permethrin	Not stated	Not stated	IARC: Not evaluated US EPA: Allethrin: not likely carcinogenic; Permethrin: likely carcinogenic	Household insecticide for cockroaches and ants

3.2.6 **Storage**

Under the Hazardous Chemical Regulation (2019/R-1057), if imports of a controlled substance exceed 200kg, the importer must have a SFP. Once pesticides are imported into the Maldives, they are transported to the designated storage facilities where they are kept until distribution to retailers or end-users. These storage facilities play a crucial role in maintaining the quality and safety of pesticides before they reach the market. However, several challenges and inefficiencies in the storage process compromise the effectiveness of this stage in the supply chain.

Importers stated that pesticides are stored in facilities that are either owned by importers or rented specifically for this purpose.²⁷ These facilities vary in size and operational standards, with some adhering to international certifications while others operate with minimal infrastructure.

Some importers have ISO certifications which require them to meet specific standards, including temperature regulation, environmental controls, and spill containment measures.²⁸ These include International Organization for Standardization (ISO) 9001-2015, 9000, 14001, 22000, 45001-2018 certifications. These controls are critical for ensuring the stability and effectiveness of pesticides, particularly those sensitive to environmental fluctuations.

Importers reported that many storage facilities are concentrated in industrial zones such as Thilafushi, which serves as a centralized storage hub. According to MoD, the majority of storage facilities of chemicals are in the Male' area and Thilafushi and some in nearby residential islands. Under the Regulation on Hazardous Chemicals (2019/R-1057), chemical storage facilities are prohibited within the Male' area since 2019. At the time of consultation with the Ministry of Defence (MoD), a total of 77 chemical storage facilities were identified. However, information on the proportion of these facilities used specifically for pesticide storage, as well as their exact locations, was not available for this assessment. The facilities are used for storing a wide range of chemicals, including pesticides, and the MoD does not maintain a separate registry for pesticide-specific storage.

²⁷ Stakeholder consultation meetings with importers B1-B4 between 20 Dec 2024 – 20 Dec 2024

²⁸ Stakeholder consultation meeting with B1 and B2 on 20 Dec 2024 and 26 Dec 2024 respectively.

3.2.7 **Transport and Distribution (Wholesale and Retail)**

Major importers in the Maldives play a dual role in the distribution of pesticides, serving both retailers who stock pesticides for resale as well as end-users, such as farmers and Pest Control Operators (PCOs). These importers are central to ensuring the availability of pesticides across multiple islands, which is critical given the country's dispersed geography. While some importers have dedicated transport vehicles, the majority rely on rented pick-up trucks and coordinated efforts to load shipments onto boats for transportation to target destinations. This was the case with the four importers interviewed for the purpose of this assignment.

To support end-users, some importers provide guidance on pesticide application methods. These include basic training or demonstrations, primarily aimed at farmers and agricultural cooperatives. However, such practices are not standardized, and the extent of information sharing varies significantly across importers. While all importers provide leaflets with instructions on pesticide application, these are predominantly in the local Dhivehi language. This ensures accessibility for local users but creates challenges for expatriate farm workers who may not understand Dhivehi.

Most Purchased Pesticides

As per importers consulted, the agricultural pesticide most commonly purchased by end-users include:

- **Diafenthion**: A widely used insecticide effective against mites and pests in crops like cucumbers and watermelons.

It is a thiourea-based insecticide and acaricide (pesticides used to kill ticks and mites) used to control a range of sucking pests (like whiteflies, aphids, thrips) and mites on various crops, including cotton, vegetables, and ornamentals. It works by disrupting the mitochondrial respiration of target organisms, acting via both contact and ingestion. Moderately toxic to mammals, it also poses risks to aquatic life and non-target insects, so proper handling and adherence to safety guidelines are essential.

- **Starkle G**: A granular pesticide favoured for its efficacy in controlling soil-borne pests such as root-feeding insects and early-stage larvae.

Its active ingredient is Dinotefuran, a neonicotinoid insecticide that acts on the central nervous system of insects by binding to nicotinic acetylcholine receptors, leading to paralysis and death. It is used on crops such as vegetables and ornamentals, and is effective through both contact and systemic action (absorption and transport within the plant). While it has low toxicity to mammals, Dinotefuran poses risks to pollinators such as bees and should be used with caution, particularly during flowering seasons.

Major Distribution Areas

Importers consulted identified the following residential islands as key distribution points where agricultural pesticides are supplied on a wholesale basis:

- Thoddoo, Alif Alif atoll: Known for its agricultural production, particularly watermelons, cucumbers, and other vegetables.
- Gan and Fonadhoo, Laamu atoll: Key agricultural hubs in the south, supporting local and regional farming needs.
- Meedhoo, Addu City: Another major distribution point in the southern atolls.
- Kulhudhuffushi, Haa Dhaalu atoll: A strategic location in the northern atolls, supporting agricultural and public health pest control needs.

Other distribution areas include commercial agricultural islands.

While pesticide imports by the tourism sector account for only a small proportion compared to other sectors, pest control operators (PCOs) provide services to a large number of resorts.

3.2.8 End-Use

The application and end-use of pesticides in the Maldives involve a diverse range of users, including:

1. PCOs – It is not possible to determine the number of PCOs based on the available data.
2. Resorts – There are 174 registered resorts in the Maldives as per MoTE by December 2024.
13. Hotels – There are 15 registered hotels in the Maldives as per MoTE.
14. Guesthouses – There are 752 registered guesthouses in the Maldives as per MoTE.
15. Liveaboards – There are 154 registered liveaboards in the Maldives as per MoTE.
3. Farmers – A total of 7,008 farmers are registered with MAAW. The highest numbers are recorded in Alifu Alifu and Laamu Atolls, as illustrated in Figure 2.13.
4. Long term leased agricultural islands – There are 52 islands currently leased for long term agricultural use. The majority of these islands are located in Noonu and Shaviyani Atolls, as shown in Figure 2.14.
5. Domestic/Individual users – Data limitations prevent estimating the number of domestic users.

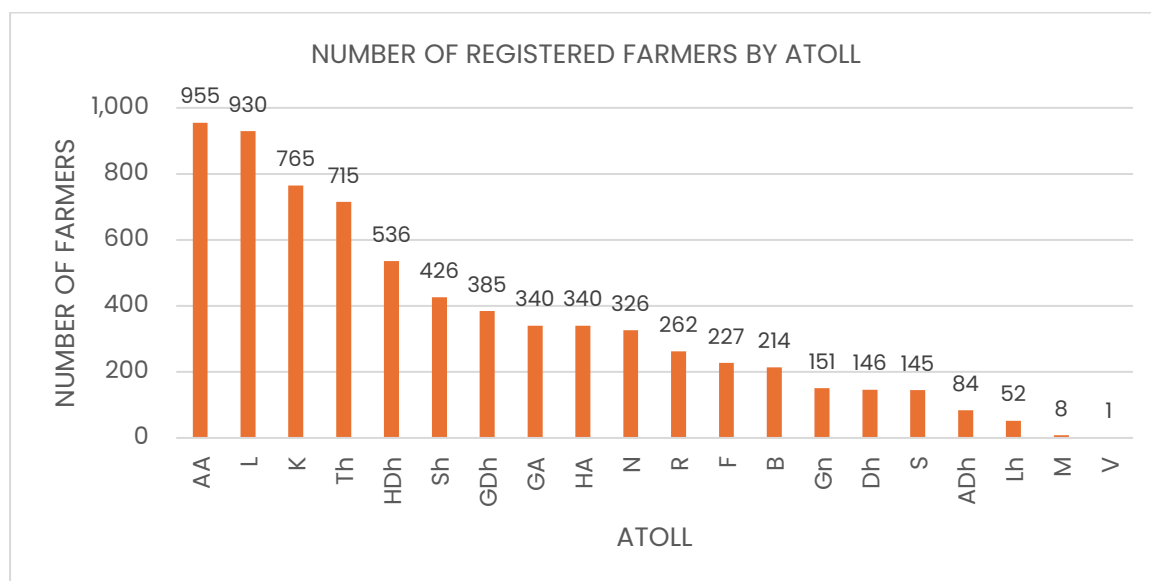


Figure 3-9 Number of registered farmers by atoll, Source: MAAW, 2024

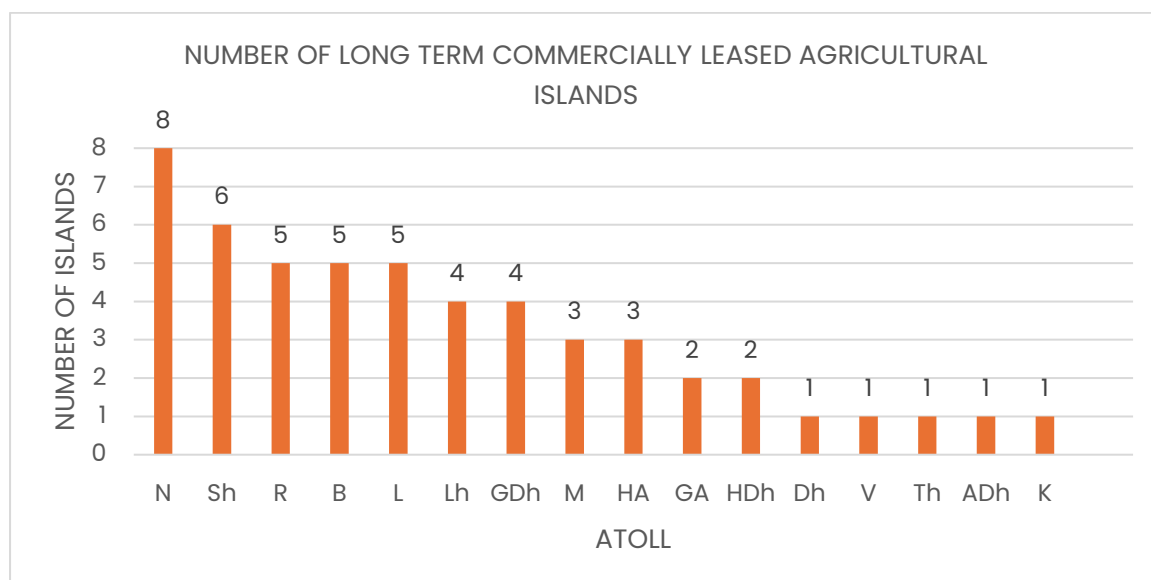


Figure 3-10 Number of long-term commercially leased agricultural islands, Source: MAAW, 2024

The current practices of using pesticides are described below.

1. **PCOs:** Importers offering pest control services reported that their staff receive training on the safe handling and application of pesticides. Employees are equipped

with Personal Protective Equipment (PPE) tailored to the specific chemicals used, minimizing health risks during application.²⁹

2. **Agricultural Sector:** The primary users of pesticides in agriculture are farmers and farmworkers, many of whom are expatriate males with limited formal education and minimal training in pesticide safety³⁰. This is also the case in the Maldives as per the importers and farmers interviewed. These workers often lack awareness of best practices for handling, mixing, and applying pesticides, which increases their risk of exposure to harmful chemicals.
3. **Tourism Sector:** Tourist facilities may have inhouse pest control operations or outsource to a PCO. It is not possible to determine exact number of tourist facilities undertaking inhouse pest control operations or outsourcing to a PCO without a census of tourist facilities. PCOs consulted have reported that they have resorts as well as guesthouses as customers.³¹
4. **Household and Gardening Use:** Individuals who use pesticides for household or leisure gardening purposes typically have no formal training in pesticide safety. They rely heavily on information provided by retailers or on instruction leaflets. Household pesticides often lack clear usage instructions and may have labels in other languages, increasing the likelihood of improper application and exposure, particularly among vulnerable groups such as children, the elderly, and pregnant women.
5. **Traditional Application Methods:** Common methods of pesticide application include handheld sprayers, backpack sprayers, and motorized mist blowers. These tools are widely used due to their affordability and accessibility but often result in over-application, inadequate pest targeting, and environmental contamination³².

²⁹ Stakeholder consultation meetings with B1-B4 between 20 Dec 2024 – 30 Dec 2024

³⁰ Kumar, N., Bohatko-Naismith, J., Palaniappan, K. and Nie, V. (2023) 'The usage of insecticides and their health impacts on farmers and farmworkers: a scoping review', *Journal of Public Health*.

³¹ Stakeholder consultation meetings with B1-B4 between 20 Dec 2024 – 30 Dec 2024.

³² Dhananjayan, V., Jayakumar, S. and Ravichandran, B. (2020) 'Conventional Methods of Pesticide Application in Agricultural Field and Fate of the Pesticides in the Environment and Human Health', in K. R. R., Thomas, S., Volova, T. and K. J. (eds.) *Controlled Release of Pesticides for Sustainable Agriculture*. Cham: Springer International Publishing, pp. 1-39.

3.2.9 **Disposal**

The disposal of pesticides in the Maldives remains a significant challenge, despite the presence of comprehensive guidelines outlined in the Agricultural Pesticide Control Act (2019). One of the challenge is the low volume of hazardous wastes generated, which makes it economically and logistically unfeasible to establish a dedicated national disposal facility. The most viable solution is to establish a centralized interim hazardous waste storage facility. Under GEF-6 Eliminating POPs through sound management of chemicals project a facility has been established Addu Hitahdhoo. Additionally, a second facility is currently under development in R. Vandhoo, to serve northern atolls. These guidelines provide detailed protocols for the safe disposal of expired and unused pesticides to minimize environmental and public health risks. However, implementation of these measures has been largely absent, resulting in a reliance on ad hoc solutions and interim measures.

At present, chemical disposal requests are received at MoD and implemented by Maldives National Defence Force (MNDF) Fire & Rescue. While some chemical stocks are reportedly disposed of by dilution with water or controlled burning; practices that require prior approval from the Environmental Regulatory Authority (ERA)—an unknown quantity of chemicals, including expired laboratory stock and pesticides, remain in temporary storage at various locations, awaiting proper disposal. Although there is no formal categorization of pesticides in these stocks, it is acknowledged that pesticides are part of the overall chemical stockpile.

Disposal practices among major pesticide users, such as agricultural producers and resorts, are poorly regulated and vary significantly:

On major agricultural islands, such as Fuvahmulah, Addu, and Laamu, farmers often dispose of used/empty pesticide containers by burying, burning, or discarding them into general waste streams, particularly due to the absence of structured collection or return systems³³. In some cases, these containers are reused for other purposes, posing potential health risks. Farmers are often unaware of the long-term environmental impacts of improper disposal.

At resorts, where landscaping and pest control require regular pesticide use, disposal is generally managed internally. Some resorts report implementing internal protocols aligned with Green Globe or EarthCheck certification standards, segregating hazardous waste, including pesticides, and transferring it to licensed contractors such as WAMCO. However, the consistency and quality of these practices vary, and regulatory oversight remains limited.

³³ Interviews with farmers in Laamu and Addu between 24 Feb 2024 – 4 April 2024

Health facilities, including hospitals and clinics, also use pesticides for vector control and facility sanitation. However, there is no evidence that hospitals are systematically involved in the disposal of pesticide waste or containers. While some hospitals in Malé and larger atolls operate small-scale medical incinerators, these are typically used for pathological and infectious waste and are not licensed or equipped to handle chemical or pesticide-related waste. As such, pesticides used in healthcare settings are likely disposed of through general waste streams or informal arrangements, unless transferred to Thilafushi or Vandhoo through WAMCO's hazardous waste collection system, although such transfers are not consistently documented.

According to MAAW, training or awareness initiatives targeting these sectors, particularly agricultural communities and resorts, on safe pesticide disposal are still insufficient.

At present, three incinerators have been established in the Maldives: one at the Regional Waste Management Facility (RWMF) in Vandhoo, Raa Atoll, one at the Thilafushi Waste Disposal Site, and one at the RWMF in Hithadhoo, Addu City. The facilities in Vandhoo and Thilafushi are operated by the Waste Management Corporation Limited (WAMCO), while the Addu facility is undergoing testing and negotiations for operational handover. These incinerators are not dedicated exclusively to hazardous waste, as they primarily serve general waste streams, while hazardous waste continues to be stockpiled at Thilafushi, highlighting persistent capacity and coordination challenges.

4 Stakeholder Mapping and Analysis

The management and regulation of pesticides in the Maldives involve multiple stakeholders across government agencies, private sector and the community. This chapter identifies the different categories of stakeholders that are pertinent to the pesticide supply chain in the Maldives.

4.1 Key Stakeholders

Below are the key stakeholders identified by categories relevant to pesticide use and management.

1. **Government agencies:** including policy-making bodies and regulatory authorities that establish and enforce laws and regulations regarding pesticide use, safety, and environmental protection.
 - a. Ministry of Economic Development and Trade (MEDT): The mandate of the Ministry includes, policy development and implementation on trade, investment, and SME's. The regulator of trade and provides business registration services to the public.
 - b. Ministry of Defence: Acts as a frontline authority for controlling the import of hazardous chemicals, including pesticides. It issues permits through the "Makudi" system and ensures compliance with storage and transportation standards.
 - c. Ministry of Agriculture and Animal Welfare: This is the primary authority for pesticide regulation, with responsibilities including the approval of pesticide imports, maintenance of the register of approved and banned pesticides, and oversight of their agricultural application.
 - d. Ministry of Health (MoH): The apex body providing leadership and guidance to protect health and wellbeing of the citizens of Maldives. It regulates and provides policy guidance in matters of health, setting norms and standards for service delivery and coordinate with other national and international stakeholders.
 - e. Ministry of Tourism and Environment: Develop tourism at a national level, and carry out long-term planning, development, monitoring, and regulatory functions to ensure a sustainable tourism industry. Also, the key government body responsible for the protection and preservation of the environment including, biodiversity conservation, climate change adaptation and mitigation, waste management pollution control, coastal protection and renewable energy, and sustainable development.

- f. Maldives National Defence Force: Supports chemical incident response, including mishandling or illegal transactions of pesticides.
 - g. Maldives Customs Service: Ensures that only approved pesticides enter the country, verifying import permits and confiscating illegal shipments.
 - h. Health Protection Agency (HPA): Works in coordination with relevant stakeholders to improve the health of individuals and communities by maintaining public health programs and services.
 - i. Environmental Regulatory Authority (ERA): ERA in the Maldives is under MoTE and plays a role in monitoring environmental contamination caused by pesticides and responding to chemical-related incidents. ERA also collaborates on policies for sustainable pesticide use.
 - j. Maldives Food and Drug Authority (MFDA): This is the regulatory body for food and medicines in Maldives.
 - k. Utility Regulatory Authority (URA): Regulates and promotes sustainable, efficient, and equitable utility services related to energy, water, sewerage and waste.
2. **Island and City Councils:** Mandated to provide pest control and waste management services in their respective islands and cities.
- l. Agro National Corporation Pvt Ltd: Mandated to support the development of the agricultural sector by enabling efficient supply chains, providing technical expertise and farmer training, promoting women's participation in farming, and facilitating access to quality fertilizers across islands.
3. **Pesticide Manufacturers:** Companies that produce and supply pesticides, responsible for ensuring product safety and efficacy.
- a. Reportedly there is no manufacturing of pesticides in the Maldives. Pesticide supply in the Maldives is through importation.
4. **Pesticide importers:** Businesses or entities engaged in procuring and importing pesticide products from international manufacturers and suppliers into the Maldives.
- a. Private companies
5. **Government agencies**
- b. State Owned Enterprises (SOEs)

6. **Wholesale and retail distributors:** Businesses responsible for distributing and selling pesticides to end-users, thereby shaping access and availability.
 - a. Private companies
7. **Government agencies**
 - b. SOEs particularly AgroNat
8. **Farmers and Agricultural Producers:** Individuals or organizations that use pesticides in their cultivation practices and are directly impacted by pesticide management decisions.
 - a. Individual farmers
 - b. Workers on farms
 - c. Private companies
 - d. Agricultural Cooperatives
9. **Pest Control Operators (PCOs):** professionals or firms engaged in controlling and managing pest populations across different sectors.
 - a. Private companies
10. **Tourism accommodation operators:** Individuals or companies responsible for the operation of resorts, guesthouses, and liveaboards within the tourism sector.
 - a. Resorts
 - b. Guesthouses
 - c. Liveaboards
11. **Extension Services and Agricultural Advisors:** Professionals who provide guidance and education to farmers on best practices for pesticide use and integrated pest management.
 - a. Hanimaadhoo Agriculture Centre of MAAW
12. **Household Users:** Individuals or families who use pesticides in and around their homes for domestic purposes, such as controlling insects, rodents, mould, or weeds. These users typically purchase pesticide products from retail outlets and may have limited knowledge of safe handling, storage, and disposal practices.
13. **Waste-related service providers:** Parties involved in waste collection, management and disposal including waste collection services, operators of Waste

Management Centres, operators of Regional Waste Management Facilities and collectors of reusable and recyclable waste.

14. **Local Communities:** Residents in areas where pesticides are used, concerned about health and environmental impacts.
15. **Consumers of agricultural produce:** Individuals who purchase agricultural products and may influence pesticide management through demand for organic or sustainably grown options.
16. **Research Institutions and Universities:** Academic and research bodies conducting studies on pesticide impacts, alternative solutions, and integrated pest management approaches.
17. **Non-governmental organizations (NGOs):** NGOs focused on environmental protection and social well-being that advocate for sustainable pesticide use and monitor environmental and social impacts.

4.2 Government Agencies

Out of the twelve different categories of key stakeholders, Table 4.1 provides the specific mandate of the Government agencies in relation to pesticides, together with crucial legislation for each agency.

Table 4-1 Roles of key regulatory agencies and relevant key legislation

Regulatory agency	Pesticide related mandated responsibility	Key legislation
MEDT	<ul style="list-style-type: none"> - Regulate trade; - Provide business registration services to the public. 	<ul style="list-style-type: none"> - Business Registration Act (Law no. 18/2014). - Import Prohibition Act (Law No 4/75). - Export Import Act (Law No 31/79). - Occupational Safety and Health Act (Act No. 09/2023).
MoD	<ul style="list-style-type: none"> - Control the import of hazardous chemicals, including pesticides; - Register new substances for importing; - Issue permits for importing; - Ensure compliance with storage and transportation standards. 	Hazardous Chemical Regulation (2019/R-1057).
MAAW	<ul style="list-style-type: none"> - Maintain a register of approved and banned pesticides; 	<ul style="list-style-type: none"> - Agricultural Pesticide Control Act (Law No 21/2019).

Regulatory agency	Pesticide related mandated responsibility	Key legislation
	<ul style="list-style-type: none"> - Oversee the application of pesticides in agriculture. 	<ul style="list-style-type: none"> - Agricultural Pesticide Control Regulation (2021/R-12). - Guidelines on Pesticides Management (n.d.).
MoH	<ul style="list-style-type: none"> - Establishing and maintaining health standards for handling chemical products imported to and produced in the Maldives; - Setting standards for and maintaining the quality of food products imported to, manufactured in, and exported from the Maldives; - Establishing and maintaining standards for food safety and quality, conducting necessary health tests and providing certification services. - Providing laboratory services needed for public health work in the Maldives; - Developing and maintaining a reference laboratory to provide testing services; building capacity and training staff to improve laboratory services. 	<ul style="list-style-type: none"> - Public Health Protection Act (Law no.7/2012).
MoTE	<ul style="list-style-type: none"> - Adoption of sound environmental principles in tourism development and operation. - Oversee environmental protection and pollution control. - Implement international conventions related to chemicals including pesticides. 	<ul style="list-style-type: none"> - The Maldives Tourism Act (Law No. 2/99). - Regulation on Protection and Conservation of Environment in the Tourism Industry - First Amendment to Protection and Conservation of Environment in the Tourism Industry (Regulation No_ 2021_R-154) - Environmental Protection and Preservation Act (Law No 4/93). - Waste Management Act (Law No 24/2022). - Waste Management Regulation of the Maldives- (2013/R-58). - Occupational Safety and Health Act (Act No. 09/2023).

Regulatory agency	Pesticide related mandated responsibility	Key legislation
MCS	<ul style="list-style-type: none"> - Ensure only approved pesticides enter the country, - Verifying import permits and confiscating illegal shipments. 	<ul style="list-style-type: none"> - Customs Act (Law no. 8/2011)- Export Import Act (Law No 31/79). - Import Prohibition Act (Law No 4/75).
ERA	<ul style="list-style-type: none"> - Monitor environmental contamination caused by pesticides; - Respond to chemical-related incidents; - Collaborate on policies for sustainable pesticide use. 	<ul style="list-style-type: none"> - Waste Management Regulation of the Maldives- (2013/R-58).
MNDF	<ul style="list-style-type: none"> - Inspects chemical storage facilities at registration stage. - Supports chemical incident response. 	<ul style="list-style-type: none"> - Hazardous Chemical Regulation (2019/R-1057). - Occupational Safety and Health Act (Act No. 09/2023).
HPA	<ul style="list-style-type: none"> - Oversee the use of pesticides for vector control. - Advises on best practices for pesticide application. 	<ul style="list-style-type: none"> - Public Health Protection Act (Law no. 7/2012).
MFDA	<ul style="list-style-type: none"> - Set standards for and maintain the quality of food products imported to, produced in, and exported from the Maldives. - Establish and maintain health standards for the handling of chemical products imported to and produced in the Maldives. - Develop and provide laboratory services to the standard of a reference laboratory, needed for the work related to public health. 	<ul style="list-style-type: none"> - Food Safety Act (Act No. 6/2024). - Presidential Decree (Reference no. 2006/19, dated 19 February 2006).
URA	Regulate and oversee the proper management of public utility services in the country.	<ul style="list-style-type: none"> - Water Resources Protection and Management Regulation (2021/R-22).
Island and City Councils:	Mandated to provide pest control services in their respective islands and cities.	<ul style="list-style-type: none"> - Decentralisation Act on Local Governance in the Maldives (Law no. 7/2010) - Occupational Safety and Health Act (Act No. 09/2023).
AgroNat	<ul style="list-style-type: none"> - Provide technical expertise and training to farmers, - Facilitates access to agricultural materials including pesticides. 	<ul style="list-style-type: none"> - Occupational Safety and Health Act (Act No. 09/2023). - Agricultural Pesticide Control Act (Law No 21/2019).

Regulatory agency	Pesticide related mandated responsibility	Key legislation
	- Links farmers to markets.	- Agricultural Pesticide Control Regulation (2021/R-12). - Food Safety Act (Act No. 6/2024).

4.3 Stakeholders' Relevance to Supply Chain Stages

Based on literature review and stakeholder consultations, the relevance of each stakeholder to each stage of the supply chain of pesticides is summarised in Table 4.2. Eight criteria were applied to determine the relevance of each stakeholder to these stages in the supply chain. The criteria are as follows:

1. **Decision-Making Power:** The stakeholder has authority or regulatory control over activities within the supply chain stage.
2. **Operational Involvement / Role in Execution:** The stakeholder is directly involved in carrying out or managing physical or logistical activities.
3. **Regulatory or Oversight Role:** The stakeholder is responsible for setting policies, issuing permits, conducting inspections, or enforcing compliance.
4. **Economic Stake / Investment:** The stakeholder has a financial interest or investment in activities at the supply chain stage (e.g., through ownership, sales, or procurement).
5. **Exposure to Risk / Externality:** The stakeholder is exposed to health, environmental, or economic risks arising from pesticide use, handling, or disposal.
6. **Knowledge / Expertise:** The stakeholder provides technical knowledge, scientific research, or practical guidance relevant to pesticide management.
7. **Responsibility / Accountability:** The stakeholder bears legal, contractual, or ethical responsibility for ensuring safe practices at the stage.
8. **Dependency / Reliance:** The stakeholder relies on pesticides for operational needs, livelihood, or service delivery at that stage.

Where the stakeholder is relevant to the stage of the supply chain it is indicated by a ✓ and where it is irrelevant it is indicated by an X. The numbers in each cell for the stages of the supply chain correspond to the criteria of relevance listed above.

Table 4-2 Relevance of stakeholders to supply chain stages of pesticides

Stakeholder	Import	Storage	Transport & Distribution	End-Use	Disposal
MEDT	✓ 1, 3	✓ 3	✓ 1,3	✓ 3	✓ 3
MoD	✓ 1,3	✓ 1, 3, 7	X	X	✓ 2, 7
MAAW	✓ 1, 3, 6, 7	✓ 1, 3, 6, 7	✓ 1, 3, 6, 7	✓ 1, 3, 6, 7	✓ 1, 3, 6, 7
MoH	✓ 1, 3, 6, 7	✓ 1, 3, 6, 7	✓ 1, 3, 6, 7	✓ 1, 3, 6, 7	✓ 1, 3, 6, 7
MoTE	✓ 1, 3, 6, 7	✓ 6, 7	✓ 6, 7	✓ 1, 3, 7	✓ 1, 3, 7
MNDF	✓ 6	✓ 1, 3, 6, 7	X	X	✓ 2, 6
MCS	✓ 1, 2, 3, 7	X	X	X	✓ 2, 3, 7
ERA	X	✓ 3, 6, 7	✓ 3, 6, 7	✓ 3, 6, 7	✓ 1, 3, 6, 7
HPA	X	X	X	✓ 3, 6, 7	✓ 3, 7
MFDA	X	X	✓	✓ 1, 3, 6, 7	X
URA	X	X	X	✓ 3, 6, 7	✓ 3, 6, 7
Local Councils	X	X	X	✓ 2, 7, 8	✓ 2, 7
Pesticide importers	✓ 2, 4, 6, 7	✓ 2, 4, 5, 6, 7	✓ 2, 4, 5, 6, 7	✓ 2, 4, 6, 7	✓ 2, 4, 5, 6, 7
Wholesale and retail distributors	X	✓ 2, 4, 5, 7, 8	✓ 2, 4, 5, 7, 8	✓ 2, 6, 7	✓ 2, 5, 6, 7
Farmers and agricultural producers	X	✓ 2, 5	✓ 2, 5	✓ 2, 4, 5, 8	✓ 2
PCOs	X	✓ 4, 5, 6, 7	✓ 2, 4, 5, 6, 7	✓ 2, 4, 5, 6, 7, 8	✓ 2, 5, 6, 7
Tourism sector operators	✓ 2, 4, 7, 8	✓ 2, 4, 7, 8	✓ 2, 4, 7, 8	✓ 2, 4, 5, 7, 8	✓ 5, 7
Extension Services	X	✓ 2, 4, 5, 6, 7	✓ 2, 4, 5, 7, 8	✓ 2, 4, 5, 6, 7, 8	✓ 6
Household users	X	✓ 5	X	✓ 4, 5, 7	✓ 5, 7
Local communities	X	✓ 5	✓ 5	✓ 5	✓ 5
Consumers of agricultural produce	X	X	X	✓ 5	X
Research institutions and universities	✓ 6	✓ 6	✓ 6	✓ 6	✓ 6
NGOs	X	X	X	✓ 6	✓ 6

5 Legislative and Policy Framework

The Maldives has enacted several laws and regulations, along with guidelines, that are relevant to the pesticide supply chain. In addition, as a party to international conventions, the Government is obligated to implement specific requirements that also pertain to pesticide management. The following sections of this chapter outline the national legislative framework, international conventions, and their relevance to the different stages of the supply chain.

5.1 National Legislative and Regulatory Framework

5.1.1 *Business Registration Act (Law no. 18/2014)*

This is an Act to provide for the registration of persons carrying on business in the Maldives, and to specify the form and manner of registrations of business and for matters incidental thereto. Except for the businesses exempted by this Act, this Act shall be applicable to any person carrying on business in the Maldives.

According to Clause 4, Every person shall, before carrying on business in the Maldives, register the business entity in one of the prescribed forms for registration specified hereunder:

- (a) a company registered under the Companies Act (Law No. 10/96); or
- (b) a partnership registered under the Partnerships Act (Law No. 13/2011); or
- (c) a cooperative society registered under the Cooperative Societies Act (Law No. 3/2007); or
- (d) a sole proprietorship registered under a statute governing sole proprietorships.

Clause 7 stipulates the types of businesses required to be registered. The exceptions to Clause 7 are given in Clause 9 Exempted Businesses, which are, following activities conducted by individuals (1) any office, employment or occupation; (2) activities carried on for personal livelihood, which includes agriculture among others.

According to Clause 10 Registration and Registry of Business Activities, in addition to the requirement to register the business entity in accordance with section 4 of this Act, if the business activity requires a permit or license from a Governmental agency, such business activity shall be commenced only after obtaining the requisite permits or licenses. The particulars relating to such business permits and licenses shall be furnished to the Registrar by the relevant Governmental agency, within 7 (seven) days of issuing of the permits or licenses to businesses.

MEDT is the implementing agency as well as the enforcement authority for the Business Registration Act.

5.1.2 **Export Import Act (Law No 31/79)**

This Act regulates the export and import of goods, including setting forth procedures, restrictions, and duties applicable to both. The Act provides a legal framework for the Maldives to manage trade, control the movement of goods across its borders, and ensure the proper documentation and compliance with national and international standards.

The Act includes provisions related to the import and export of hazardous materials, ensuring that these goods meet safety standards to protect public health and the environment.

The implementing agency is MEDT and the enforcement agency is MCS.

5.1.3 **Import Prohibition Act (Law No 4/75)**

The main objective of this Act is to regulate, control, and prevent the unauthorized import, production, possession, and distribution of restricted items, particularly those that pose security, safety, or legal risks.

According to the Act, the importation of hazardous chemicals is subject to strict controls to ensure public safety and environmental protection as per Section 1, (a), 3. Importers must obtain prior approval from MoD, as the regulating authority, before bringing such substances into the country. This measure aims to prevent the unauthorized entry of potentially dangerous materials and to regulate their use within the Maldives.

The implementing agency is MEDT.

5.1.4 **Regulation on Hazardous Chemicals (2019/R-1057)**

Hazardous Chemical Regulation (2019/R-1057) is formulated by the MoD under the Import Prohibition Act (Law no. 4/75). This regulation sets forth rules and standards under which non-explosive hazardous chemicals, can be imported, stored, and used within the territories of Maldives.

Hazardous chemicals are considered as non-explosive chemicals and, acids and poisonous substances that are produced using these non-explosive chemicals. For the purposes of this Regulation, hazardous chemicals shall be chemicals other than those listed in Schedule 6 to this Regulation. Schedule 6 of the Regulation provides a list of chemicals that does not require obtaining a permit to import under this Regulation. According to

consultations with MoD, pesticides come under this regulation and require a permit to import.³⁴

The main objectives of this regulation include:

- Classification of hazardous chemicals and state the rules that must be abided by the importers;
- Outline parameters within which hazardous chemicals can be imported, stored, used and disposed of, including safety measures that must be applied for the application of hazardous chemicals and;
- Provides procedural rules on obtaining import permits.

The implementing as well as the enforcement agency is MoD.

5.1.5 ***Agricultural Pesticide Control Act (Law no. 21/2019)***

The Control of Agricultural Pesticides Act of the Maldives establishes comprehensive standards for the import, use, production, export, and proper disposal of pesticides used in agriculture in the Maldives. It also outlines best practices to ensure public health, environmental protection, and ecological conservation. Currently, the Act is not fully implemented and enforced as informed by MAAW during the stakeholder consultations.

Major objectives of the act include:

- Setting standards for import, export, sales, production, application, storage and disposal for agricultural pesticides;
- Setting rules and regulations to ratify the agricultural pesticide related international conventions that Maldives is a party to;
- Licensing requirements and regulatory procedure relevant to all stages of the lifecycle of agricultural pesticides;
- Planning of awareness programs and trainings for safe and effective application of pesticides;
- Setting forth standards for safety precautions to be taken in the usage of pesticides;
- Setting a mechanism for dealing with illegal imports, exports, sales, application and disposal of pesticides;
- Reducing the amount of pesticides used in the Maldives, and promoting use of pesticide alternatives in the country.

³⁴ Stakeholder consultation meeting held with MoD on 20 Nov 2024.

The responsibilities of the implementing agency are defined in the Act, Article 6 Responsibilities in Relation to Control of Agricultural Pesticides. The responsibilities are:

- (a) Determine and implement safety measures to protect against pesticide hazards;
- (b) In order to reduce the damage caused by the use of pesticides to the environment, designate and publish areas where the use of pesticides is prohibited and; areas and the extent to which pesticides may be used certain circumstances;
- (c) Maintain and publish an Approved Pesticide Registry in accordance with the Act;
- (d) Perform the necessary laboratory analysis on pesticides for the purposes of this Act through a laboratory operating to a standard acceptable to the Government;
- (e) Monitor the trade in pesticides and, collect and evaluate relevant statistics;
- (f) Prepare and evaluate the labels and Material Safety Data Sheets (MSDS) for pesticides produced under licenses granted in accordance with the Act;
- (g) Monitor and oversee the application of pesticides by users;
- (h) Promote integrated pest management in order to reduce dependence on pesticides;
- (i) Collaborate with the government agencies and research institutes of countries where pesticides are imported from on matters related to pesticides management;
- (j) Coordinate with relevant agencies in the implementation of relevant international conventions and agreements to which Maldives is a party to and other responsibilities in relation to pesticides management;
- (k) Raise public awareness on the dangers of misuse of pesticides and reducing risks through the appropriate use of pesticides and plan trainings on such matters;
- (l) Formulate and implement regulations relating to the manufacture, import, export, sale, use and disposal of pesticides;
- (m) Conduct research on requests to add or remove pesticides from the Approved Pesticide Registry, and gather all relevant information pertaining to those pesticides.
- (n) Gather the necessary information for issuing licenses related to the manufacture of pesticides in the Maldives, as well as for their import, export, packaging, and trade.

The Act addresses the following areas of pesticide management:

Chapter 3 Permitted Pesticide Registry including the process of granting permission, criteria, information to be included in the Registry, conditions related to amendments to the Registry and transitional matters.

Chapter 4 Pesticides Management consists of articles related to the use of pesticides, prohibiting pesticides that do not meet standards, disposal, packaging and labelling, re-packaging, storage, transport and distribution and prohibition of advertising pesticides.

Chapter 5 Issuance of Licenses and Permits states that no person shall manufacture, import or export, trade and repackage pesticides except under a license. The article also mandates

formulation of regulation on the rules specific to import and export of pesticides and regulation on the criteria to be met to be eligible for a license. In addition, it includes conditions for temporary permits as well as revoking of license or permits.

Chapter 6 Inspection and Approval mandates the Ministry to monitor import, export, manufacture, packaging, repackaging, labelling, storage, sale, use and disposal of pesticides for compliance as well as appoint inspectors for the purpose. The Chapter includes powers and duties of inspectors and actions to be taken when in non-compliance.

Chapter 7 Violations and Penalties defines the offenses under the Act in relation pesticide manufacture or repackaging, import or export, trade, storage, labelling, disposal, distribution, record-keeping, advertising and application. It also includes provisions on reporting cases of non-compliance.

The main implementing agency is the MAAW and the implementation is mandated to the Minister.

Under the Act, MAAW is responsible for publishing and maintaining the Approved Pesticide Registry, which includes a list of approved pesticides (Annex X), and must contain the common name, scientific name, formulation, concentration, approved activities of the pesticide, and details to be contained in the label or safety data sheet provided with the product. Additionally, a pesticide board has been established to provide guidance on pesticide related matters. This committee includes members from ERA, MoTE, MoH, MoD, and MCS.

5.1.6 **Agricultural Pesticide Control Regulation (2021/R-12)**

Under the Control of Agricultural Pesticides Act, Clause 47(a), MAAW is mandated to formulate regulations as required. Agricultural Pesticide Control Regulation outlines the standards and rules required to achieve the following objectives:

- Sustainable usage, sales, transportation, storage and disposal of agricultural pesticides, while safeguarding the health and safety of all living things, including the surrounding environment;
- Ensure that pesticides are being used as instructed in the pesticide label and MSDS;
- Align national pesticide standards with international standards;
- Reduction or prevention of pesticide exposure related incidents;
- Prevention of use of hazardous pesticides;
- Set standards for import, transport, usage, storage and disposal of pesticides;
- Reduce waste of pesticide and;

- Quality control of pesticides.

The main enforcement agency for this regulation is MAAW.

In Section II Importing of Pesticides, Article 5(a) it is stated that the permission to import pesticides into the Maldives will be granted under Article 42(a)(i) of this regulation, for the use of government institutions, or to parties who have been licensed to import pesticides into the Maldives. Article 5(b) states that pesticides not listed in the Approved Pesticides Registry, or formulations or concentrations of a permitted pesticide that is not included in the Approved Pesticides Registry, can only be imported into the Maldives after obtaining written import permission.

Article 6 Criteria for Importing lists the information is required to submit to the Ministry when applying for a permit to import. The validity of the import permit is 90 days from the date of issuance as stated in Article 7 of the Regulation. Section II also includes articles on the Rejection of import permit application (Article 8); Temporary import permit (Article 9); Conditions for importing under temporary permit (Article 10); Permission to use pesticides imported under temporary permit (Article 11); Duration of temporary permits and modifications to temporary permits (Article 12); Standards of pesticides that can be imported into the Maldives (Article 13); Notification of import (Article 14) and Ports of import (Article 15).

Section III is on exporting of pesticides from the Maldives addressing Export permit (Article 16); Export Conditions (Article 17); Duration of export permit (Article 18) and Standards for Exportable Pesticides (Article 19).

Section IV Producing, packaging and labelling pesticides, Article 20 is on the permission for pesticide production, packaging and labelling. In Clause (a), it is a requirement to have a license in order to obtain the permission for pesticide production, packaging, and labelling in the Maldives. This Section also includes articles related to rejection of Applications for Permission to Produce, Package, and Label Pesticides (Article 21); granting permission and registration for pesticides produced, packaged and labelled (Article 22) and standards for containers used for packaging of pesticides (Article 23).

Section V is related to the permission for repackaging and labelling of pesticides, prohibiting repackaging and labelling without written prior permission from the Ministry (Article 24 (a)).

Disposal of pesticides is detailed out in Section VI including Pesticide Concentrates That Must Be Disposed (Article 25); Reducing Pesticide Concentrates That Require Disposal (Article 26); Disposal of Pesticide Concentrates That Require Disposal (Article 27); Pesticide waste to be disposed (Article 28); Pesticide waste management (Article 29); Water contaminated with pesticide (Article 30); Reducing contamination of water with pesticide (Article 31) and Disposal of pesticide contaminated water (Article 32).

Section VII addresses storage of pesticides including storage in shops (Article 34), in warehouses (Article 35) and on farms (Article 36). Article 37 defines the quantity of pesticide that can be stored on farms. Pesticide storage in home gardening areas is covered in Article 38 with quantity that can be stored in home gardens defined in Article 39.

Section VIII is on the transport and distribution of pesticides. Article 40 is on the vessel or vehicle used for transporting pesticides. Article 41 includes provisions on the standards to be followed in transporting pesticides.

Section IX is on the issuance of license for conducting pesticide related transaction with Article 42 detailing the activities requiring a license. Article 43 is on applicants eligible for license. Article 44 is on requirements to complete before applying for a license. Conditions that must be met by parties applying for a license are detailed in Article 45. Article 46 is on the process of applying for a license and Article 47 states reasons that an application may be rejected. Article 49 details the conditions that a licensee must comply with during the license period. Article 50 to Article 55 includes provisions related to validity of license and renewal of license.

Section X is on record keeping while Section XI and Section XII are on warnings, offenses and penalties.

5.1.7 **Maldives Customs Act (8/2011)**

This Act sets out the principles and procedures by which MCS is established as a state institution and defines the objectives, powers, responsibilities, privileges of the Service. The main objectives of this Act are as follows;

- To ensure that Maldives Customs system operate on steady principles; to establish a service by the name of “Maldives Customs Services” and define operational principles for that service;
- To protect income of the State, social rights and to strengthen the system which operates and maintains activities of passengers, crafts, goods arriving and leaving to and from the Maldives.
- To stop import and export of illegal items by checking suspected persons and cargos arriving and leaving the Maldives and specifically by checking crafts that arrive and depart from or to the Maldives and by strengthening custom’s control in official trade ports;
- To simplify, standardize and assist to enforce customs procedures in accordance with international conventions, established principles relating to customs.

Chapter II MCS, provides the roles and responsibilities of MCS. A key responsibility is examining and searching all crafts, individuals, luggage, and goods entering or leaving the Maldives. Their duties include preventing smuggling to and from the country, ensuring that all imports and exports comply with Maldivian laws and regulations, and seizing any illegal items. They also oversee the import and export of goods requiring special permission to ensure they are handled correctly.

Chapter VI Power to Search, provides MCS the authority to inspect and search all goods being imported, exported, or under their control, including checking for prohibited items and verifying declarations. To facilitate this, they are empowered to unpack, open, count, weigh, assess, test, and sample goods, as well as to mark, seal, isolate, and protect goods. If necessary, they can also inspect and search goods in a separate location. Furthermore, MCS has the jurisdiction to seize prohibited imports, smuggled goods, items imported or exported in violation of regulations, goods lacking necessary import/export information, goods with untrue documentation, and goods not collected on time.

According to Chapter V Customs Procedures, anyone importing goods to the Maldives is required to submit a prescribed declaration to MCS within a specified timeframe, detailing the goods, their quantity, and price information. This declaration must be accompanied by a commercial invoice, packing list, bill of lading or airway bill, and any other documents required by MCS regulations. Furthermore, after consulting with relevant government authorities and in accordance with international treaties, the Customs Service will classify commodities using the Harmonized Commodity Description and Coding System.

5.1.8 Customs General Regulation

Customs General Regulations cover a range of areas, including prohibited and restricted items, duty exemptions, declaration procedures, and penalties for breaches.

In Part 3 Goods imported into the Maldives, Chapter 1 Declaration of import goods, it is stated that goods can be imported into the Maldives by parties authorized by the MEDT and the import permit issued by the Ministry must be presented to Customs for the purpose of importing goods, with commercially used goods consigned under the permit holder's name. Importers are required to use the registry number provided by Customs in all their dealings with the Customs authority. Furthermore, individuals importing goods must submit the Goods Declaration, as prescribed in the relevant schedule, to complete the import declaration process. This Goods Declaration must be accompanied by necessary documents, including permits from relevant government authorities for goods that require such permits for importation.

In Part 6 Classification of Goods, according to international conventions, goods in the Maldives must be coded and classified for Customs using the principles of the Harmonized Commodity Description and Coding System of the World Customs Organization. Customs

will maintain a public database of this classification data and the corresponding tariff rates. It is the responsibility of the goods owner to declare their goods under the correct classification when completing the Goods Declaration and to provide true and complete information about the goods to Customs for classification purposes. Customs may obtain samples of goods for classification through laboratory analysis or by presenting samples to the Tariff Committee.

Part 12 Search and inspection, Chapter 3 Search and inspection of Import goods states that Customs is mandated to search and inspect all goods imported into the Maldives and those under their control, ensuring that the Goods Declaration aligns with the imported goods and that no prohibited items are included. In conducting these searches and inspections of imported goods, Customs has the discretionary power to unpack, open, count, weigh, assess, test, draw samples, or use any other method of searching and inspection deemed necessary.

Part 13 Investigation mentions that Customs is authorized to investigate unlawful acts such as smuggling goods into and out of the Maldives, falsifying prices or information on goods exceeding the declared amount, and the unlawful importation of goods. Customs has the authority to seize import and export prohibited goods, goods smuggled into or out of the Maldives in contravention of laws and regulations, goods lacking necessary import or export information within a given timeframe, and goods not collected on time. Additionally, Customs may temporarily seize goods, articles, or crafts during an ongoing investigation until its completion.

In Part 14 Procedure on seized goods and other articles, it is stated that goods seized or brought under Customs control for violating laws, abandoned goods, forfeited goods, and other goods confiscated will be treated as stipulated in regulations. Restricted goods imported against the regulations of other government bodies will be disposed of as determined by those authorities. Goods that violate laws, seized goods, goods under Customs control, abandoned goods, and ownerless goods posing a threat to public health or safety will be disposed of as decided by the relevant government authority after consultation. Specifically, import-prohibited goods, including dangerous chemicals, will be handed over to the Maldives National Defence Force for disposal. Customs is also required to maintain records of goods under their control and the procedures followed for these goods.

Part 16 Registering under Customs, entities intending to import goods to the Maldives are required to register with Customs and will be assigned a special registration number upon completion of the process. Chapter 5 Registration of the Importers, parties importing goods to the Maldives, excluding those for personal use, are required to register with Customs by submitting an application form as specified in Schedule 30. Along with the application, the following original documents must be provided for registration: the permit to import goods, the company registration (if applicable), and the vessel registration (in the case of an international cargo vessel).

5.1.9 **Public Health Protection Act (Law no.7/2012)**

The Public Health Act outlines the key principles for protecting public health in the Maldives. It defines who is responsible for public health protection, explains how these responsibilities should be carried out, and sets guidelines for limiting certain basic rights of Maldivian citizens and residents when necessary for public health reasons, as permitted by the Constitution.

Part five of the Public Health Protection Act of the Maldives addresses health risks. It states that public health risk is to be defined in the regulation to be made under the Act, which is to consider scientific findings, past experiences, and international standards. This regulation also establishes general principles for identifying what constitutes a public health risk. The Act allows the HPA to conduct risk assessments to evaluate the impact of existing or potential health risks and mandates the establishment of monitoring systems for these risks. Additionally, it outlines the requirement for specific individuals and organizations, as specified in the regulations, to report any identified public health risks to the Director General promptly, ensuring timely communication when such risks are detected. However, the above-mentioned regulation to define public health risk has not yet been formulated.

Part Six of the Public Health Protection Act addresses public health emergencies. It states that if the Director General determines, based on reasonable evidence, that a public health emergency has occurred in a specific location, they may advise the Minister to declare such an emergency. The Minister is then required to declare the public health emergency, specifying both the affected area and the duration of the declaration.

Part seven of the Public Health Protection Act prohibits any person from engaging in activities that are hazardous to public health in their residence or any property they control. The Act in Article 41, mandates that every Council the responsibility for maintaining cleanliness and safety within its jurisdiction to prevent public health risks. Councils must take necessary actions to address any situation that poses a risk to public health and respond appropriately to any emerging threats. However, they must also adhere to the regulations, instructions, or orders set by the Minister or Director General in accordance with the Act.

In Article 42, the Act defines the activities considered hazardous to public health that include among others, the following relevant to pesticides, (e) Discharge of water or other substances from residential areas, non-residential areas, or buildings that produce or create conditions that could produce substances hazardous to health; (f) Emission of gases, smoke, chemicals, radiations or vibrations from residential or non-residential areas that are inherently hazardous to public health and create or could create conditions hazardous to the health of people living or working in the surrounding environment (i) Abandonment of waste materials or other items considered waste or unclean items,

allowing them to accumulate and (j) Performing an action or creating conditions where, due to any object or circumstance, a person's body, health, or life is endangered.

According to Article 43, the Director General is empowered to issue an order to cease any activity or condition deemed hazardous to public health, specifying a timeframe for compliance and requiring the implementation of necessary measures to mitigate the hazard. This authority extends to prohibiting or regulating the possession, breeding, production, and importation of specific items, birds, animals, or insects within the Maldives. Should the designated party fail to comply with the order within the stipulated period, the Director General may seek enforcement through the Civil Court. Upon reviewing the case, if the Civil Court determines that a public health hazard exists, it may mandate rectification within a specified timeframe and prohibit the recurrence of such actions at the location in question.

HPA is the primary implementing agency of the Act.

5.1.10 **Occupational Safety and Health Act (Law no. 22/2024)**

The Occupational Safety and Health Act was ratified on 2 January 2024, and requires full compliance by 2 January 2025. The Act mandates that employers systematically assess and control workplace hazards "as far as reasonably practicable," including those posed by hazardous substances. Employers must provide safe materials and protective equipment where risks cannot be eliminated, conduct regular monitoring and health checks for employees exposed to hazardous agents, and supply training on safe handling procedures.

The Act requires employers to implement health and safety policies and management systems that explicitly address chemical risks. This includes appointing a Health and Safety Officer in larger workplaces (75+ employees), ensuring safe storage, appropriate ventilation, use of PPE, emergency response planning, and incident reporting specifically for chemical exposures. Non-compliance can result in fine penalties, and injured workers are entitled to medical treatment and compensation for disability or death caused by hazardous exposure at work.

5.1.11 **Environmental Protection and Preservation Act (Law No 4/93)**

The main object of the Environmental Protection and Preservation Act (Law No. 4/93) of the Maldives, enacted on 19 March 1993, is to protect and preserve the natural environment of the Maldives. Clause 8 of this Act addresses the disposal of hazardous waste, titled "Hazardous/ Toxic or Nuclear Wastes." This clause stipulates that hazardous, toxic, or nuclear wastes harmful to human health and the environment shall not be disposed of anywhere within the territory of the country. Additionally, it mandates that permission must be obtained from the Ministry of Transport and Shipping at least three months in advance for

any transboundary movement of such wastes through the territory of the Maldives. The implementing agency for the Environmental Protection and Preservation Act is MoTE.

5.1.12 **Maldives Tourism Act (Law no. 2/99)**

The Maldives Tourism Act establishes the legal framework for tourism development and operations in the country, including the allocation of islands and zones for tourism, and the leasing and management of facilities such as resorts, guesthouses, hotels, marinas, and related services.

Under Clause 17, operating a tourist hotel or guesthouse requires registration and licensing from the Ministry of Tourism, contingent on compliance with infrastructure standards, service requirements, location criteria, and payment of prescribed fees.

The Ministry is empowered to classify tourist establishments, define service standards, and enforce compliance through regular monitoring. If any establishment fails to meet the required standards or violates regulations, the Ministry may impose penalties up to MVR 1,000,000 and suspend operating licenses until issues are resolved.

The implementing agency for the Maldives Tourism Act is MoTE.

5.1.13 **Decentralisation Act on Local Governance in the Maldives (Law no. 7/2010)**

The Decentralization Act outlines the roles and authority of local councils that are assigned specific functions under the law. Under the Act, the country is divided into islands, atolls, and cities, each governed by elected councils: Island Councils, Atoll Councils, and City Councils. The Act delineates a range of public services to be delivered by local councils, including basic community services and socio-economic development programmes.

Among the public services to be given by the island and city councils relevant to pesticides management are pest control services, management of waste at island/city level and provision of basic services related to public health.

5.1.14 **Waste Management Act (Law No 24/2022)**

The Waste Management Act (24/2022) establishes a comprehensive framework for sustainable waste management, aiming to mitigate or eliminate the adverse effects of waste on public health, safety, and the environment. It seeks to enhance health and safety standards while minimizing the environmental impacts associated with waste management practices. This Act supersedes the Waste Management Regulation (2013/R-

58). Clause 44 of this Act prohibits the importation of any kind of waste into the Maldives by anyone.

The main objectives of the act include:

- Mitigating environmental and health impacts of waste;
- Promote a reduction in waste production, reusing, recycling and repurposing;
- Establish a waste management system in every inhabited island and provide waste management service to all residents of the island;
- Establish waste management systems in tourism islands, islands leased for varuvaa and other commercial islands;
- Establish regional waste management system to deal with waste that cannot be handled through island waste management systems;
- Provide waste management service as a utility and outline utility providers and customer rights;
- Ensure ownership at every stage of waste production and;
- Ensure international convention obligations related to waste management are fulfilled.

MoTE serves as the designated authority responsible for implementing and overseeing this Act. In addition, the ERA, URA, the local councils and other bodies that may have designated responsibilities are also mandated and empowered to implement this Act as defined respectively. The Ministry is also required to prepare regulations in relation to waste management in islands and areas leased for tourism and other industrial activities, on seafaring vessels, on uninhabited islands and sand banks and aircrafts.

In Chapter 4 Waste Minimization, under Article 18 Extended Producer Responsibility Part (a), importers and manufacturers are held responsible for the waste produced by them.

Chapter 10 of the Act is dedicated to hazardous waste and special waste. Clause 47 (a) states that waste generated from the listed substances are considered hazardous waste. Ministry is required to publish and maintain a list of hazardous waste on the Ministry's website, as stated in Clause 47 (b). According to 47 (e) it is prohibited to recycle or process hazardous waste for extraction of materials. Clause 48 states that special waste are waste that requires special handling and management, excluding those listed as hazardous waste. Clause 49 mandates the Ministry to publish a list of substances that requires management as hazardous waste and special waste at Waste Management Centres and by service providers. Clause 50 requires reporting of incidences related to hazardous waste and special waste to the relevant local council and the ERA. Clause 52 requires the waste management service providers to maintain an inventory of hazardous and special waste. It requires the Ministry to formulate regulations in relation to preparation and maintenance of such inventory.

Chapter 11 is relevant to waste disposal and pollution. Clause 56 is on designating areas of polluted due to incidents. Part (a) requires reporting of incidents by the party carrying out any activity that causes such an incident to the local council and ERA. Clause 56 (b) mandates the Ministry to formulate the regulation related to protocol during an incident. Clause 56 (c) requires the ERA to compile and publish a registry of such designated areas. The Act, under Article 57 prohibits the disposal of hazardous waste in the ground, terrestrial water body, to the lagoon and to the sea, unless permitted. Article 58 mandates the ERA to instruct the relevant parties in case of an emergency.

Chapter 12 Maintenance of Records on Waste and Conducting Waste Audits requires the Ministry to formulate regulations in relation to this, under Article 56 (a). Under such regulation all relevant parties will be required to collect and maintain records as well as provide the records to the URA. Under Article 60 of this Chapter, the Ministry is mandated to undertake an audit of the waste the management situation in the country annually and publish accordingly.

The implementing agency for the Waste Management Act is MoTE.

5.1.15 Waste Management Regulation (2013/R-58)

The Waste Management Regulation published on gazette in August 2013 came into force in February 2014. ERA implements the Waste Management Regulation. The aim of the Regulation is to implement the national waste policy which contains specific provisions to (a) implement measures to minimize impacts on human health; (b) formulate and implement waste management standards; (c) implement an integrated framework for sustainable waste management (d) encourage waste minimization, reuse and recycling (e) implement Polluter Pays Principle; (f) introduce Extended Producer Responsibility. WMR contains four main sections: (i) waste management standards; defines standards for waste collection, transfer, treatment, storage, waste site management, landfills and managing hazardous waste (2) waste management permits; defines approval procedures for waste sites (iii) waste transfer. Standards and permits required for waste transport on land and sea, including transboundary movements, (iv) reporting requirements: defines reporting and monitoring requirements and procedures (v) enforcement: defines procedures to implement WMR and penalties for non-compliance.

Storage, transportation and handling of waste shall conform to the standards specified in Regulation. If any hazardous waste is to be disposed of in the Maldives, waste sites specifically approved to manage hazardous and Special Category waste should handle it. Section 2 Standards for Waste Management, Articles 8 and 9 define the standards for management of hazardous and special waste.

5.1.16 **Land Transport Act (Law No 5/2009)**

The law establishes provisions for vehicle registration, classification, roadworthiness, road use, safety of vehicle and pedestrians. Article 57 Carrying of Goods and Materials: (e) stipulates that hazardous materials, may only be transported on vehicles authorized by the Ministry for this purpose, in accordance with Ministry regulations, and must be appropriately labelled as required.

The implementing and enforcement agency is Ministry of Transport and Civil Aviation (MTCA).

5.1.17 **Maritime Act (Law No 69/78)**

The law sets forth rules for registering and managing maritime vessels operating in the Maldives. The objective is to classify vessels and manage their registration, while improving maritime safety. The Act addresses various aspects of maritime law, including shipping, navigation, and safety at sea.

While the primary focus of the Act is on shipping and maritime regulations, it includes clauses related to the handling and transport of hazardous goods or substances. Specifically, the Act is aligned with international maritime conventions such as the International Maritime Dangerous Goods (IMDG) Code, which sets standards for the safe transport of dangerous goods by sea.

The implementing and enforcement agency is MoTCA

5.1.18 **Regulation on Carriage of Dangerous Goods by Air (MCAR-18)**

Regulation on Carriage of Dangerous Goods by Air (MCAR-18) was published under the provision of the Maldives Civil Aviation Act (Law no. 2/2001). The provisions of this regulation govern the transport of dangerous good by air (for both international and domestic operations).

MCA Definitions and Abbreviations MCAR-1 defines Dangerous goods is as Articles or substances which are capable of posing a risk to health, safety, property or the environment and which are shown in the list of dangerous goods in the Technical Instructions or which are classified according to those Instructions.

The implementing agency for the Regulation on Carriage of Dangerous Goods by Air is MCAA.

5.1.19 *Water Resources Protection and Management Regulation (2021/R-22)*

This regulation has clauses on prohibiting contamination of ground water lens due to agriculture, usage of fertilizers, pesticides or other similar substances by farmers in a manner that it may contaminate the water lens. It also sets standards on how fertilizer and pesticide shall be stored stating that it should be in a place or area designed in such manner that, in case of a leak, it can be collected and stored without spillage to the ground.

Implementing agency is URA.

5.1.20 *Regulation on Protecting and Conservation of Environment in the Tourism Industry*

The regulation requires all pesticides used in tourist resort, picnic island, marina or such a place to have been imported after obtaining written permission from the relevant government authority, in Article 4.1. Additionally, Article 5.2 stipulates that toxic or hazardous waste shall be kept in separate bins for each type, and shall be labelled as such. According to Section 8 Penalty, if any provision of this regulation is contravened by any tourist resort, picnic island, marina, hotel, guest house, or tourist vessel, shall be guilty of an offence, and shall be liable to a fine. If non-compliance of a provision occurs more than once, the Ministry reserves the right to revoke the licence.

The Regulation is implemented by the Ministry of Tourism under the Tourism Act (Law no. 2/99).

5.2 National Policies and Strategies

5.2.1 *National Fisheries and Agricultural Policy 2019–2029*

This policy document sets out the basis of future policy framework in fisheries and agricultural sectors. It includes provisions related to agricultural pesticides that focus on ensuring their safe and sustainable use in agriculture. Specifically, the policy emphasizes:

- **Regulation and Monitoring:** The policy calls for the regulation of pesticide use, ensuring that only approved and safe pesticides are used in agricultural practices. It seeks to minimize the adverse effects of pesticides on the environment, human health, and biodiversity.
- **Training and Awareness:** The policy advocates for training programs for farmers and stakeholders on the proper use, handling, and disposal of pesticides to reduce risks associated with misuse.

- Integrated Pest Management (IPM): The policy encourages the adoption of Integrated Pest Management strategies that prioritize non-chemical methods, such as biological control and crop rotation, over the heavy reliance on chemical pesticides.
- Environmental Protection: It aims to protect the environment by ensuring that agricultural practices, including pesticide application, do not contribute to soil degradation, water pollution, or harm to non-target species.

5.2.2 **Health Master Plan 2016–2025**

The Health Master Plan 2016–2025 of the Maldives places strong emphasis on managing environmental health risks, particularly those related to chemical exposure, including the use of pesticides. Recognizing the significant impact of pesticides on both environmental and public health, the Plan calls for coordinated and integrated management of chemicals such as insecticides, pesticides, and fertilizers across all relevant sectors. It highlights the importance of regulating pesticide use in controlling vector-borne diseases while minimizing health risks through strict enforcement of safety standards.

The Plan also promotes multi-sectoral collaboration to reduce environmental contamination—particularly air, water, soil, and marine pollution—that may result from improper pesticide use. It stresses the need to empower communities to demand safe food and water, ensure rigorous quality control, and reduce exposure to harmful substances. By strengthening public health protection systems, enforcing waste and chemical management regulations, and prioritizing pesticide oversight, the Plan aims to build a safer, more resilient health system capable of addressing current and emerging chemical-related health challenges, among other things.

5.2.3 **Magey Saafu Raajje National Waste and Resources Management Policy and Strategy**

The Magey Saafu Raajje National Waste and Resource Management Policy and Strategy 2024–2028 envisions advancing green development and a circular economy through an integrated solid waste management system. The aim is to minimize the negative impacts of waste on the environment, climate, and public health, thereby supporting sustainable development.

Among the six guiding principles of the policy, three are especially relevant to pesticide management. The waste hierarchy principle prioritizes waste prevention, reduction, reuse, and repair, followed by recycling and energy recovery, with incineration and landfill as last options. The polluter pays principle places the financial responsibility for waste management on those who generate the waste. The extended producer responsibility

principle holds producers and importers accountable for managing their products throughout their lifecycle, including disposal.

Of the twelve strategies outlined in the policy, Strategy 11: Safe Management of Hazardous Waste is particularly relevant to pesticide disposal. This strategy includes constructing and operating hazardous waste storage facilities within regional waste management centers, developing standard operating procedures for hazardous waste activities and establishing a reporting system to track and publish data on hazardous waste by type.

5.3 International Commitments and Frameworks

5.3.1 *International Conventions*

The Maldives is a party to four international conventions guiding pesticide management. The international conventions are:

- **Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal:** Regulates the transboundary movement and disposal of hazardous waste. Basel Convention was ratified by the Maldives on 10th October 1992.
- **Stockholm Convention on Persistent Organic Pollutants (POPs):** Eliminates persistent organic pollutants (POPs) in pesticides. Maldives ratified the Stockholm Convention on 17th October 2006.
- **Rotterdam Convention on the Prior Informed Consent (PIC) procedure** for certain hazardous chemicals and pesticides in international trade: Ensures prior informed consent for importing hazardous pesticides. The date of ratification by the Maldives is 17th October 2006.
- **Minamata Convention on Mercury:** Phases out mercury-containing pesticides. Maldives ratified the Minamata Convention on 13th May 2024.

The relevance of these conventions to pesticides is summarized in Table 5.1 below. The Ministry of Tourism and Environment (MoTE) serves as the Focal Point for all four conventions.

Table 5-1 Details of International Conventions and Obligations

Convention	Overview	Relevance to Pesticides
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	<p>Controls the international movement of hazardous wastes, including those resulting from pesticides.</p> <p>It requires parties to reduce hazardous waste generation and dispose of it as close to the source as possible, minimizing transboundary movements.</p>	<p>Importation, Distribution & Waste Management: For the Maldives, compliance means restricting imports of hazardous pesticide wastes and ensuring the safe disposal of any pesticide waste in accordance with international standards to prevent environmental harm.</p>
Stockholm Convention on Persistent Organic Pollutants (POPs)	<p>Focuses on reducing or eliminating the release of POPs, a group of chemicals known for their toxicity, persistence, and ability to bioaccumulate.</p>	<p>Usage & Environmental Protection: For pesticides, it specifically targets chemicals that remain in the environment and accumulate in human and animal tissues, posing health risks. Member countries, including the Maldives, are committed to phasing out POP pesticides, using safer alternatives, and adopting stricter regulatory control over existing POPs.</p>
Rotterdam Convention on the Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals and Pesticides in International Trade.	<p>Establishes a PIC procedure, where parties must provide explicit consent before the importation of certain hazardous pesticides.</p>	<p>Importation & Monitoring/Control: It provides a framework to monitor and control the trade of dangerous chemicals, including pesticides that are banned or restricted in other countries.</p> <p>The Maldives, as a participant, is informed of pesticide hazards and has the right to refuse imports of high-risk pesticides, supporting efforts to protect public health and the environment.</p>
Minamata Convention on Mercury	<p>Primarily addresses mercury. Impacts pesticide management indirectly. Some pesticides contain mercury as an additive. Convention calls for phasing out such uses and implementing safer alternatives.</p>	<p>Usage & Waste Management: The Maldives' alignment with this convention involves eliminating mercury-based pesticides and ensuring that any mercury waste from pesticides is safely managed, thus reducing health risks associated with mercury exposure in agricultural settings.</p>

5.3.2 **FAO & WHO International Code of Conduct on Pesticide Management**

The International Code of Conduct on Pesticide Management, jointly developed by FAO and WHO, was first adopted in 1985 and last updated in 2014. It provides a voluntary global framework for the sound management of pesticides throughout their life cycle—from registration and distribution to use and disposal. Aimed at minimizing risks to human health and the environment, especially in countries with limited regulatory systems, the Code offers guidance to governments, industry stakeholders, and end users. It promotes responsible pesticide practices, including Integrated Pest Management (IPM), and has influenced national legislation in many countries, including the Maldives.

The Code outlines comprehensive management practices for pesticide handling, covering risk assessment, regulation, labelling, and user training. It advocates for strong national legislation, accountability, and elimination of harmful practices such as repackaging and false advertising. Recommended measures include promoting IPM, ensuring proper dosage and use of personal protective equipment (PPE), maintaining safe application equipment, and storing pesticides in secure, ventilated areas. It also emphasizes record-keeping, clear labelling, and safe disposal methods such as triple-rinsing containers and managing obsolete pesticides through return and collection systems.

5.3.3 **FAO Guidelines on Highly Hazardous Pesticides (HHPs)**

It provides further detailed measures to address pesticides that are considered especially dangerous due to their acute toxicity, long-term health risks, or high potential for environmental harm. These guidelines encourage countries to identify and prioritize HHPs for risk mitigation or phase-out. The document recommends restricting their use in communities lacking protective gear or technical capacity, substituting them with safer alternatives, and taking regulatory action to prohibit their import and sale when necessary [3].

5.3.4 **WHO Classification of Pesticides by Hazard**

It provides a scientific system for categorizing pesticides based on their acute toxicity to humans. This classification ranging from extremely hazardous (Class Ia) to unlikely to present acute hazard (Class U) is used to guide regulatory decisions, such as restricting high-hazard pesticides or requiring additional precautions for their handling and use. This classification also informs labelling and helps define safety protocols for storage and transportation, especially in countries where regulatory enforcement may be limited.

5.3.5 **Codex Alimentarius**

The Codex Alimentarius, established in 1963 by the Food and Agriculture Organization (FAO) and the World Health Organization (WHO), is a globally recognized collection of food standards, guidelines, and codes of practice. Its main goal is to protect consumer health and ensure fair practices in food trade. Updated annually by the Codex Alimentarius Commission, it includes a wide range of provisions, including those for food hygiene, additives, contaminants, and labelling. One of its critical functions related to pesticides is the establishment of Maximum Residue Limits (MRLs)—the highest permissible levels of pesticide residues in food—based on scientific risk assessments by the Joint FAO/WHO Meeting on Pesticide Residues (JMPR). Although the Codex is voluntary, it plays a central role in both domestic regulation and international trade through its reference in the World Trade Organization's (WTO) Sanitary and Phytosanitary (SPS) Agreement.

The Codex Committee on Pesticide Residues (CCPR) leads the work on MRLs by evaluating data on pesticide toxicity, dietary exposure, and results from field trials conducted under realistic agricultural conditions. A fundamental principle underpinning MRLs is adherence to Good Agricultural Practices (GAPs)—nationally approved standards that ensure pesticides are applied safely and effectively in real farming environments. GAPs help maintain residue levels within legal limits while achieving adequate pest control, and they incorporate measures to protect the environment, safeguard agricultural workers, and ensure proper storage and disposal of pesticides. In the context of pesticide management, the integration of MRLs and GAPs forms a critical foundation for ensuring food safety and promoting responsible pesticide use globally.

5.3.6 **Integrated Pesticide Management**

Integrated Pest Management (IPM) is a sustainable and science-based approach to pest control that reduces reliance on chemical pesticides by combining various methods tailored to specific pests and local conditions. At its core, IPM emphasizes pest prevention, monitoring, and control through the least harmful means possible. It includes a mix of strategies such as cultural, biological, mechanical, and chemical controls, applied in a coordinated manner. In the Maldives, traditional cultural practices provide a strong foundation for IPM and can be complemented with modern techniques to enhance effectiveness and sustainability.

Cultural control methods have historically been used by Maldivian farmers to manage pests in ways that align closely with IPM principles. These include practices such as burning smoke under trees to deter insects, releasing free-range chickens and cats to manage insect and rodent populations, using plant-based repellents, and burning the soil in bush fallow systems to control nematodes and soil-borne pathogens. Traditional rat traps, made from coral stone and triggered with fibre from *Hibiscus tiliaceus*, also reflect deep-rooted, locally adapted knowledge. These time-tested methods can be integrated with modern

cultural practices, such as crop rotation, intercropping, and optimized planting schedules to disrupt pest lifecycles.

In addition to cultural controls, modern IPM employs biological control agents like predatory insects, pheromone traps for monitoring and controlling specific pests, and light traps to reduce nocturnal insect populations. It also includes mechanical controls such as insect-proof netting and barriers, as well as selective pesticide use based on threshold levels and regular pest surveillance. By combining these modern tools with traditional knowledge, IPM in the Maldives can be both effective and locally appropriate. Integrating both approaches into Good Agricultural Practices (GAPs) supports safer food production, protects environmental health, and empowers farmers to make informed pest management decisions.

5.3.7 **FAO Pesticide Registration Toolkit**

The FAO Pesticide Registration Toolkit is an online decision-support system developed by the Food and Agriculture Organization (FAO) to help countries strengthen their national pesticide registration and regulatory processes. It provides practical guidance, risk assessment methodologies, and access to global scientific evaluations, enabling regulatory authorities to make informed decisions on pesticide approvals. The toolkit supports all stages of registration, including data evaluation, health and environmental risk assessments, label reviews, and efficacy checks. It also offers specific guidance on managing Highly Hazardous Pesticides (HHPs) and aligns with international best practices and the FAO/WHO International Code of Conduct on Pesticide Management.

Designed particularly for countries with limited technical capacity, the toolkit consolidates resources from international organizations such as WHO, JMPR, and OECD, allowing users to rely on existing scientific evaluations rather than duplicating efforts. It serves not only as a technical tool but also as a capacity-building resource, helping governments modernize regulatory systems, implement risk reduction measures, and ensure the safe and effective use of pesticides. Through its comprehensive approach, the toolkit contributes to global efforts to protect human health, safeguard the environment, and promote sustainable agriculture.

5.3.8 **Sustainable Development Goals**

The Sustainable Development Goals (SDGs), adopted by all United Nations Member States in 2015, form a universal agenda to end poverty, protect the planet, and ensure prosperity for all by 2030. Comprising 17 interlinked goals and 169 associated targets, the SDGs offer a framework to guide national development efforts in a balanced and integrated manner. They address global challenges such as climate change, environmental degradation, inequality, and sustainable economic growth, and emphasize partnerships, innovation, and

accountability. For Small Island Developing States (SIDS) like the Maldives, the SDGs are particularly significant as they provide a roadmap to strengthen environmental resilience, support inclusive economic growth, and promote sustainable use of natural resources amidst vulnerabilities such as climate change and limited land availability.

In the context of the pesticide supply chain, the most relevant goal is SDG 12: *Ensure sustainable consumption and production patterns*. Table 5.2 presents all Sustainable Development Goals identified as relevant to pesticide management.

Table 5-2 SDGs and their targets relevant to pesticides supply chain

SDG	Targets	Relevance to pesticides
SDG 2 Zero Hunger End hunger, achieve food security and improved nutrition and promote sustainable agriculture.	2.4: By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters, and that progressively improve land and soil quality.	Linked to the role of pesticides in agricultural productivity and food security.
SDG 3 Good Health and Well-being Ensure healthy lives and promote well-being for all at all ages.	3.9: By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination. 3.d: Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks (including those from chemical exposure).	Emphasizes reducing health risks from hazardous chemicals and pollution, which is closely linked to safe pesticide use and management
SDG 6 Clean Water and Sanitation Ensure availability and sustainable management of water and sanitation for all.	6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	Improper handling or disposal of pesticides can contaminate freshwater sources
SDG 12 Responsible Consumption and Production	12.4: By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international	Relates directly to sustainable pesticide

Ensure sustainable consumption and production patterns	frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment.	procurement, use, and disposal practices.
	12.5: By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse.	
SDG 14 Life Below Water Conserve and sustainably use the oceans, seas and marine resources for sustainable development	14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution (which includes pesticide runoff).	Improper handling or disposal of pesticides can contaminate and adversely impact marine ecosystems and species.

5.4 Applicability of Legislation to Supply Chain Stage

Table 5.3 highlights the legal instruments applicable at different stages of the pesticide supply chain. Their relevance has been assessed using a set of criteria to ensure clarity. The criteria are as follows:

- 1. Legal Applicability:** The instrument establishes binding requirements relevant to the supply chain stage, such as import permits or waste disposal obligations.
- 2. Stage-Specific Regulatory Content:** The instrument includes specific rules, standards, or procedures relevant to the technical or operational aspects of the stage.
- 3. Enforcement and Compliance Provisions:** The instrument assigns enforcement responsibilities, monitoring, penalties, or reporting obligations for that stage.
- 4. Guidance for Best Practices:** The instrument provides technical or procedural guidance (e.g., safe use protocols, labelling requirements, storage manuals) relevant to the stage.
- 5. Institutional Responsibilities:** The instrument defines roles or responsibilities of government agencies or other stakeholders during that stage.
- 6. Stakeholder Coverage:** The instrument addresses or affects key actors involved in the stage (e.g., importers, farmers, PCOs).
- 7. Risk Management / Safety Provisions:** The instrument includes health, safety, or environmental protection measures relevant to risks at the stage.

8. Alignment with International Standards/Agreements: The instrument reflects obligations or principles from international treaties (e.g., Rotterdam, Stockholm Conventions), especially in stages like import or disposal.

9. Promotion of Sustainable or Integrated Pest Management: The instrument promotes sustainability, reduction of pesticide use, or alternatives relevant to the stage (mostly for end-use and disposal).

10. Coverage of Monitoring, Reporting, or Data Requirements: The instrument establishes monitoring, data collection, or reporting requirements for the stage (e.g., pesticide use tracking, disposal records).

In Table 5.3, where the legislation is applicable to the stages of the supply chain it is shown with a '✓' and where it is not relevant an 'X' is used. The numbers corresponding to the relevance criteria listed above are assigned to each legal instrument across the different stages of the supply chain.

Table 5-3 Relevant legislation at various stages of supply chain

Legislation	Import	Storage	Transport & Distribution	End-Use	Disposal
Business Registration Act (Law no. 18/2014)	✓ 1, 5, 6, 10	✓ 1, 5	✓ 1, 5	✓ 1, 5	✓ 1, 5
Export Import Act (31/79)	✓ 1, 2	X	X	X	✓ 1, 2
Import Prohibition Act (4/75)	✓ 2, 3	X	X	X	X
Hazardous Chemical Regulation (2019/R-1057)	✓ 1, 2, 3, 5, 10	✓ 1, 2, 3, 4, 6, 7, 8, 10	✓ 1, 2, 3, 4, 6, 7, 8, 10	✓ 1, 2, 3, 4, 6, 7, 8	✓ 1, 2, 3, 4, 6, 7, 8, 10
Agricultural Pesticides Control Act (21/2019)	✓ 1, 2, 3, 4, 9	✓ 1, 2, 3, 4	✓ 1, 2, 3, 4	✓ 1, 2, 3, 4, 9	✓ 1, 2, 3, 4
Agricultural Pesticides Control Regulation (2021/R-12)	✓ 1, 2, 3, 4, 6, 10	✓ 1, 2, 3, 4, 6, 7, 10	✓ 1, 2, 3, 4, 6, 7, 10	✓ 1, 2, 3, 4, 6, 7, 9	✓ 1, 2, 3, 4, 6, 7, 9, 10
Maldives Customs Act (8/2011)	✓ 1, 2, 3, 5, 6, 8	X	X	X	✓ 1, 2
Customs General Regulation	✓ 1, 2, 3, 5, 6	X	X	X	✓ 1, 5
Public Health Protection Act (Law no.7/2012)	X	✓ 2, 5	✓ 2, 5	✓ 2, 5	✓ 2, 5
Environmental Protection and Preservation Act (4/93)	X	X	✓ 1	X	✓ 1, 2
Waste Management Act (24/2022)	X	X	X	X	✓ 2, 3, 5, 10
Waste Management Regulation (2013/R-58)	✓ 2	X	X	X	✓ 1, 2, 3, 4, 5, 10
Land Transport Act (5/2009)	X	X	✓ 1, 7	X	X
Maritime Act (69/78)	X	X	✓ 1	X	X

Legislation	Import	Storage	Transport & Distribution	End-Use	Disposal
Regulation on Carriage of Dangerous Goods by Air (MCAR-18)	X	X	✓ 1	X	X
Water Resources Protection and Management Regulation (2021/R-22)	X	✓ 1, 2, 7	✓ 1, 2	✓ 1, 2, 6, 7, 10	✓ 1, 2, 3, 6, 7
Regulation on Protecting and Conservation of Environment in the Tourism Industry	✓ 1, 6	X	X	X	✓ 1, 4

5.5 Assessment of Implementation, Enforcement and Compliance

Each of the legal laws and regulations have been assessed for implementation, enforcement and compliance based on findings of stakeholder consultations. The assessment is presented by each stage of the supply chain below.

5.5.1 Import Stage

Requirement/process	Responsible stakeholder	Findings
Business Registration Act (Law no. 18/2014)		
Every person shall, before carrying on business in the Maldives, register the business entity in one of the prescribed forms for registration specified in the Act.	MEDT; Importers	Business Registration is required to apply for the CIP through Makudi Portal. ³⁵
If the business activity requires a permit or license from a Governmental agency, such business activity shall be commenced only after obtaining the requisite permits or licenses.	Importers	Importers apply for permit to MoD through the Makudi Portal.
Particulars relating to such business permits and licenses shall be furnished to the Registrar by the relevant Governmental agency.	MAAW; MoD	MoD mentioned that the Ministry coordinates with the relevant Government agencies in issuing of permits for chemicals import. ³⁶
Import Prohibition Act (Law No 4/75)		
Importers must obtain prior approval from MoD for importing hazardous chemicals including pesticides.	Importers; MoD; MAAW; MCS	When the shipment arrives at Customs, MCS checks the Makudi Portal to verify that the required import approvals have been obtained. If approvals are incomplete or if the importer has not obtained approvals, the shipment is held by the MCS until the proper documents are submitted. ³⁷

³⁵ MOD (2019) *Hazardous Chemical Regulation*, Maldives: Dhivehi Sarukaaruge Gazette,.

³⁶ Stakeholder consultation meeting with MoD on 20 Nov 2024.

³⁷ Stakeholder consultation meeting with MCS on 21 Nov 2024.

Requirement/process	Responsible stakeholder	Findings
		<p>Certain chemicals are being imported without the required permits.³⁸</p> <p>Sometimes, importers do not apply for permits until the shipment has arrived at the port.³⁹</p> <p>If a shipment includes a chemical that is on the Closed List, the shipment is not cleared. Some traders operate to ISO standards with regular audits for compliance. As a result, they do not import restricted or banned chemicals.⁴⁰</p>
Hazardous Chemical Regulation (2019/R-1057)		
<p>Pesticides classified as hazardous chemicals and in the Controlled List of chemicals must be registered through the Makudi Portal for import.</p> <p>Check if the substance is on the Makudi Portal.</p>	<p>Importer; MoD</p>	<p>In the Makudi Portal, chemicals are categorised into three groups:</p> <ol style="list-style-type: none"> 1. Open List: Does not require prior approval. 2. Controlled List: Includes substances requiring specific approval 3. Closed List: Contains substances that are prohibited from import, except those that have an exemption for military purposes. <p>All pesticides that are classified as hazardous under the Hazardous Chemicals Regulation are on the Controlled List. For agricultural pesticides, verification from MAAW is required if the pesticide is on the Approved Agricultural Pesticide Registry. CIP is issued by MoD for the pesticides on the Registry.</p> <p>Importers informed that introduction of new regulations causes delays in shipments and clearing shipments.⁴¹</p> <p>Interviews with Key Informants also revealed that banned or restricted pesticides are also being imported under different labels</p>

³⁸ Ibid.

³⁹ Ibid.

⁴⁰ Stakeholder consultation meeting with B1, B2 between 20 Dec 2024 and 30 Dec 2024.

⁴¹ Stakeholder consultation meeting with B1-B4 between 20 Dec 2024 – 30 Dec 2024.

Requirement/process	Responsible stakeholder	Findings
		<p>According to MoD, most importers are not familiar with Makudi Portal. However, the major importers informed that they are familiar with Makudi and find it easy to use.⁴² Small scale or irregular importers may be facing challenges.</p>
<p>If the pesticide is not on the approved list of substances, the importer must apply for a New Substance Approval first.</p> <p>Submit Material Safety Data Sheets (MSDS).</p>	<p>Importer; MoD</p>	<p>MoD verifies and approves the New Substance submitted via Makudi Portal. If a substance requires approval from another regulatory agency, the MoD coordinates with the relevant authority before granting approval.</p> <p>On average, 15–20 new substance requests related to chemicals are submitted daily. Once the pesticide is registered, the importer applies for a permit to import the specified quantity.</p> <p>According to MoD, importers often fail to enter detailed information on substances from the MSDS into the Makudi Portal.⁴³ Accurate and complete entry is essential, as the MSDS is relied upon by the MNDF Fire & Rescue during incident response. Consequently, MoD must undertake the time-consuming task of verifying and manually entering the information. In many cases, manufacturer websites are primarily in local languages, with only the active ingredients provided in English.</p> <p>There is currently no system in place to verify the MSDS; therefore, the information provided by the importer is used as submitted.⁴⁴</p> <p>If the importer adds the wrong HS code, MoD cannot amend it.</p> <p>There are only two staff within MoD to verify and approve New Substances as well as CIP.⁴⁵</p> <p>If the New Substance is an agricultural</p>

⁴² Ibid.

⁴³ Stakeholder consultation meeting with MoD on 20 Nov 2024.

⁴⁴ Stakeholder consultation meeting with MoD on 20 Nov 2024.

⁴⁵ Ibid.

Requirement/process	Responsible stakeholder	Findings
		<p>pesticide, MAAW also verifies against the Approved Agricultural Pesticide Registry.</p> <p>Importers seem to be aware of current regulations and documentation required according to the major importers.⁴⁶</p>
Obtain CIP.	Importer; MoD;	<p>Once a New Substance has been registered and the pesticide is procured, the importer needs to apply for CIP. On average, 50 permits related to chemicals are released daily.⁴⁷</p> <p>Have to register each shipment even if the same substance because it can have different commercial names and sometimes composition changes.⁴⁸</p>
Obtain Storage Facility Permit if the chemical is on the Controlled List and import quantity exceed 200kg or 200litres.	Importers; MoD; MNDF Fire.	<p>For pesticides listed under the Controlled List, Storage Facility Permit must be obtained.</p> <p>When a Storage Facility Permit application is received, MoD conducts an inspection covering land use, ventilation, fire safety, and accessibility.⁴⁹</p> <p>MoD provides a detailed inspection report to the importer, including required modifications. Once the facility complies with all standards, a reinspection is conducted, and the permit is issued.⁵⁰</p> <p>After verifying all documentation and obtaining a no-objection letter from relevant agencies (if applicable), the MoD issues CIP.⁵¹</p> <p>If the quantify (by weight) of pesticides to be imported is under 200 kg, a Storage Facility Permit is not required.⁵²</p>

⁴⁶ Stakeholder consultation meetings with B1-B4 between 20 Dec 2024 – 30 Dec 2024.

⁴⁷ Stakeholder consultation meeting with MoD on 20 Nov 2024.

⁴⁸ Ibid.

⁴⁹ Ibid.

⁵⁰ Ibid.

⁵¹ Stakeholder consultation meeting with MoD on 20 Nov 2024.

⁵² Ibid.

Requirement/process	Responsible stakeholder	Findings
All chemicals must be properly labelled prior to importing.	Importer	MCS informed that many chemicals are often imported without proper labelling in English language. ⁵³ Importers operating to ISO standards informed that international labelling standards are followed, products are checked in laboratories to check formulation and compliance is ensured. ⁵⁴
Maintain records of chemicals imported and submit records to MoD every six months.	Importer; MoD	Although importers maintain records as part of their accounting and auditing processes, submitting of records to MoD has not been reported.
Export Import Act (Law No 31/79)		
Provisions related to the import and export of hazardous materials, ensuring that these goods meet safety standards.	MEDT; Importer	Import of hazardous materials is regulated by MoD through Makudi Portal.
Customs Act (8/2011)		
Examining goods and ensuring compliance with import regulation.	MCS	MCS conducts random checks on consignments. MCS does not have the capacity to conduct on-the-spot testing or access to laboratory facilities to conduct testing on chemicals including pesticides. ⁵⁵
Provide accurate and complete documentation for all imported goods to facilitate customs processing and duty assessment.	Importer	MCS uses Makudi Portal verify documents.
Customs General Regulation		
Provide MEDT business registration.	Importer	Provided to register at MCS.
Register at MCS as an importer.	Importer	Importers have MCS registration.

⁵³ Follow up meeting with MCS on 21 Jan 2025.

⁵⁴ Meeting with B1 and B2 on 20 Dec 2024 and 26 Dec 2024, respectively.

⁵⁵ Follow up meeting with MCS on 21 Jan 2025.

Requirement/process	Responsible stakeholder	Findings
Submit information on import goods including permits from relevant government authorities.	Importer	Upon verification on Makudi Portal, some pesticides are either not registered or incorrectly registered. According to MCS importers are at times unaware which pesticides require registration on the Makudi Portal.
Agricultural Pesticide Control Act (Law No 21/2019)		
Importers must obtain a license from MAAW to import pesticides.	Importers; MAAW	Entities currently only require a business registration to proceed with import permits. According to stakeholder consultations with MAAW, this Act is not being implemented fully at present including licensing. Therefore, licensing is not carried out currently. ⁵⁶
Publishing and maintaining an Approved Agricultural Pesticides Registry.	MAAW;	MAAW maintains the Approved Agricultural Pesticide Registry. It includes Common name/Active ingredient, formulations, concentrations (%), pesticide type, US EPA toxicity class, WHO hazard class, host/plant area and target pest. The Registry also includes a list of Biopesticides. A list of approved substances is available on Makudi Portal.
Approve pesticides for production, use, sales, import and export.	MAAW	MoD verifies with MAAW when a New Substance registration is received via the Makudi Portal for agricultural pesticides. ⁵⁷
Ensure quality of pesticides.	MAAW	Some of the importers are ISO certified and have regular ISO audits to ensure that standards are met. Importers revealed that the choice of suppliers/countries is influenced by factors such as cost, quality, certifications and the approvals required. Need to find cheap sources as farmers cannot afford if sourced from a more expensive country. ⁵⁸ Importers also emphasised the lack of a laboratory facility to test the quality of

⁵⁶ Stakeholder consultation meeting with MAAW on 20 Nov 2024.

⁵⁷ Ibid.

⁵⁸ Stakeholder consultation meeting with B4 on 30 Dec 2024.

Requirement/process	Responsible stakeholder	Findings
		pesticides as one of the main challenges. A central laboratory facility that can be used by all importers to test quality of pesticides was given as a recommendation. ⁵⁹
Regulation on Protecting and Conservation of Environment in the Tourism Industry		
All pesticides used in tourist resort, picnic island, marina or such a place to have been imported after obtaining written permission from the relevant government authority	Tourist establishments	MCS data shows that resorts are also importers of pesticides. Many resorts are customers of PCO businesses that operate to ISO standards.

5.5.2 Storage

Requirement/process	Responsible stakeholder	Findings
Hazardous Chemical Regulation (2019/R-1057)		
Register the warehouse with MoD. Ensure storage facilities are according to required standards.	Importer; MoD	Importers apply for Storage Facility Permit through the Makudi Portal. MoD carries out inspection of the storage when a Storage Facility Permit application is received through the Makudi Portal. ⁶⁰ In addition, inspections at the time of renewing show that storage facilities are often not maintained as required. ⁶¹ However, some importers have warehouses with temperature control as they operate to ISO standards. ⁶²

⁵⁹ Stakeholder consultation meeting with B2 on 26 Dec 2024.

⁶⁰ Stakeholder consultation meeting with MoD on 20 Nov 2024.

⁶¹ Ibid.

⁶² Ibid.

Requirement/process	Responsible stakeholder	Findings
For pesticides listed under the Controlled List, Storage Facility Permit must be obtained.	Importer;	According to MoD, importers obtain Storage Facility Permit through the Makudi Portal when necessary. ⁶³
If the weight of the pesticide in the controlled list of chemicals exceeds 200kg, the importer must have a Storage Facility Permit prior to importing.		MoD stated that often the Storage Facility Permits are expired and not renewed until a new shipment is to be imported that requires the permit. ⁶⁴ Storage Facility Permits are issued for a period of one year.
Workers involved in warehousing must be informed on the hazard level and type of hazard.	Importer; Wholesale & retail distributor;	Some of the importers reported that they recruit trained personnel or their employees are provided training to new recruits. ⁶⁵
All chemicals must be kept in storage according to the requirements of this regulation. This includes, but is not limited to, packaging, labelling, storing according to classes of chemicals, record keeping and informing to relevant authorities should there be any leakages and other concerns.	Wholesale & retail distributor; PCOs	<p>According to MoD, no further inspections are carried out once a Storage Facility Permit is issued. Authorities lack the capacity to inspect storage facilities regularly.⁶⁶</p> <p>Some chemical warehouses are kept at room temperature, as mentioned by key stakeholders. Some importers mentioned that the warehouse includes containers rented from the Government and these containers do not have temperature or humidity controls.⁶⁷</p> <p>Some importers use labelling complying with ISO standards as well as the Agricultural Pesticide Control Regulation of Maldives.⁶⁸</p>
If there are workers who do cannot read and/or understand Dhivehi or English, labels should also be in a language that they can understand.	Importer; Wholesale & retail distributor;	Needs to be studied further.
Agricultural Pesticide Control Act (Law No 21/2019)		

⁶³ Ibid.

⁶⁴ Ibid.

⁶⁵ Stakeholder consultation meetings with B1-B4 between 20 Dec 2024 – 30 Dec 2024.

⁶⁶ Stakeholder consultation meeting with MoD on 20 Nov 2024.

⁶⁷ Stakeholder consultation meeting with B4 on 30 Dec 2024.

⁶⁸ Stakeholder consultation meeting with B1-B4 between 20 Dec 2024 – 30 Dec 2024.

Requirement/process	Responsible stakeholder	Findings
Pesticides must not be stored in residential premises, places where animals are kept, or places where food products or animal feed are handled.	Importer; Wholesale & retail distributor;	Some stakeholders revealed that pesticides are also in retail shops along with other household goods. ⁶⁹ This can be observed when visiting retail shops.
Agricultural Pesticide Control Regulation (2021/R-12)		
Shops, warehouse, storage in agricultural areas and storage in home gardening should be according to the Pesticide Guidelines for Pesticide Disposal, Shop, Warehouse and Factory.	Importer; Wholesale & retail distributor; Farmers and agricultural producers; Household users.	In open farms, pesticides are sometimes stored in cupboards in a store room made of tin sheets within the premises of the farm. ⁷⁰ Home gardeners often store pesticides within storage areas in the home. ⁷¹
Water Resources Protection and Management Regulation (2021/R-22)		
Pesticide shall be stored in a place or area designed with a bund wall that in case of a leak, it can be collected and stored without spillage to the ground.	Importers; Farmers and agricultural producers; Household users.	In open farms, pesticides are sometimes stored in cupboards in a store room made of tin sheets within the premises of the farm. ⁷²

5.5.3 *Transport and Distribution*

Requirement/process	Responsible stakeholder	Findings
Hazardous Chemical Regulation (2019/R-1057)		
Ensure proper handling of the chemicals in accordance with	Importers;	Major businesses involved in the pesticides-related business have reported to follow

⁶⁹ Stakeholder consultation meeting with MAAW on 20 Nov 2024.

⁷⁰ Stakeholder consultation meeting with farmer from Laamu Atoll, 2 Mar 2024.

⁷¹ Stakeholder consultation meeting with home gardeners in Addu Atoll, 16 Feb 2025.

⁷² Stakeholder consultation meeting with farmer from Laamu Atoll, 2 Mar 2024.

Requirement/process	Responsible stakeholder	Findings
the Schedule 1 of the Regulation.	Wholesale & retail distributors; Farmers and Agricultural Producers: PCOs: Tourism accommodation operators	standards with some operating to ISO standards. ⁷³ Some businesses reported that only trained personnel are recruited and/or employees are trained by them. ⁷⁴
Communicate to buyers upon sales on proper handling, storage and use of the chemicals as well as safety procedures. Provide the information in writing in both Dhivehi and English languages.	Importers; Wholesaler & retail distributors;	According to importers and distributors, the information is provided both verbally and in writing during sales. ⁷⁵ Importers and distributors mentioned that customers are given information on how to handle, mix, apply and use the pesticide. Leaflets are provided to customers upon sales. Contact numbers are also included in the leaflets for customers to contact for more information or provide feedback. ⁷⁶
Maintain sales records.	Wholesale & retail distributors;	Records are maintained for business purposes using programs such as QuickBooks for distribution and stock, as informed by key businesses. Some businesses reported to keep track of pesticide distributed vs sold through annual office audits. Keep track of pesticides nearing expiry through proforma invoices. Major businesses reported that they do not have instances of expired pesticides. ⁷⁷
Obtain official document identifying the purchaser and record the purpose of the purchase and the identity of the purchaser.	Wholesale & retail distributors;	Weather records are maintained as per the regulation needs to be further studied.

⁷³ Stakeholder consultations with B1-B4 between 20 Dec 2024 – 30 Dec 2024.

⁷⁴ Ibid.

⁷⁵ Ibid.

⁷⁶ Ibid.

⁷⁷ Ibid.

Requirement/process	Responsible stakeholder	Findings
<p>Ensure proper labelling of all chemicals in accordance with this regulation.</p> <p>If there are workers who cannot read and/or understand Dhivehi or English, labels should also be in a language that they can understand.</p>	Wholesale & retail distributors;	<p>Some of the key importers and distributors informed that to their knowledge most of the farmers are foreign migrant workers.⁷⁸</p> <p>Needs to be studied further.</p>
Re-packaging should be done into appropriate containers and with proper labelling.	Wholesale & retail distributors;	During stakeholder consultations it was informed that pesticides are usually not re-packaged by importers and distributors due to safety issues. While many repackage fertilizers. ⁷⁹
Agricultural Pesticide Control Act (Law No 21/2019)		
Transport of pesticides in any vehicle or vessel containing food, animal feed or animals can be carried out with precautions to ensure that the food, animal feed or animals are not affected.	Wholesale & retail distributors;	Major businesses involved in the pesticides-related business have reported to follow standards with some operating to ISO standards. ⁸⁰
Advertising of pesticides is prohibited.	Wholesale & retail distributors	According to MAAW, some wholesale and retail distributors visit farming islands with training materials related to use of different pesticides. ⁸¹
Agricultural Pesticide Control Regulation (2021/R-12)		
<p>Pesticides may be transported with passengers for up to 24 hours only.</p> <p>Transport vehicles or vessels must be free of sharp edges and must have barriers to</p>	<p>Importers;</p> <p>Wholesale & retail distributors</p>	<p>Some importers and distributors operate according to ISO standards while others follow local legislation.⁸²</p> <p>Accidents or incidents involving pesticides during transport were not reported in stakeholder consultations.</p>

⁷⁸ Ibid.

⁷⁹ Stakeholder consultations with B1-B4 between 20 Dec 2024 – 30 Dec 2024.

⁸⁰ Ibid.

⁸¹ Meeting to discuss standards with MAAW, 22 Jun 2025.

⁸² Stakeholder consultations with B1-B4 between 20 Dec 2024 – 30 Dec 2024.

Requirement/process	Responsible stakeholder	Findings
<p>prevent fumes from reaching the driver.</p> <p>Transport must be supervised at all times from loading to unloading, including by the driver or captain.</p> <p>Pesticides must not be transported alongside food, animal feed, animals, or other goods used by people; especially in small vessels or vehicles.</p> <p>Vehicles must be clearly labelled to indicate they are carrying pesticides, and transport must follow MSDS (Material Safety Data Sheet) guidance.</p>		
Land Transport Act (Law No 5/2009)		
<p>Rules for vehicle registration, classification, road worthiness, road use, vehicle and pedestrian safety.</p> <p>No provisions specifically for pesticides.</p>	<p>Importers; Wholesale & retail distributors</p>	<p>According to importers, transport takes place both by land and sea. Most often transport is to other islands by Sea. Transport is by vehicle if within Male'. Importers are not aware of means of transport on other islands.⁸³</p> <p>Since hazardous chemicals can now be stored in Thilafushi only, transport costs associated with distribution are high for importers.⁸⁴</p> <p>Most importers do both wholesale and retail and the companies have retail shops. Customers buy from the shop directly. For wholesale, the pesticides are delivered directly to boats.⁸⁵ Shops in the islands selling pesticides seem to be retailers that bring stock from Male' and they themselves are not</p>

⁸³ Stakeholder consultations with B1-B4 between 20 Dec 2024 – 30 Dec 2024.

⁸⁴ Ibid.

⁸⁵ Ibid.

Requirement/process	Responsible stakeholder	Findings
		importers. Retail shops on the islands bring their stock by boat. ⁸⁶

5.5.4 **End-use**

Requirement/process	Responsible stakeholder	Findings
Hazardous Chemical Regulation (2019/R-1057)		
Ensure that the chemical is used for the purpose that the permit was issued for.	Business entity	See findings for Agricultural Pesticide Control Act.
Undertake safety measures as required.	PCOs; Farmers; Workers	Farm owners/farmers mentioned use of medical grade gloves and masks as PPE used during application (Farmers interviews). However, it has also been reported that farmers do not use PPE at all or the appropriate level of PPE use. ⁸⁷ Pest control service is provided by major private business, who have reported that the operations are up to ISO standards as most of their clients are high-end resorts. ⁸⁸
Ensure first-aid is available at the place of use for immediate delivery. Provide access to a healthcare facility where necessary.	Business entity; PCOs	No reference was made to first-aid by farmers during the interviews. Major PCOs operate to ISO standards. ⁸⁹
Agricultural Pesticide Control Act (Law No 21/2019)		
Use pesticides only for the intended purpose.	Business entity; PCOs; Farmer;	According to some Key Informants, pesticides are being used inappropriately and disproportionately on farms. ⁹⁰ The concerns about misuse and excessive use of pesticides have also been raised by different

⁸⁶ Ibid.

⁸⁷ Ajila, M. 'Chapter 5 Impact of Agricultural Chemical Inputs on Human Health and Environment in Maldives', 113-126.

⁸⁸ Stakeholder consultations with B1 and B2 on 20 Dec 2024 and 26 Dec 2024 respectively.

⁸⁹ Ibid.

⁹⁰ Interviews with farmers in Addu City and Laamu Atoll on 2 Mar 2025 and 14 Apr 2025 respectively.

Requirement/process	Responsible stakeholder	Findings
	Household users;	<p>stakeholders.⁹¹ For instance, in using Abamectin (locally referred to as <i>Rihaakuru Beys</i>) are sprayed with it and harvested soon after, earlier than the safe period to harvest. Another example is chilli, which has a short harvesting period and pesticides sprayed on them are likely to remain by harvesting time. In addition, pesticides that should not be used on leafy crops are applied on them.</p> <p>There is also mixing of different types of pesticides such as insecticides and fungicides by foreign migrant workers, as mentioned by one of the Key Informants. In addition, pesticides are also being used without consideration to the concentration levels.</p> <p>It was also mentioned by Key Informants that home gardeners also use pesticides without due attention to appropriate application standards.</p> <p>Moreover, expatriate workers or farms are not properly trained on the use of pesticide resulting in mishandling and misapplication of pesticides.</p> <p>Farmers also mentioned that they obtain information from other farmers on the island or the retail shops. They did not mention contacting wholesalers or the original importers of the pesticides.</p>
Take all necessary precautions to avoid harm to humans, animals, and terrestrial and marine environment.	Importers; Wholesale/retail distributors; Farmers & agricultural producers;	<p>Major PCOs reported to be operating to ISO standards.⁹²</p> <p>As mentioned by some farmers, pesticides are mostly needed in open farms. In greenhouses, pesticides are not needed or it is minimal.⁹³</p> <p>Pesticides used in open farms are also likely to be dispersed by wind to nearby households,</p>

⁹¹ MECCT (2022) *Baseline Assessment on National Use of Chemicals*, Maldives.

⁹² Stakeholder consultations with B1-B4 between 20 Dec 2024 – 30 Dec 2024.

⁹³ Interviews with farmers in Addu City and Laamu Atoll on 2 Mar 2025 and 14 Apr 2025 respectively.

Requirement/process	Responsible stakeholder	Findings
	PCOs; Tourism accommodation providers;	<p>as expressed by one of the Key Informants, affecting the people living in these areas.⁹⁴</p> <p>It is reported that farmers often apply pesticides in quantities that surpass the manufacturer's recommended technical guidelines.⁹⁵</p> <p>Farming plots have also been observed to have small wells dug to access groundwater and pesticides are added directly to groundwater well.⁹⁶</p> <p>Farmers/workers use pesticides excessively and inappropriately.^{97 98}</p>
Use protective equipment.	Importers; Wholesale/retail distributors; Farmers & agricultural producers; PCOs; Tourism accommodation providers;	<p>Major PCOs reported to be operating to ISO standards.⁹⁹</p> <p>Farm owners/farmers mentioned use of medical grade gloves, fabric gloves, shoes and masks as PPE during application.¹⁰⁰ PPEs are also not used by many workers as revealed by one of the Key Informants, and appropriate PPE are often unavailable to workers or even to purchase.¹⁰¹</p> <p>One of the Key Informants cited that skin issues are observed among expatriate workers employed in farms.¹⁰²</p>
Report any adverse effects of a pesticide to the Ministry;	Importers; Wholesale/retail distributors;	Not reported.

⁹⁴ Interviews with farmers in Addu City and Laamu Atoll on 2 Mar 2025 and 14 Apr 2025 respectively.

⁹⁵ Ibid.

⁹⁶ Standards meeting with MAAW on 22 Jun 2025.

⁹⁷ MECCT (2022) *Baseline Assessment on National Use of Chemicals*, Maldives.

⁹⁸ Ajila, M. 'Chapter 5 Impact of Agricultural Chemical Inputs on Human Health and Environment in Maldives', 113-126.

⁹⁹ Stakeholder consultations with B1-B4 between 20 Dec 2024 – 30 Dec 2024.

¹⁰⁰ Interviews with farmers in Addu City and Laamu Atoll on 2 Mar 2025 and 14 Apr 2025 respectively.

¹⁰¹ Ibid.

¹⁰² Ibid.

Requirement/process	Responsible stakeholder	Findings
	Farmers & agricultural producers; PCOs;	
Refrain from the import, export, use or selling of pesticides that are not on the Approved Agricultural Pesticide Registry;	Importers; Wholesale/retail distributors; Farmers & agricultural producers; PCOs; Tourism accommodation providers;	Farmers use pesticides that are available in the shops on the island. ¹⁰³ Use of some banned pesticides have been reported. ¹⁰⁴
Store expired pesticides, used containers, and contaminated materials until they are disposed of.	Importers; Wholesale/retail distributors; Farmers & agricultural producers; PCOs; Tourism accommodation providers;	Farmers stated that pesticides are used up before expiry. ¹⁰⁵ Major PCOs, who are also importers, have reported that pesticides are imported in small quantities because disposal is difficult. ¹⁰⁶
Water Resources Protection and Management Regulation (2021/R-22)		
Prohibits the contamination of ground water lens due to agriculture, including pesticides.	Farmers	According to some Key Informants, there are open wells to access groundwater in some farms. Some workers often mix pesticides directly into these wells. ¹⁰⁷

¹⁰³ Ibid.

¹⁰⁴ MECCT (2022) *Baseline Assessment on National Use of Chemicals*, Maldives.

¹⁰⁵ Interviews with farmers in Addu City and Laamu Atoll on 2 Mar 2025 and 14 Apr 2025 respectively.

¹⁰⁶ Stakeholder consultations with B1-B4 between 20 Dec 2024 – 30 Dec 2024.

¹⁰⁷ Interviews with farmers in Addu City and Laamu Atoll on 2 Mar 2025 and 14 Apr 2025 respectively.

5.5.5 *Disposal*

Requirement/process	Responsible stakeholder	Findings
Waste Management Act (24/2022)		
Publish and maintain a list of hazardous waste.	MoTE.	There is no specific list of hazardous waste. A list of properties of hazardous waste is given.
Publish a list of substances that requires management as hazardous waste and special waste at Waste Management Centres and by service providers.		MoTE is currently developing an inventory of hazardous waste.
Maintain an inventory of hazardous and special waste.	WMC operators and waste-related service providers.	Inventory of hazardous waste is not maintained by WMC operators and service providers at present.
Pack and label hazardous waste and special waste as required for storage/stockpiling.	WMC operators and waste-related service providers.	WAMCO stated that the company does not provide the service to collect and dispose hazardous waste due to lack of capacity. Any hazardous waste received is informed to MNDF or kept in a designated area within WMC managed by them. ¹⁰⁸ From the hazardous waste received at WAMCO, pesticides are not identified separately. ¹⁰⁹
Report incidents involving hazardous waste and special waste to the local council and ERA.	WMC operators and waste-related service providers.	MNDF Fire receives reports of incidents. All chemical spills and incidents are attended by the MNDF. The costs are covered by the MNDF, and not the importer/user. ¹¹⁰
Designate areas of incidents as polluted areas.	ERA	Incidents are reported to MNDF Fire.
Formulate the regulation related to protocol during an incident.	MoTE	Regulation not yet formulated.

¹⁰⁸ Stakeholder consultation meeting with WAMCO, 2 Dec 2024

¹⁰⁹ Ibid.

¹¹⁰ Stakeholder consultation meeting with MoD on 20 Nov 2024.

Requirement/process	Responsible stakeholder	Findings
Maintain records on waste.	MoTE, Waste-related service providers; WMCs; URA.	Data specific to pesticides are not maintained as WAMCO does not provide the service to manage hazardous waste. ¹¹¹
Hazardous Chemical Regulation (2019/R-1057)		
Disposal of waste related to chemicals.	MoD; MCS;	<p>As reported by MoD¹¹², the Ministry receives request to disposal chemical waste. When a request is received, MoD informs MNDF Fire, which then carries out the disposal. However, there is no mechanism to track on stocks or monitor uninformed or inappropriate disposal. There is also a backlog of chemicals to be disposed according to MoD.</p> <p>As informed by MoD¹¹³, at present the waste is segregated and burnt with permission from the ERA. It is diluted, if that is the best solution. Best way to dispose is re-exporting. Two shipments have been re-exported through WAMCO. However, the cost of re-exporting is very high.</p> <p>An estimated 10–20% of chemical imports expire and need disposal according to MoD.¹¹⁴ Appropriate disposal of the expired chemical is problematic due to technical capacity.</p> <p>Transporting chemicals to the site for disposal is also challenging according to MoD.¹¹⁵ The agency that should bear the cost of transport is not clear. MNDF and WAMCO has come to an agreement whereby MNDF will assist to transport via sea with loading and unloading undertaken by WAMCO.</p>
Disposal of chemicals imported without permit.	Importer/ business entity;	
Request to MoD to dispose of chemicals that have been imported either due to expiry or any other reason.	PCOs;	

¹¹¹ Stakeholder consultation meeting with WAMCO, 2 Dec 2024

¹¹² Stakeholder consultation meeting with MoD on 20 Nov 2024.

¹¹³ Ibid.

¹¹⁴ Ibid.

¹¹⁵ Stakeholder consultation meeting with MoD on 20 Nov 2024.

Requirement/process	Responsible stakeholder	Findings
		Some importers informed that there are no expired products to dispose. ¹¹⁶ Other importers mentioned vaguely that expired pesticides are disposed appropriately and did not provide details on the ways of disposal. ¹¹⁷ Importers also mentioned that importing in excess is avoided as it is difficult to dispose of expired products. Proper disposal services were highlighted as a key issue by some importers.
Maintain records on chemical stocks that are sent for disposal.	Importer	Records are of expired products kept by businesses for accounting purposes. ¹¹⁸
Customs General Regulation		
Handover dangerous chemicals, as an import prohibited goods to MNDF.	MCS	According to MoD ¹¹⁹ , shipments that are not claimed due to various reasons such as importing without permit and products that expire while under MCS are reported to the MoD for disposal.
Agricultural Pesticide Control Act (Law No 21/2019)		
No person shall dispose of any pesticide or pesticide waste in a manner that could harm human or animal health or the terrestrial or marine environment, or in a manner contrary to the guidelines established by the relevant authority.	Importers; Distributors; End-users; Waste-related service providers.	There are no proper hazardous waste disposal facilities at present. Some requests are received at MoD for disposal of chemicals. ¹²⁰
Agricultural Pesticide Control Regulation (2021/R-12)		
Following pesticide concentrates must be disposed of: (a) Discontinued pesticide concentrates; (b)	Regulatory authorities; Importers;	At present hazardous waste is stockpiled in the Interim Hazardous Waste & Chemicals Storage Facility in Addu City and Thilafushi. There are also chemicals requiring disposal kept in

¹¹⁶ Stakeholder consultations with B1-B4 between 20 Dec 2024 – 30 Dec 2024.

¹¹⁷ Ibid.

¹¹⁸ Ibid.

¹¹⁹ Stakeholder consultation meeting with MoD on 20 Nov 2024.

¹²⁰ Stakeholder consultation meeting with MoD on 20 Nov 2024.

Requirement/process	Responsible stakeholder	Findings
<p>Expired pesticide concentrates; (c) Pesticide concentrates that do not meet the standards and; (d) Leaking pesticide concentrates and pesticide concentrates mixed with materials such as sawdust and sand.</p> <p>It is prohibited to dispose pesticides in the environment as well as Toilets, drainage junctions, wells, and similar places.</p>	<p>Distributors; End-users; Waste-related service providers;</p>	<p>selected locations as there is no means to dispose them as reported by MoD. ¹²¹</p> <p>MNDF disposes some hazardous waste when requested from other Government agencies or private sector, by diluting or burning according to MoD. ¹²²</p>
<p>Pesticides requiring disposal must be reduced by all parties.</p>	<p>Importers; Distributors; End-users;</p>	<p>There is no surveillance of pesticides once the consignment is cleared from the Customs. Some businesses keep track of their sales and have reported that shipments are ordered for the required quantity and hence, there is usually no expired pesticides.</p>
Regulation on Protecting and Conservation of Environment in the Tourism Industry		
<p>Toxic or hazardous waste shall be kept in separate bins for each type, and shall be labelled as such.</p>	<p>Tourism accommodation operators;</p>	<p>Resorts are known to have high standard of waste management practices with segregation and keeping separate areas for different types of waste. Recyclables and hazardous waste are transferred by resorts to Thilafushi usually.</p> <p>Guesthouses on residential islands usually transfer their waste to the Island WMC, managed by the Island Council in most cases.</p>

¹²¹ Stakeholder consultation meeting with MoD on 20 Nov 2024.

¹²² Stakeholder consultation meeting with MoD on 20 Nov 2024.



6 Social, Environmental and Economic Impacts of Pesticides

Potential adverse and beneficial impacts of the pesticide life cycle are identified and evaluated in this section. Significant impacts are identified and evaluated in two stages. The first stage identified the environmental, social and economic impacts that may be affected by key activities. The second stage determines the significance of impacts of each component using impact evaluation matrix as described in Annex A Methodology.

6.1 Impact Identification

The pesticide lifecycle—spanning import, storage, transport, end-use, and disposal—generates varied impacts across social, environmental, and economic domains. The following table (Table 6.1) summarizes key activities and their effects, rated as negative (-), neutral (0), or positive/negative (+/-).

Table 6-1 Impact Identification for different stages of pesticide lifecycle

Stage activities	Labour & working conditions	GHG	Resource efficiency	Marine water	Soil quality and groundwater	Ambient noise levels	Ambient air quality	Marine Biodiversity	Terrestrial biodiversity	Community	Heritage	Landscape integrity	Land
Import													
Procurement of pesticide	0	0	0	0	0	0	0	0	0	0	0	0	0
Transport of pesticide to Maldives	-/+	-	-	-	0	0	-	-	0	0	0	0	0
Storage of pesticide on board transportation	0	0	0	-	0	0	0	-	0	0	0	0	0
Storage													
Transport of pesticide to warehouses	-	-	-	-/+	-	0	0	-/+	0	0	0	0	0
Storage of pesticide in warehouses	-	-	-	0	-	0	0	0	0	-	0	0	0
Transport													
Transport of pesticides to end-users using vessels	-	-	-	-	0	0	-	-	0	0	0	0	0
Transport of pesticides to end-users using vehicles	-	-	-	0	-	0	-	0	0	0	0	0	0
End-use													

Stage activities	Labour & working conditions	GHG	Resource efficiency	Marine water	Soil quality and groundwater	Ambient noise levels	Ambient air quality	Marine Biodiversity	Terrestrial biodiversity	Community	Heritage	Landscape integrity	Land
Application of pesticides	-	-	-	0	-	0	0	0	-/+	-/+	0	-/+	-/+
Disposal													
Disposal of pesticides	-	-	-	-	-	-	0/-	-	0	-	0	0	0
Stockpiling	-	-	0	-	-	0	0	0	0	-	0	-	0

6.2 Significant Impacts

6.2.1 Social Impacts

Human Health

Predicted Changes

- Pesticides are used widely in the Maldives for agricultural, health and household purposes.

Although, they have restrictions on certain pesticides based on toxicity, MAAW's approved list of pesticides has 23 pesticides which are potentially carcinogenic according to the US EPA. While there is not enough evidence to show a definitive link between pesticide and cancer, many detailed studies have provided pesticide use as a risk factor for various forms of cancers.¹²³

- Pesticides are also known to pose neurotoxic, endocrine disruptive effects on humans. Exposure can happen through inhalation, consumption of water and food. The import of such pesticides can increase chronic exposure risks.
- Residues of these substances have been detected in fruits, vegetables and cereals in many countries, and limited local testing capacity in the Maldives raises concern over undetected contamination.
- Without proper regulation or routine residue monitoring, the likelihood of carcinogen ingestion through food or drinking water remains high.

Sensitive Receptors

- General population (especially children and children with special needs, elderly, pregnant women and breast-feeding mothers)
- Consumers of locally grown produce
- Residents near farms or contaminated water sources

Impact Significance

Impact significance is estimated to be major as:

¹²³ Ministry of Environment and Energy (2016) *Maldives National Chemical Profile 2016*, Maldives.



- Chronic ingestion of carcinogenic pesticide residues can contribute significantly to national cancer burden over time, especially in a country where health systems may not be equipped for early detection and long-term cancer treatment.

Occupational Health and safety

Predicted Changes

- Health and safety risks arising from handling of pesticides are likely. Accidents related to improper pesticide use can lead to injury, and fatalities.
- Accidental spills/leakage of hazardous substances can contaminate the site and pose risks to human health.
- Farmers and agricultural workers often lack training and access to personal protective equipment (PPE), leading to direct exposure to harmful chemicals. Acute exposure causes symptoms like dizziness, nausea, and skin irritation, while chronic exposure increases risks of cancer and neurological disorders.¹²⁴
- Residual pesticides in crops and seafood present long-term health risks for consumers, including endocrine disruption and developmental issues.¹²⁵
- Improper household use of pesticides and lack of clear usage instructions lead to accidental exposures, especially among vulnerable groups like children and the elderly.
- Secondary exposure also occurs when workers return home in contaminated clothing, exposing family members including children.

Sensitive Receptors

- Labourers involved in the handling and transport of pesticides
- Farmers and agriculture workers
- Their families (secondary exposure)
- Migrant labourers
- Community

Impact Significance

Impact significance is estimated to be major as:

¹²⁴ Kim, K. H., Kabir, E. and Jahan, S. A. (2017) 'Exposure to pesticides and the associated human health effects', *The Science of the total environment*, 575, pp. 525–535.

¹²⁵ Sajad, M., Shabir, S., Singh, S., Bhardwaj, R., Alsanie, W., Alamri, A., Alhomrani, M., Alsharif, A., Vamanu, E. and Singh, M. (2024) 'Role of nutraceutical against exposure to pesticide residues: power of bioactive compounds', *Frontiers in nutrition*, 11, pp. 1342881.

- Risks to health and safety can be irreversible and have detrimental, lasting impacts on workers physical as well as mental health. There are also cascading impacts on household income and national healthcare systems.

Storage and Handling – Risk of Explosions

Predicted Changes

- Improper storage of concentrated pesticide products, especially under high temperatures and humidity (typical in the Maldives), can lead to spontaneous combustion or chemical reactions.
- Accidental fires can release toxic fumes and spread contaminants to soil and groundwater, creating complex emergency and clean-up scenarios.

Sensitive Receptors

- Storage workers
- Nearby residents and facilities
- Environment (soil, water, air)

Impact Significance

Impact significance is estimated to be moderate as:

- Explosions involving pesticide warehouses can cause fatalities and long-term contamination, especially in islands with limited emergency response capacity.

Labour and working conditions – Migrant workers

Predicted Changes

- Migrant workers employed in agriculture in the Maldives often engage in high-risk pesticide-related tasks (mixing, spraying, disposal) without adequate safety gear or training.
- Without formal contracts or grievance mechanisms, workers are vulnerable to exploitative practices, wage theft, long working hours, and exposure to unsafe chemical storage environments.ⁱ

Sensitive Receptors

- Migrant farm workers
- Informally employed pesticide handlers

Impact Significance

Impact significance is estimated to be major as:

- Health risks and poor working conditions violate basic labour rights and increase the likelihood of acute poisoning, chronic illness, and psychosocial stress.
- Undocumented workers are often excluded from health monitoring, social protection schemes, or formal recourse, exacerbating their vulnerability and institutional invisibility

6.2.2 Environmental Impacts

Groundwater and soil

Predicted Changes

- Improper pesticide storage, spillage, leaching, and heavy rains increase the risk of contamination of shallow aquifers and topsoil layers in the Maldives. The islands' porous limestone geology and thin freshwater lens make groundwater especially vulnerable to pollution.
- Contaminated soil leads to loss of beneficial microorganisms and decreased soil fertility, affecting long-term crop productivity and increasing reliance on synthetic inputs.
- Repeated contamination can reduce natural remediation capacity of soils and increase cumulative toxicity in both terrestrial and marine systems.

Sensitive Receptors

- Groundwater lens
- Soil ecosystems
- Farmers
- Community

Impact Significance

Impact significance is estimated to be major as:

- The Maldives relies heavily on rainwater and shallow groundwater for freshwater supply. Pesticide intrusion reduces the availability of potable water and can lead to long-term loss of soil fertility, biodiversity, and self-sustaining farming practices.



- Soil degradation leads to reduced resilience of farming systems and increased dependency on external inputs, perpetuating a cycle of ecological and economic vulnerability.

6.2.3 **Economic Impacts**

Marine and Coastal Environment – Tourism Impact

Predicted Changes

- In the Maldives, runoff during the monsoon season from agricultural areas can carry pesticides into coastal lagoons, impacting coral reefs and marine biodiversity. This seasonal runoff also increases the risk of soil contamination, particularly on the country's limited arable land, with potential long-term consequences for food security and land productivity.
- This degrades reef health and visibility—key tourism assets in the Maldives—potentially reducing dive and snorkel-related revenue and increasing reputational risk for eco-resorts.

Sensitive Receptors

- Coral reef ecosystems
- Marine species
- Tourism operators and tourists

Impact Significance

Impact significance is estimated to be major as:

- The degradation of marine ecosystems directly affects the Maldives' tourism economy, which accounts for more than half of the national GDP.

6.3 Cumulative Impacts

The cumulative impacts of pesticide use in the Maldives extend beyond immediate health and ecological risks, contributing to long-term challenges that threaten environmental, social, and economic sustainability.

Human Health and Wellbeing: Chronic exposure to pesticides whether through direct contact, contaminated water, or food residues can lead to reproductive, developmental, and neurological health issues. Vulnerable populations such as children, pregnant women, and farm workers are especially at risk. Migrant agricultural workers face cumulative occupational exposure without adequate protections, amplifying long-term health consequences and social inequities.

Environmental Degradation: Repeated and widespread use of pesticides contributes to the gradual depletion of soil quality and contamination of the freshwater lens, an important source of non-potable water. These changes are compounded by the islands' porous limestone geology and limited arable land, leading to persistent damage even at low contamination levels.

Marine and Coastal Ecosystems: Runoff and leaching of pesticides into coastal waters can affect coral reefs, fish populations, and seagrass beds. This can potentially disrupt marine food chains and fisheries over time.

Climate Vulnerability and Ecosystem Resilience: The loss of biodiversity, degradation of soil, and disruption of ecological services such as pollination and natural pest control reduce the Maldives' resilience to climate-induced stresses such as flooding, saltwater intrusion, and storm surges. These cumulative ecological stresses interact with and intensify the impacts of climate change.

Economic Impacts on Agriculture and Tourism: With approximately 90% of its food requirements met through imports, the Maldives' agricultural sector remains underdeveloped, contributing only about 1.1% to the national GDP between 2014 and 2018. Declining soil fertility and ecosystem degradation further hinder local agricultural productivity, potentially increasing dependency on imports. Simultaneously, environmental degradation; including polluted coastal waters and diminished marine biodiversity; may reduce the appeal of the Maldives as a pristine tourism destination, threatening its largest revenue-generating sector.

Regulatory and Governance Challenges: Cumulative impacts are exacerbated by gaps in regulatory enforcement, weak monitoring of pesticide imports and usage, limited data on pesticide residues in ecosystems, and lack of inter-agency coordination. Over time, these governance failures reinforce systemic vulnerabilities and reduce the capacity to mitigate risks.

7 Life Cycle Analysis

This LCA evaluates Diafenthion and Deltamethrin; two widely used pesticide in the Maldives. The LCA is for the supply chain stages used in this report i.e. import, storage, transport and distribution, end-use and disposal.

7.1 Diafenthion

Diafenthion is a widely used insecticide in the Maldives, and this LCA evaluates its environmental impacts with a focus on three key areas: biodiversity, soil health, and water pollution.

Diafenthion has low acute oral and dermal toxicity in humans and moderate inhalation toxicity, while being categorised by the WHO as a Class III pesticide active ingredient (slightly hazardous).¹²⁶ Diafenthion is extremely toxic to aquatic organisms and non-target species, which poses major environmental concerns in the delicate island ecosystem of the Maldives.¹²⁷ The assessment is based on general global assumptions.

7.1.1 Inventory Analysis

Table 7-1 Inventory Analysis for Diafenthion

Stage	Chemical	Unit	Input	Output	Notes
Importation	Diafenthion	kg	5242		According to Maldives Customs Import Data in 2024 ¹²⁸
	Marine diesel	litre	34		Transportation from Turicorin Port to the Maldives, a distance of 890km on a 380 TEU cargo ferry. ¹²⁹
	Carbon dioxide	kg		109	Based on Table 7-2.
	Spillage	%		2	

¹²⁶ World Health Organization (2020) *WHO recommended classification of pesticides by hazard and guideline to classification*, 2019 edition Geneva.

¹²⁷ National Registration Authority for Agricultural and Veterinary Chemicals (Australia) Public release summary of the evaluation by the NRA of the new active constituent : Diafenthion in the product : Pegasus Miticide. 1996. National Registration Authority for Agricultural and Veterinary Chemicals.

¹²⁸ Maldives Customs Service (2024) 'Total Import 2024'. Available at: <https://www.customs.gov.mv/Statistics> (Accessed: 10 Feb 2024).

¹²⁹ Ortiz-Pérez, M. D., Torres-Dosal, A., Batres, L. E., López-Guzmán, O. D., Grimaldo, M., Carranza, C., Pérez-Maldonado, I. N., Martínez, F., Pérez-Urizar, J. and Díaz-Barriga, F. (2005) 'Environmental Health Assessment of Deltamethrin in a Malarious Area of Mexico: Environmental Persistence, Toxicokinetics, and Genotoxicity in Exposed Children', *Environmental Health Perspectives*, 113(6), pp. 782–786.

	Plastic (packaging)	kg	25		Stored in standard 5-25kg HDPE containers.
Storage	Diafenthion	kg	5137		
	Electricity consumption	kWh/year	54750		Assumed electricity consumption for a 3000sqft storage shed.
	Carbon dioxide	kg		39968	Based on Table 7-2.
	Spillage	%		2	
Distribution	Diafenthion	kg	5034		
	Spillage	%		3	
	Diesel (for marine transport)	litre	3003		Average inter-island transport distance was taken to be 238km.
	Diesel (for land transport)	litre	0.88		Based on Table 7-2.
	Carbon dioxide	kg		9627	Based on Table 7-2.
Application	Diafenthion	litre	644		
	Fresh water	litre	3222		Assumed to be diluted at a ratio of 1:5 with water.
	Electricity consumption	kWh	22		Assumed to consume small amounts of electricity 0.6kWh per session
	Carbon dioxide	kg		16	Based on a CO ₂ emission factor of 0.73 kg CO ₂ per kWh.
Disposal	Diafenthion residue	kg	64		Assuming that 10% of the applied Diafenthion remains as residue
	Expired Diafenthion containers	kg	786.3		Assuming that 15% of the Diafenthion stock is expired
	Plastic (HDPE in containers)	kg	97		Used containers plus expired containers
	Carbon dioxide	kg		280	Based on Table 7-2.
	Dioxins and furans	kg		Trace	

Table 7-2 Emissions from the life cycle of Diafenthion

Energy/Material Type	CO ₂ Emission Factor	Unit
Marine Diesel Oil ¹³⁰	3.205 kg CO ₂ e	per litre

¹³⁰ Herdzyk, J. (2021) 'Decarbonization of marine fuels—The future of shipping', *Energies*, 14(14), pp. 4311.

Diesel (Land transport)¹³¹	2.68 kg CO ₂ e	per litre
Electricity (Maldives grid)¹³²	0.73 kg CO ₂	per kWh
High-Density Polyethylene (HDPE)¹³³	2.6 kg CO ₂	per kg

7.1.2 Lifecycle Stages and Impacts

Importation

Process: Diafenthiuron is imported primarily from India via container ships and arrives at Male' Port.

Assumptions:

- In 2024, the Maldives imported 34,949 kg of pesticides from India, with Diafenthiuron estimated to account for 15%.
- Upon arrival at the Male' port, Diafenthiuron is typically unloaded via forklifts and is stored in standard 5–25 kg high-density polyethylene (HDPE) containers.
- Spillage risks are highest during the following activities:
 - Containers may be left exposed to environmental elements such as rain or direct sunlight during temporary storage at the port. Prolonged exposure can compromise packaging integrity, especially if the containers are not weatherproof or adequately sheltered.
 - If Diafenthiuron containers are not securely fastened within the shipping container during loading, rough sea conditions can cause the cargo to shift. This movement may lead to ruptures, leaks, or collapse of internal packaging.
 - Excessive vertical stacking of the containers during shipment may increase internal pressure resulting in leakage or container deformation during transit.
 - During offloading, there is a risk of puncture or mechanical damage, if containers are mishandled or dropped. This risk is increased when there is no prior visual inspection of container integrity before unloading begins.

¹³¹ Zahoor, A., Mehr, F., Mao, G., Yu, Y. and Sápi, A. (2023) 'The carbon neutrality feasibility of worldwide and in China's transportation sector by E-car and renewable energy sources before 2060', *Journal of Energy Storage*, 61, pp. 106696.

¹³² U4E (2020) 'Maldives Savings Policy Assessment'.

¹³³ Benavides, P. T., Lee, U. and Zarè-Mehrjerdi, O. (2020) 'Life cycle greenhouse gas emissions and energy use of polylactic acid, bio-derived polyethylene, and fossil-derived polyethylene', *Journal of Cleaner Production*, 277, pp. 124010.

- Many pesticide consignments lack secondary containment (e.g., banded pallets or sealed crates). In the event of primary packaging failure, the pesticide may leak directly onto the container floor. This can potentially lead to the contamination of the port environment upon unloading.
- Transportation emissions from production sites to the Maldives contribute to greenhouse gas emissions.

Impacts:

- **Water Pollution:** Accidental leakage of Diafenthiuron during transport or offloading at the port can result in direct discharge into the marine environment. It poses a significant risk to surrounding water bodies due to its high toxicity to aquatic organisms.
- **Soil Health:** Impacts on soil health are minimal at this stage unless a spill occurs directly onto uncontained ground surfaces.
- **Biodiversity:** Marine biodiversity at ports may be at risk due to chemical leaks.

Storage

Process: Diafenthiuron is typically stored in general-purpose warehouses, often shared with other goods. These facilities are usually not equipped with environmental controls such as temperature regulation or humidity management. From these storage sites, the pesticide is distributed to agricultural islands.

Assumptions:

- Diafenthiuron should be stored in a dry, well-ventilated area, protected from direct sunlight and moisture to avoid chemical degradation.
- The electricity required to maintain acceptable storage conditions (including lighting and ventilation) is 55.8 kWh/day for a 3000 sq. ft. storage area.
- Poor storage conditions may degrade the pesticide, potentially increasing the toxicity of breakdown products.
- Containment measures such as impermeable flooring, bunds, and spill kits are generally inadequate or missing, increasing the risk of accidental release or leakage.

Impacts:

- **Water Pollution:** Risk of runoff or leakage from warehouses contaminating nearby water sources especially during seasonal heavy rainfall.

- **Soil Health:** Spills can lead to localized soil contamination. The compound and its by-products have a tendency to adhere firmly to soil particles, remaining concentrated in the topsoil. This reduces the chance of deep leaching, but it can also have a big impact on microbial communities, inhibit nitrogen-fixing bacteria, and decrease the fertility of the soil. In sandy or coral-based soils, such contamination can create long-term pollution hotspots, especially where remediation is delayed or not undertaken.
- **Biodiversity:** Though Diafenthiuron has low water solubility, it has a moderate potential for bioaccumulation. If it reaches nearby aquatic environments, even in small amounts, it may accumulate in marine organisms over time, potentially disrupting marine food chains and threatening local biodiversity.
- **Human health:** Personnel handling improperly stored or degraded Diafenthiuron are at a risk of slight skin and eye irritation with moderate inhalation toxicity.

Distribution

Process: After storage, Diafenthiuron is transported from centralized storage facilities (e.g., Thilafushi) to distribution hubs or directly to retailers and end-users. Transport typically involves rented diesel-powered light-duty pickup trucks to navigate on the islands. Cargo vessels are used to transport Diafenthiuron from storage to outer islands such as, Thoddoo, Fuvahmulah, Kelaa, Thunburi and Kaashidhoo. The approximate distances from Male' were taken as below:

Table 7-3 Distance from Male' to some outer islands

Island	Distance from Male (km) ¹³⁴
Aa.Thoddoo	~67.6
Gn.Fuvamulah	~497
Ha.Kelaa	~311
L.Thunburi	~233
K.Kaashidhoo	~86
<u>Total Distance (km)</u>	1,194
<u>Average Distance (km)</u>	238

¹³⁴ Maldives Bureau of Statistics (2009) 'Area and Distance to Male' and Atolls Capitals, By Locality'. Available at: <https://statisticsmaldives.gov.mv/yearbook2009/Geograpy/1.5.htm> (Accessed: 10 Feb 2024).

Assumptions:

- Limited training for transport staff in handling hazardous chemicals.
- Absence of secondary containment measures during transport (e.g., spill-proof containers).
- Use of general-purpose vehicles without proper safety features for transporting hazardous materials.
- High spillage risk during loading/unloading at island jetties or transfer to smaller boats.

Impacts:

- **Water Pollution:** Accidental spills during transport, particularly during loading and unloading onto boats, can lead to pesticide contamination in nearby marine environments. Diafenthiuron residues from unsealed or poorly handled containers can leak into coastal waters, affecting marine biodiversity. Diafenthiuron is sparingly soluble in water but may reach surface water through runoff or container leakage. Once in aquatic environments, it tends to bind to sediments but may gradually release residues over time. This slow release can lead to the accumulation of Diafenthiuron in lagoons and reef flats, especially in areas with limited tidal flushing. Such conditions can create chronic contamination zones that pose long-term risks to marine ecosystems.
- **Soil Health:** If spills occur during land transport, localized soil contamination may result due to strong adsorption to soil particles. The residues of Diafenthiuron can persist in tropical soils for 5 to 30 days, with longer persistence in low-organic content soils.¹³⁵ Therefore, the risk of disruption to microbial activity and reduced soil fertility is increased in exposed areas.
- **Biodiversity:** Both marine and terrestrial biodiversity are at risk from accidental releases during transit. Marine life near jetties such as fish, algae, and crustaceans is particularly vulnerable to Diafenthiuron and its breakdown products, which are toxic even at low concentrations. The compound has a moderate potential for bioaccumulation, and repeated low-level exposure can affect reproductive health and alter food web dynamics in coral reef ecosystems.

¹³⁵ National Registration Authority for Agricultural and Veterinary Chemicals (Australia) Public release summary of the evaluation by the NRA of the new active constituent : Diafenthiuron in the product : Pegasus Miticide. 1996. National Registration Authority for Agricultural and Veterinary Chemicals.

Application

Process: Diafenthiuron is applied using handheld sprayers, backpack sprayers, or motorized mist blowers, often without precision. Based on field surveys conducted in 2019, insecticides including Diafenthiuron are applied three times per month, with an average of 17.9 litres per application.

Assumptions:

- Non-target exposure to beneficial insects and aquatic organisms.
- Power-driven mist blowers consume small amounts of electricity in the range of 0.3–0.6 kWh per session.
- Many farmers lack formal training in pesticide safety or application precision.
- Applications are often done manually, with minimal consideration of wind drift or runoff.
- Protective gear is inconsistently used, increasing risk of exposure for applicators and nearby ecosystems.
- Fields are located close to residential zones or freshwater bodies in islands such as Thoddoo and Fuvahmulah City, increasing the chance of non-target contamination.

Impacts:

- **Water Pollution:** Significant contamination of freshwater systems and coastal environments due to runoff.
- **Soil Health:** Accumulation of toxic residues reduces soil fertility and microbial activity.
- **Biodiversity:** Harm to non-target species, including pollinators (e.g., bees) and aquatic life, disrupting ecological balance.¹³⁶
- **Human health:** Personnel handling Diafenthiuron are at a risk of slight skin and eye irritation with moderate inhalation toxicity. In addition to this, repeated exposure can result in risk of lung lesions including via the skin.

Disposal

Process: Expired or unused Diafenthiuron is often disposed of through open dumping or burning due to a lack of proper disposal facilities.

¹³⁶ Ibid.

Assumptions:

- Improper disposal can introduce unintentional persistent organic pollutants (POPs) into the environment although Diafenthiuron is not a POP.
- No formal retrieval system exists for expired stocks.

Impacts:

- **Water Pollution:** Open dumping may allow Diafenthiuron to leach into groundwater or surface water, especially during rainfall, posing a contamination risk. Although Diafenthiuron has low water solubility, it can bind strongly to soil particles and still reach aquatic environments via soil erosion or runoff, particularly during rainy season.
- **Soil Health:** Improper disposal of Diafenthiuron, particularly through open dumping can lead to direct soil contamination due to its strong sorptivity to soil particles. This persistence can disrupt soil microbial communities and reduce nutrient cycling, ultimately degrading soil fertility over time.¹³⁷ Moreover, repeated dumping in the same location can result in localized accumulation of pesticide residues.
- **Biodiversity:** While Diafenthiuron itself is not a POP, improper burning under low-temperature, uncontrolled conditions may result in the unintentional formation of POPs such as dioxins and furans. These byproducts can bioaccumulate in food chains, threatening soil organism, aquatic species, and birds.

7.1.3 *Interpretation*

Water Pollution: Diafenthiuron's potential to cause water pollution primarily arises from improper handling and storage during transport and application. Lack of adequate training and awareness among workers handling the pesticide can result in spills, improper containment, or illegal disposal into open fields or coastal areas, which leads to the pesticide reaching aquatic ecosystems. Although Diafenthiuron has low water solubility, it can still contaminate water bodies through runoff, especially if applied excessively or without proper safeguards. This can result in harmful effects on marine life, particularly in the Maldives' fragile coral reef ecosystems, where even small concentrations of pesticides can disrupt aquatic biodiversity.

Soil Health: Soil contamination from Diafenthiuron occurs from poor storage, improper application practices, or improper disposal methods, such as dumping unused pesticides into fields can cause the pesticide to seep into the ground. Insufficient training on safe handling and application methods increases the risk of spills, which can then lead to long-

¹³⁷ Ibid.

term damage to soil health. The pesticide's strong affinity for soil particles causes it to accumulate in the topsoil, impacting microbial activity and reducing fertility. Over time, this can degrade soil quality, making it harder for plants to grow and affecting agricultural productivity, especially in areas where repeated pesticide use occurs without adequate knowledge of its long-term effects and where waste is buried without proper containment.

Biodiversity: The impact on biodiversity is largely due to the toxicity of Diafenthiuron to non-target species. Improper application, often a result of inadequate training, can cause the pesticide to affect beneficial insects, such as pollinators, and aquatic life. Inadequate spill containment during transportation and storage, further exacerbates the risk of contamination. When empty containers are discarded in the open or washed onto beaches and into lagoons, residual pesticide can enter terrestrial and aquatic environments, affecting non-target organisms. These impacts threaten the health of ecosystems in the Maldives, where delicate marine life and terrestrial fauna are vulnerable to pesticide exposure. Poor application techniques and lack of proper disposal methods contribute to persistent environmental damage.

7.1.4 *Targeted Improvements*

1. Improve Application Practices: Farmers should receive training on precision application techniques to minimize runoff and overuse of Diafenthiuron. Additionally, promoting Integrated Pest Management (IPM) strategies can reduce the dependence on Diafenthiuron and other harmful chemicals, lowering environmental risks. Regular residual testing on crops can also be implemented to ensure that pesticide residues are within safe limits, preventing harmful levels from entering the food chain.

2. Enhance Storage and Spill Management: Regulations should be enforced to ensure Diafenthiuron is stored in facilities with proper spill containment measures. Regular inspections of storage sites must be conducted to ensure compliance and prevent accidental releases, thereby reducing the risk of contamination.

3. Establish Proper Disposal Systems: Alongside operationalizing the chemical incinerator in Addu City, a dedicated disposal facility should also be established in the Malé region to enhance accessibility and feasibility. A nationwide collection program for expired and unused diafenthiuron stocks is recommended, incorporating designated drop-off points and public awareness campaigns to discourage unsafe practices such as open dumping or burning.

4. Monitor Environmental Impacts: Regular water and soil testing should be conducted in areas with high pesticide use to track contamination levels. Additionally, establishing biodiversity monitoring programs will help assess the impact on pollinators and aquatic life, providing crucial data for future mitigation strategies.



5. Encourage Alternatives: Promoting the use of biopesticides or less harmful alternatives to Diafenthiuron can significantly reduce environmental risks, offering safer solutions for pest control while maintaining crop protection in the Maldives.

6. Explore International Disposal Options: Given the limitations of local facilities, the feasibility of exporting hazardous pesticide waste for safe disposal under international conventions such as the Basel Convention should be assessed. This approach may provide a more sustainable solution, especially for stocks that cannot be safely treated within the country.

7.2 Deltamethrin

Deltamethrin is a type II pyrethroid insecticide widely used in both agriculture and public health protection, for controlling diseases such as dengue fever and malaria¹³⁸. In the Maldives, Deltamethrin is an essential tool reducing the prevalence of vector-borne diseases and safeguarding public health. It is widely used for fogging and indoor residual spraying because of its proven effectiveness. However, despite its critical role in disease control, deltamethrin also poses potential risks to human health, the environment, and local biodiversity.

The LCA for Deltamethrin has been conducted with a specific focus on its use in public health interventions within the Maldives. The study also acknowledges its use in agriculture, though public health use remains the primary lens of analysis. The following impact categories, which are of particular relevance to public health and environmental safety in the Maldives: Human health, Soil health, Biodiversity and Water pollution.

7.2.1 Inventory Analysis

Table 7-4 Inventory Analysis for Deltamethrin

Stage	Chemical	Unit	Input	Output	Notes
Importation	Deltamethrin	kg	2913		According to Maldives Customs Import Data in 2024.
	Marine diesel	litre	34		Transportation from Tuticorin Port to the Maldives, a distance of 890km on a 380 TEU cargo ferry.
	Carbon dioxide	kg		109	Based on Table 7-5.
	Spillage	%		2	
	Plastic (packaging)	kg	150		Assuming a mixed use of 5L and 25L HDPE containers.
Storage	Deltamethrin	kg	2149		
	Electricity Consumption	kWh / year	56000		Assuming electricity consumption with cooling for a 3000sqft storage shed required for Deltamethrin
	Carbon dioxide	kg	40880		Based on Table 7-5.
	Spillage	%		2	

¹³⁸ Ortiz-Pérez, M. D., Torres-Dosal, A., Batres, L. E., López-Guzmán, O. D., Grimaldo, M., Carranza, C., Pérez-Maldonado, I. N., Martínez, F., Pérez-Urizar, J. and Díaz-Barriga, F. (2005) 'Environmental Health Assessment of Deltamethrin in a Malarious Area of Mexico: Environmental Persistence, Toxicokinetics, and Genotoxicity in Exposed Children', *Environmental Health Perspectives*, 113(6), pp. 782–786.

Distribution	Deltamethrin	kg	2106		
	Spillage	%		3	
	Marine diesel	litre	1943		Average inter-island transport distance was assumed to be 185km considering six scattered resorts across northern, central and southern region.
	Diesel	litre	0.88		For small vehicles used in the islands.
	Carbon dioxide	kg		6228	Based on Table 7-5.
Application (for one island)	Deltamethrin	litre	1790		The application rate is assumed to be 75mL product per hectare with a maximum of 10 applications per year.
	Fresh water	litre	540		Water volumes of 20-30 L/ha can be used for fogging.
	Electricity consumption	kWh	22		Assumed to consume small amounts of electricity 0.6kWh per session.
	Carbon dioxide	kg		16	Based on Table 7-5.
Disposal	Deltamethrin residue	kg	179		
	Expired/unused Deltamethrin	kg	316		Assumed 15% of Deltamethrin is unused.
	Plastic (HDPE in containers)	kg	97		Used containers and unused containers.
	Carbon dioxide	kg		251	
	Carbon Monoxide	kg		Trace	
	Bromide ion, Cyanide ions etc	kg		Trace	

Table 7-5 Emissions from the life cycle of Deltamethrin

Energy/Material Type	CO ₂ Emission Factor	Unit	Notes
Marine Diesel Oil ¹³⁹	3.205 kg CO ₂ e	per litre	(Herdzik, 2021)
Diesel (Land transport) ¹⁴⁰	2.68 kg CO ₂ e	per litre	(Zahoor <i>et al.</i> , 2023)
Electricity (Maldives grid) ¹⁴¹	0.73 kg CO ₂	per kWh	(U4E, 2020)
High-Density Polyethylene (HDPE) ¹⁴²	2.6 kg CO ₂	per kg	(Benavides, Lee and Zarè-Mehrjerdi, 2020)

7.2.2 Lifecycle Stages and Impacts

Importation

Process: Deltamethrin is imported into the Maldives primarily from countries such as India or China in formulated forms such as emulsifiable concentrate or ultra-low volume liquids. These are transported via container ships and typically arrive at Malé Port. The insecticide is packed in 50–500 ml HDPE bottles or aluminium sachets housed in secondary cardboard cartons.

Assumptions:

- In 2024, the Maldives imported an estimated 18,277 kg of insecticides from India, with deltamethrin accounting for approximately 10–12% of this volume, reflecting its widespread use in vector control and fogging operations.¹⁴³
- Deltamethrin products arrive in small-volume containers suited for field application and are frequently delivered with other chemicals
- Upon arrival at the port, insecticides are offloaded either manually or with forklifts and are often temporarily stored in open yards.
- Spillage and contamination risks are elevated in the following scenarios:

¹³⁹ Herdzik, J. (2021) 'Decarbonization of marine fuels—The future of shipping', *Energies*, 14(14), pp. 4311.

¹⁴⁰ Zahoor, A., Mehr, F., Mao, G., Yu, Y. and Sápi, A. (2023) 'The carbon neutrality feasibility of worldwide and in China's transportation sector by E-car and renewable energy sources before 2060', *Journal of Energy Storage*, 61, pp. 106696.

¹⁴¹ U4E (2020) 'Maldives Savings Policy Assessment'

¹⁴² Benavides, P. T., Lee, U. and Zarè-Mehrjerdi, O. (2020) 'Life cycle greenhouse gas emissions and energy use of polylactic acid, bio-derived polyethylene, and fossil-derived polyethylene', *Journal of Cleaner Production*, 277, pp. 124010.

¹⁴³ Maldives Customs Service (2024) 'Total Import 2024'. Available at: <https://www.customs.gov.mv/Statistics> (Accessed: 10 Feb 2024).

- High temperatures and humidity in port storage areas can cause expansion or softening of packaging for low-grade HDPE bottles.
- Poor stacking during sea freight can cause compression damage or rupture of secondary packaging.
- Lack of secondary containment meaning that, pesticides can seep directly onto shipping container floors at the port.
- Manual offloading without inspection may result in ruptured or leaking bottles being handled unknowingly, increasing the risk of dermal exposure to port workers.

Impacts:

- **Water Pollution:** Accidental leakage of Deltamethrin during transport or offloading at the port can result in direct discharge into the marine environment. It is not rapidly biodegradable in aquatic environment.¹⁴⁴
- **Soil Health:** Minimal impact during this stage.
- **Biodiversity:** It causes toxic effects to aquatic organisms.¹⁴⁵
- **Human Health:** Workers handling Deltamethrin are at risk of acute toxicity.¹⁴⁶

Storage

Process: Deltamethrin is typically stored in general-purpose warehouses, often shared with other goods. These warehouses lack specialized infrastructure such as temperature or humidity control. After procurement or direct import, Deltamethrin is distributed to residential islands or resorts according to need.

Assumptions:

- Deltamethrin should be stored in a dry, well-ventilated area, protected from direct sunlight and moisture to avoid chemical degradation.

¹⁴⁴ Yadav, R., Shinde, N., Patil, K., Kote, A. and Kadam, P. (2023) 'Deltamethrin toxicity: impacts on non-target organisms and the environment'.

¹⁴⁵ Ortiz-Pérez, M. D., Torres-Dosal, A., Batres, L. E., López-Guzmán, O. D., Grimaldo, M., Carranza, C., Pérez-Maldonado, I. N., Martínez, F., Pérez-Urizar, J. and Díaz-Barriga, F. (2005) 'Environmental Health Assessment of Deltamethrin in a Malarious Area of Mexico: Environmental Persistence, Toxicokinetics, and Genotoxicity in Exposed Children', *Environmental Health Perspectives*, 113(6), pp. 782–786.

¹⁴⁶ Ibid.

- The electricity required to maintain acceptable storage conditions (including lighting and ventilation) is 55.8 kWh/day for a 3000 sq. ft. storage area however, this might be higher in resorts due to air-conditioned spaces.
- Poor storage conditions may degrade the pesticide, potentially increasing the toxicity of breakdown products.
- Containment measures such as impermeable flooring, bunds, and spill kits are generally inadequate or missing, increasing the risk of accidental release or leakage.

Impacts:

- **Water Pollution:** Due to the close proximity of resort facilities to marine environments, leaks or improper disposal from storage areas can lead to pesticide runoff into lagoons and beaches. Studies have detected deltamethrin residues in surface water samples, indicating the potential for contamination of surrounding water sources.¹⁴⁷
- **Soil Health:** Deltamethrin can persist in soil for a long duration leading to long term effects on the health of the soil.¹⁴⁸
- **Biodiversity:** The Maldives' tourism economy relies on pristine reef ecosystems. Even trace amounts of deltamethrin entering marine environments can bioaccumulate in reef, harming sensitive species and disrupting food webs in the reef.
- **Human health:** Workers handling Deltamethrin are at risk of skin and eye irritation or respiratory exposure, especially without protective equipment.¹⁴⁹

Distribution

Process: In the Maldives, deltamethrin intended for public health use is transported from central warehouses to islands and resorts by sea, typically using cargo ferries, *dhonis*, and supply boats. These vessels often carry mixed loads, including fuel, food, and construction materials, with limited separation for hazardous substances. Upon arrival at each island, the pesticide is typically transferred using small pickups or mini-vehicles to storage rooms. These local movements are short.

Assumptions:

¹⁴⁷ Yadav, R., Shinde, N., Patil, K., Kote, A. and Kadam, P. (2023) 'Deltamethrin toxicity: impacts on non-target organisms and the environment'.

¹⁴⁸ Ibid.

¹⁴⁹ Ibid.

- Deltamethrin is packaged in cardboard cartons, without any secondary containment, during marine transport.
- Loading and unloading occur near island jetties or resort supply docks, without proper spill response protocols.
- Rain and big waves during open-sea transport can damage packaging, particularly during long or rough trips.
- There are no dedicated emergency procedures or equipment for marine pesticide spills.

Impacts:

- **Water Pollution:** Leakage during shipping can lead to direct contamination of lagoon ecosystems and coral reefs. Deltamethrin residues have been detected in water samples from agricultural regions at concentrations exceeding the recommended limit by World Health Organization, indicating its potential to pollute local aquatic environment.¹⁵⁰
- **Soil Health:** Deltamethrin can persist in the soil which can result in long-term effect on its health.¹⁵¹ In resort zones where landscaping and surface runoff further distributes residues.
- **Biodiversity:** Deltamethrin is toxic to aquatic organisms affecting their growth rate and reproduction rate. This is because it can accumulate in the fatty tissues of aquatic organisms.¹⁵²
- **Human health:** Workers handling the pesticide during distribution without proper PPE may be exposed through skin contact, inhalation of vapours, or accidental spills. Lack of segregation in transport can lead to accidental misuse, increasing the chance of exposure, particularly in resorts or health centres with high staff turnover.

¹⁵³

¹⁵⁰ Ibid.

¹⁵¹ Ibid.

¹⁵² Oliveira, J. M., Losano, N. F., Condessa, S. S., de Freitas, R. M. P., Cardoso, S. A., Freitas, M. B. and de Oliveira, L. L. (2018) 'Exposure to deltamethrin induces oxidative stress and decreases of energy reserve in tissues of the Neotropical fruit-eating bat *Artibeus lituratus*', *Ecotoxicology and Environmental Safety*, 148, pp. 684–692.

¹⁵³ Ibid.

End-use

Process: Deltamethrin is applied across Maldivian islands primarily for mosquito control under public health campaigns. Common methods of application include fogging machines mounted on vehicles or carried by hand, and occasionally handheld sprayers for indoor residual spraying. Applications are often conducted outdoors in the early mornings or evenings, particularly in residential areas, resort islands, and urban centres like Male’.

Assumptions:

- Non-target exposure to beneficial insects and aquatic organisms.
- ULV spraying is only advised during dengue outbreaks with the permission of Health Protection Agency, however, in some islands fogging is done daily.
- Electric or fuel-powered fogging machines are used which consumed electricity and generates emissions.
- Many operators lack formal training in pesticide safety or application precision.
- Fogging is conducted near residential zones and water bodies, including resort islands without adequate buffer zones.

Impacts:

- **Water Pollution:** Deltamethrin has the potential to contaminate both freshwater and marine ecosystems through surface runoff, especially following applications in vector control or agriculture. Due to its fat-soluble nature, it tends to accumulate in sediments and aquatic species, raising concerns for coral reef health and marine biodiversity.¹⁵⁴
- **Soil Health:** Repeated ground-level applications, such as fogging or spraying, can cause deltamethrin to accumulate in the upper layers of soil. Elevated concentrations may suppress beneficial microbial populations like bacteria, fungi, and actinomycetes, and reduce essential soil enzyme activity.¹⁵⁵ These disruptions can alter the soil’s physical and chemical characteristics, including lowering pH, degrading organic matter, and depleting key nutrients like phosphorus and nitrogen.¹⁵⁶

¹⁵⁴ Ibid.

¹⁵⁵ Ibid.

¹⁵⁶ Ibid.

- **Biodiversity:** As a broad-spectrum insecticide, deltamethrin can be harmful to organisms beyond its intended targets. Its toxicity to aquatic life and pollinators such as bees raises concerns about ecological balance. Over time, it may accumulate through food chains, potentially destabilizing ecosystems.¹⁵⁷
- **Human Health:** Individuals involved in the handling or application of deltamethrin may experience mild irritation to the skin and eyes, as well as moderate risks when inhaled. Acute exposure may affect the nervous system and trigger allergic responses. However, there remains limited research on its long-term health impacts in humans.¹⁵⁸

Disposal

Process: In the absence of a structured hazardous waste management system, expired or unused deltamethrin products are frequently discarded via open dumping or burning. Most regions in the Maldives currently lack centralized infrastructure for the safe collection, treatment, or retrieval of pesticide waste, resulting in uncontrolled disposal practices.

Assumptions:

- Improper disposal can introduce persistent organic pollutants (POPs) into the environment.
- No formal retrieval system exists for expired stocks.

Impacts:

- **Water Pollution:** Open dumping or improper burning can contaminate groundwater and surface water when leachate generated from the dumpsites is transported during rainfall events.
- **Soil Health:** Dumping deltamethrin directly onto bare ground can leave persistent residues that may alter soil pH, reduce organic matter, and disrupt nutrient cycling.¹⁵⁹

¹⁵⁷ Ortiz-Pérez, M. D., Torres-Dosal, A., Batres, L. E., López-Guzmán, O. D., Grimaldo, M., Carranza, C., Pérez-Maldonado, I. N., Martínez, F., Pérez-Urizar, J. and Díaz-Barriga, F. (2005) 'Environmental Health Assessment of Deltamethrin in a Malarious Area of Mexico: Environmental Persistence, Toxicokinetics, and Genotoxicity in Exposed Children', *Environmental Health Perspectives*, 113(6), pp. 782-786.

¹⁵⁸ Ibid.

¹⁵⁹ Yadav, R., Shinde, N., Patil, K., Kote, A. and Kadam, P. (2023) 'Deltamethrin toxicity: impacts on non-target organisms and the environment'.

- **Biodiversity:** Under uncontrolled conditions, there is a risk of unintentional formation of bromide ions, cyanide ions, and carbon monoxide.¹⁶⁰ These by-products can bioaccumulate in food chains, threatening soil organism, aquatic species, and birds.
- **Human health:** Residents living near open dump sites risk long-term exposure through contaminated air, soil, or water.

7.2.3 Interpretation

Human Health: Health risks to humans are most pronounced during storage and application phases. Inhabitants and workers in close proximity, particularly on smaller islands, are at risk of exposure through inhalation, dermal absorption, and ingestion of contaminated surfaces or materials. Children are especially vulnerable due to hand-to-mouth behaviours.¹⁶¹ Acute exposure is associated with allergic reactions and effects to the nervous system.¹⁶² Inadequate storage poses a risk of accidental human exposure or contamination of consumables. Deltamethrin can persist on indoor surfaces, and its metabolites have been detected in human urine within 30 minutes of exposure, highlighting the potential for rapid uptake.¹⁶³

Water Pollution: Contamination of water sources by deltamethrin predominantly occurs during application and disposal stages. On tourist islands in the Maldives, deltamethrin is widely applied for vector and pest control, particularly in landscaped areas and around resort infrastructure. Improper application techniques such as excessive spraying, lack of buffer zones, or use immediately before rainfall can lead to surface runoff that carries pesticide residues into adjacent marine ecosystems. Deltamethrin exhibits low water solubility and a prolonged aquatic half-life of up to 126 days, and due to its lipophilicity, it tends to bioaccumulate in the fatty tissues of aquatic fauna.¹⁶⁴ Improper disposal methods, such as discarding residues near coastal zones exacerbate this issue. These practices may pose significant risks to marine biodiversity, as toxicity levels can be exacerbated under

¹⁶⁰ Optimum Agro (2022) *Deltamethrin 10EC Insecticide*.

¹⁶¹ Ortiz-Pérez, M. D., Torres-Dosal, A., Batres, L. E., López-Guzmán, O. D., Grimaldo, M., Carranza, C., Pérez-Maldonado, I. N., Martínez, F., Pérez-Urizar, J. and Díaz-Barriga, F. (2005) 'Environmental Health Assessment of Deltamethrin in a Malarious Area of Mexico: Environmental Persistence, Toxicokinetics, and Genotoxicity in Exposed Children', *Environmental Health Perspectives*, 113(6), pp. 782–786.

¹⁶² Yadav, R., Shinde, N., Patil, K., Kote, A. and Kadam, P. (2023) 'Deltamethrin toxicity: impacts on non-target organisms and the environment'.

¹⁶³ Ortiz-Pérez, M. D., Torres-Dosal, A., Batres, L. E., López-Guzmán, O. D., Grimaldo, M., Carranza, C., Pérez-Maldonado, I. N., Martínez, F., Pérez-Urizar, J. and Díaz-Barriga, F. (2005) 'Environmental Health Assessment of Deltamethrin in a Malarious Area of Mexico: Environmental Persistence, Toxicokinetics, and Genotoxicity in Exposed Children', *Environmental Health Perspectives*, 113(6), pp. 782–786.

¹⁶⁴ Yadav, R., Shinde, N., Patil, K., Kote, A. and Kadam, P. (2023) 'Deltamethrin toxicity: impacts on non-target organisms and the environment'.

elevated temperatures and low water hardness; conditions characteristic of tropical environment.¹⁶⁵

Soil Health: Soil contamination arises mainly during pesticide storage, application, and disposal. Leaks from poorly maintained or corroded containers during storage can lead to localised soil contamination. In the application stage, uncalibrated spraying equipment or over-application can result in excess pesticide settling into the soil. Deltamethrin exhibits strong sorption to soil particles and moderate persistence of 97 days, particularly under aerobic conditions.¹⁶⁶ Disposal practices, such as unregulated dumping or burial of deltamethrin waste, further contribute to its build-up in soils. Over time, this can suppress beneficial soil microbiota, including bacteria, and fungi which is essential for organic matter decomposition and nutrient cycling ultimately leading to reduced fertility and impaired ecosystem function.¹⁶⁷

Biodiversity: The ecological impacts of Deltamethrin span the entire pesticide lifecycle, with significant risks during application and disposal. As a broad-spectrum insecticide, deltamethrin affects non-target terrestrial species such as pollinators and aquatic organisms.¹⁶⁸ On tourist islands, frequent application in non-agricultural zones increases exposure for these organisms. Improper disposal practices allow residual pesticides to enter aquatic systems, where they may cause both acute and chronic toxicity in fish. Deltamethrin's high bioconcentration factor enables it to accumulate in organisms and biomagnify through trophic levels.¹⁶⁹ Furthermore, weak regulatory controls during importation and storage can lead to large stockpiles being mishandled or improperly discarded, thereby heightening ecological risk.

¹⁶⁵ Ibid.

¹⁶⁶ Oliveira, J. M., Losano, N. F., Condessa, S. S., de Freitas, R. M. P., Cardoso, S. A., Freitas, M. B. and de Oliveira, L. L. (2018) 'Exposure to deltamethrin induces oxidative stress and decreases of energy reserve in tissues of the Neotropical fruit-eating bat *Artibeus lituratus*', *Ecotoxicology and Environmental Safety*, 148, pp. 684–692.

¹⁶⁷ Ibid.

¹⁶⁸ Ibid.

¹⁶⁹ Ibid.

7.2.4 Targeted Improvements

1. Improve Application Practices: Individuals involved in spraying Deltamethrin should be trained in proper application techniques, including dosage control and spatial targeting, to prevent unnecessary dispersion. Public health workers and resort staff should receive specific guidance on safe re-entry intervals to minimize human exposure. Adoption of Integrated Vector Management (IVM) strategies should be promoted to reduce over-reliance on chemical pesticides.

2. Strengthen Storage and Handling Regulations: Deltamethrin should be stored in well-ventilated, secure facilities with spill containment systems in place. Training programs should be developed for resort operators, agriculture workers, and island councils on how to manage accidental spills and prevent leaks into nearby water bodies. National regulations should be updated to mandate routine checks and certification of pesticide storage areas.

3. Develop Safe Disposal Infrastructure: As Deltamethrin persists in soil and aquatic environments, disposal of expired or unused stocks must be managed through formalized systems. Establishing regional disposal centres across key atolls would provide facilities for the safe management of expired or unused deltamethrin and associated container.

4. Monitor Environmental and Health Impacts: A national monitoring framework should be implemented to test for Deltamethrin residues in soil, water, and biota particularly around areas with routine fogging or spraying. Health surveillance programs should be introduced to detect signs of acute or chronic exposure, especially among workers and residents in high-application zones. Biodiversity monitoring around resorts and urban zones should assess impacts on coral reefs, pollinators, and aquatic organisms.

5. Promote Safer Alternatives: Promote the transition to biopesticides or mechanical pest control in both public health and tourism sectors. Local councils and resorts should be incentivized to adopt eco-friendly repellents and biological control methods, such as larvivores fish for mosquito control.

6. Assess International Disposal Pathways: Given the persistence and bio-accumulative nature of Deltamethrin, international disposal under agreements like the Basel Convention should be explored for obsolete pesticide stocks. Coordination with regional disposal facilities may provide safer long-term solutions, especially for large-scale users such as resorts or government health programmes.

8 Identification of Inefficiencies and Gaps

The International Code of Conduct on Pesticides Management¹⁷⁰ has been used to identify the inefficiencies and gaps in the supply chain of pesticides and pesticides management in the Maldives. has been applied to identify inefficiencies and gaps in the pesticide supply chain and management practices in the Maldives. For this assessment, the most relevant articles and clauses for each stage of the supply chain have been referenced, rather than providing an exhaustive list from the Code.

The following sections outline the identified inefficiencies and gaps at each stage of the supply chain.

8.1 Import

Stakeholder interviews and key informant consultations revealed several systemic challenges in the importation stage:

#	Code of Conduct	Inefficiencies and gaps
1	Regulatory Compliance: Ensure adherence to international and national regulations regarding pesticide importation.	<p>Multiple registration requirements across MEDT, MCS, and MAAW result in fragmented and inconsistent data on pesticide importers.</p> <p>Limited involvement of the Ministry of Health (MoH) in the import process, despite the importation of pesticides for public health use.</p> <p>Overlapping or unclear institutional mandates create inefficiencies in regulatory enforcement and compliance, contributing to informal or illegal imports.</p> <p>Sudden regulatory changes, including the introduction of new requirements, can disrupt shipments and increase the risk of non-compliance.</p>
2	Harmonization of data requirements: Ensure robust and consistent data requirements for proper tracking, risk assessments and monitoring.	Inconsistent data requirements across regulatory authorities during registration and permitting processes create opportunities for counterfeiting and illegal trade.

¹⁷⁰ FAO and WHO (2014): *International Code of Conduct on Pesticide Management*. Available at: <https://www.fao.org/fao-who-codexalimentarius/thematic-areas/pesticides/en/#c452840>.

#	Code of Conduct	Inefficiencies and gaps
3	Quality assurance and testing: Possess or have access to facilities to verify and exercise control over the quality of pesticides imported and offered for sale according to FAO or WHO recommended specifications or national specifications.	<p>There are no dedicated analytical laboratories, and existing facilities do not provide services that allow regulatory agencies or importers to verify pesticide type, quality, and concentration.</p> <p>No formal arrangements exist for accessing laboratory facilities in other countries, including neighbouring states.</p> <p>Importers and users often prioritize low-cost options, which may result in compromises on product quality.</p>
4	Earmark adequate resources: Ensure allocation of adequate resources for regulatory implementation and enforcement.	<p>Insufficient resources allocated to regulatory bodies for effective oversight, leading to informal or illegal imports of pesticides.</p> <p>Inadequate technical capacity, such as equipment necessary for on-the-spot testing or verification of labels, active ingredients or packing standards, for enforcement at entry points that allow unauthorized products to enter the market.</p>
5	Risk Assessment: Evaluate potential risks to health and environment before import.	<p>No access to pesticide databases by regulatory authorities to help verify data given by importers during the permit process.</p> <p>There is no system for gathering comprehensive and up-to-date data on pesticide impacts to support the review of risks associated with approved pesticides.</p> <p>There is a shortage of qualified personnel to conduct in-depth risk assessments for both new substance requests and approved pesticides.</p>
6	Information Exchange: Detect and control counterfeiting and illegal trade in pesticides through national inter-agency and intergovernmental cooperation and information sharing.	<p>Importers are not adequately engaged in the compliance process and often lack awareness of permit requirements or training on the use of the Makudi Portal. According to MCS and MoD, the majority of businesses are unaware that substances must be registered in the Makudi Portal prior to import. Importers are also frequently unfamiliar with which pesticides require permits and the procedures for obtaining them.</p> <p>Lack of formal channel from the regulatory authorities to update importers regularly on amendments to the Controlled List. Importers fail to monitor updates on the Controlled List.</p> <p>As a result, unapproved substances are imported, and shipments of permitted pesticides often arrive without the required CIP.</p>
7	Training and Capacity Building: Give high priority to relevant training and capacity building.	<p>No specific training is conducted on the use of the Makudi Portal</p> <p>Training activities are not planned or held on a regular basis.</p>

#	Code of Conduct	Inefficiencies and gaps
		Government officials primarily gain exposure through conferences, workshops, and training programmes abroad.
8	Post registration surveillance and monitoring studies: Collaborate to determine the fate of pesticides and their health and environmental effects.	Regulatory authorities do not conduct systematic tracking, surveillance, or monitoring of pesticides after registration and import.

8.2 Storage

Stakeholder interviews and consultations identified several critical challenges associated with the storage of pesticides in the Maldives:

#	Code of Conduct	Inefficiencies and gaps
1	Regulatory Oversight and Compliance: Establish and enforce regulatory oversight to ensure compliance with all safety and environmental standards.	Insufficient regulatory capacity to monitor and inspect storage facilities on a regular basis, resulting in gaps in compliance with safety standards.
2	Facility Standards: Ensure storage facilities meet safety and environmental standards.	Lack of adequate temperature regulation and environmental controls, leading to potential degradation of pesticides. Standardized safety features like spill containment, ventilation, or proper segregation of hazardous chemicals are also limited to storage facilities that are ISO certified.
3	Safety Protocols: Implement and maintain safe storage practices to prevent contamination and accidents.	No or inadequate training of employees on safety protocols, leading to improper storage practices. Poor record-keeping of storage conditions and safety checks. No monitoring of Storage Facilities by the authorities once the permit is issued.
4	Inventory Management: Keep accurate records of stored pesticides and expiry dates.	No centralised system by the Government to keep track of stock. Importers maintain records of stock for sales purposes. This means that the quantity of obsolete products requiring proper disposal is unknown.
5	Cost Management for Compliance	High costs of upgrading facilities to meet standards pose a barrier to compliance.

8.3 Distribution

The pesticide distribution process is constrained by several logistical and operational challenges as revealed by stakeholders:

#	Code of Conduct	Inefficiencies and gaps
1	Licensing and Training: Ensure distributors are licensed and trained in safe handling and distribution practices.	Although the Pesticides Control Regulation provides for licensing, it is not currently implemented due to limited capacity. As a result, any business with a general business registration is able to trade pesticides.
2	Transport and Handling Standards: Ensure there are protocols for handling pesticides during distribution.	Transport of agricultural pesticides is not monitored for compliance with the requirements in the Pesticide Control Regulation, as the regulation is not currently enforced by MAAW. At this stage, occupational Health and Safety practices are limited or absent, except in businesses operating under ISO standards.
3	Traceability: Maintain a system for tracking pesticide distribution to prevent illegal trade and misuse.	There is no system in place to track pesticides from importation through distribution and final use. Without such tracking it is not possible to know whether supply of pesticides matches demand and prevent oversupplying.
4	Consumer Education: Provide information about safe use and risks to retailers and consumers.	Educational materials are too technical, not translated into local languages, or not adapted to the literacy level of the general public. Information is often only shared at the retailer level, not directly reaching farmers, household users, or workers who actually handle pesticides. There are no systems to assess whether consumers understand and follow the safety guidance.
5	Labelling and Packaging Standards: All pesticide containers should be clearly labelled in line with relevant regulations and/or international best practices.	Labels are not up to standards in national regulations and international guidelines. Labels have tiny fonts, unclear hazard warnings, or technical language that is difficult for users (especially farmers or small retailers) to understand. Labels are often only in the language of the exporting country and not translated into local languages, limiting users' ability to understand safe use, storage, and disposal instructions. Regulatory agencies do not have the capacity to systematically check pesticide labels and packaging at the point of import, sale, or distribution, allowing substandard products into the market.

#	Code of Conduct	Inefficiencies and gaps
6	Training and Education	No standardized system for educating end-users on safe handling and application. This inconsistency leaves many farmers, pest control operators and the general public reliant on informal knowledge or retailer advice.
7	Information Exchange: Facilitate sharing of information about risks and safe handling.	Some shops provide information leaflets at the point of sale or upon request; however, these leaflets are not standardized.

8.4 End-use

Stakeholder consultations and secondary research highlight several systemic challenges in the end-use of pesticides:

#	Code of Conduct	Inefficiencies and gaps
1	Regulation of the use of pesticides: Ensure regulation of use of pesticides, and allocate adequate resources to effectively fulfil this responsibility.	The Agricultural Pesticides Act and Regulation are comprehensive; however, sufficient resources are not allocated for the implementation and enforcement.
2	Systemic data collection and record keeping: Assess potential impacts on human health and the environment and monitor usage trends for economic and other purposes.	No mechanism exists to gather data on pesticide use across sectors and users.
3	Coordinated and collaborative efforts: Combine efforts for the proper use of pesticide application.	There is no coordinated effort between the Government and the pesticide industry to ensure that of pesticide use, application methods and equipment are appropriate.
4	Training Programs: Conduct regular training for users on safe application techniques and protective measures.	A notable gap exists in formal training for end-users on safe pesticide handling and application. This lack of training leads to improper mixing and application techniques and increased health risks for users (and others).

#	Code of Conduct	Inefficiencies and gaps
		While some ISO-certified businesses provide training on pesticide safety as part of their Corporate Social Responsibility initiative, such efforts remain rare and do not reach the majority of end-users.
5	Compliance Monitoring: Monitor use to ensure compliance with safety standards.	No monitoring done to check whether MSDS or instructions on how to use different pesticides are being implemented.
6	Use of PPE	Many pesticide users do not use adequate PPE due to limited awareness of the importance of PPE and restricted access to affordable and appropriate PPE in local markets. There is also a financial burden associated with purchasing protective gear. There are also no standards for PPE and application equipment.
7	Food Safety and Residue Management	Agricultural produce grown in the country are not regularly checked for pesticide residues.
8	Health surveillance programmes: Conduct surveillance of those who are occupationally exposed to pesticides.	There is no surveillance programme in place to monitor adverse health impacts on workers or to investigate and document cases of poisoning.

8.5 Disposal

There are several critical challenges persisting in the disposal stage of the pesticide supply chain:

#	Code of Conduct	Inefficiencies and gaps
1	Inventory: Establish and maintain inventory of obsolete or unusable stocks of pesticides and used containers.	There is no one agency that is maintaining data on obsolete or unusable stocks of pesticides.
2	Safe collection: Establish systems for the safe collection and disposal of expired and obsolete pesticides and pesticide containers.	<p>The Maldives' dispersed island geography poses logistical challenges for collecting and transporting hazardous waste including pesticides related waste to a centralized stockpiling and disposal facility.</p> <p>There is also limited segregation of hazardous waste from municipal waste. Therefore, hazardous waste including pesticides are often mixed together from the collection stage to disposal.</p>
3	Environmentally Sound Disposal: Develop and enforce guidelines for the safe disposal of pesticide waste and containers.	<p>The comprehensive disposal guidelines set forth in the Agricultural Pesticide Control Act (2019) remain unimplemented, leaving a regulatory vacuum in addressing expired pesticides.</p> <p>In the absence of formal disposal infrastructure, some importers and users resort to unsafe practices such as open dumping or burning, which release harmful toxins into soil, water, and air.</p> <p>While the MNDF provides temporary oversight, its role in pesticide disposal is reactive rather than systemic, lacking the infrastructure and expertise required for effective hazardous waste management.</p> <p>Importers and end-users face financial constraints in adhering to safe disposal practices, particularly if transportation to centralized facilities incurs additional costs.</p>
5	Public Awareness: Educate the public about the hazards of improper disposal.	Some stakeholders, such as farmers, workers and household users are often unaware of proper disposal methods, further contributing to unsafe practices.

9 Recommendations for Pesticide Supply Chain

The following set of recommendations has been developed to address the key challenges and gaps identified in pesticide management in the Maldives, with a primary objective of minimizing risks to human health and protecting the natural environment from the adverse impacts of pesticide misuse and mismanagement. Emphasis is placed on the import stage of the pesticide supply chain to ensure quality assurance at the point of entry. A robust import data system not only ensures that the pesticides imported into the Maldives meet high standards but also improves overall pesticide management by providing accurate and traceable information. By focusing on the quality of imported pesticides, this approach helps minimize risks and challenges in the subsequent stages of the supply chain, ultimately enhancing safety and reducing the potential for harm in pesticide handling, application, and disposal.

These recommendations also focus on improving the regulatory framework, enhancing data integration, and strengthening implementation and enforcement mechanisms, while promoting safer and more sustainable pesticide practices. Actions include harmonizing pesticide definitions and classifications across legal instruments and data systems, empowering women and migrant workers, and fostering collaboration with international partners. Additionally, these recommendations highlight the need to enhance waste management practices, delineating clear roles for implementing agencies and invest in research to support evidence-based decision-making. Together, these efforts form a comprehensive, multifaceted approach to pesticide management that will reduce risks to health and the environment, align with global best practices, and contribute to the Maldives' long-term sustainability goals.

1. Standardise Definitions, Categorization and Terminology related to Pesticides Management Across Legislation, Makudi Portal and Maldives Customs Services Import Data.

Rationale: Currently, there is a lack of harmonization in the definitions and categorization of pesticides across legal frameworks and data systems. This results in inconsistencies in reporting and compliance monitoring. Standardizing definitions will ensure a common understanding of pesticides across all stakeholders, streamline data collection, and enhance regulatory oversight, leading to more effective management and enforcement.

Implementation:

- Amend existing legislation of Hazardous Chemical Regulation (2019/R-1057), Agricultural Pesticide Control Act (Law no. 21/2019) and Agricultural Pesticide

Control Regulation (2021/R-12) to standardize definitions and categories of pesticides across these legal instruments.

- Align definitions and categories used in the Makudi Portal with those adopted in the amended legal instruments.
- Use international classification systems such as the Globally Harmonized System of Classification and Labelling of Chemicals, The WHO Recommended Classification of Pesticides by Hazard and guidelines to classification, 2019 edition, the FAO Pesticide Registration Toolkit – Hazard Classification, and USEPA Pesticide Classification, for pesticide classification in the Makudi Portal.
- Integrate categorization to hazard classes and approved use conditions within the registration and permit modules of the Makudi Portal.

2. Implement with Urgency the Agricultural Pesticide Control Act (Law no. 21/2019 and the Agricultural Pesticide Control Regulation (2021/R-12).

Rationale: The Agricultural Pesticide Control Act and the Regulation provide a comprehensive framework for managing pesticides in the Maldives, based on international best practices. The scope of the Agricultural Pesticide Control Act mainly includes Permitted Pesticide Registry; Pesticides Management; Issuance of Licenses and Permits; Inspection and Approval; and Violations and Penalties. The Agricultural Pesticide Control Regulation further addresses key areas of Import; Criteria for importing including information requirements for permit process; Producing, packaging and labelling pesticides; Disposal of pesticides; Storage of pesticides including storage in shops, warehouses and farms as well as home gardens; Transport and distribution of pesticides including vessels and vehicles; Issuance of license for conducting pesticide related transaction; Record keeping and reporting and; warnings, offenses and penalties. Therefore, the effective implementation of the Act and Regulation will address existing gaps in the regulation and management of pesticides, ensuring safer use, reducing environmental and health risks, and aligning with global standards.

Implementation:

- Dedicate staff within MAAW for enforcement of Agricultural Pesticide Control Act and Agricultural Pesticide Control Regulation.
- Identify the priority areas of implementation from the Act and Regulation.
- Allocate budget in the upcoming national budget for priority actions.
- Conduct rapid training for employees in relation to the priority actions.

3. Harmonize Data Collection and Analysis Across Makudi Portal and the Maldives Customs Services Import Data.

Rationale: The current data systems for pesticide tracking lack integration, limiting the ability to analyse pesticide supply and usage effectively. Harmonizing data across the Makudi Portal and MCS Import Data will enable comprehensive analysis, improving decision-making, risk assessments, and enforcement activities.

Implementation:

- Review and revise the data fields in Makudi Portal and MCS Import Data.
- Incorporate existing unique ID systems such as Business Registration Number, Import/Export License Number, and Customs Identification Number into Makudi Portal and MCS Import Data.
- Record and maintain import data of pesticides according to Chemical Import Permits and the Approved Agricultural Pesticide Registry.
- Generate monthly data analytics reports to support verification and decision-making processes.

4. Require Verified Hazard Data and Globally Harmonized System of Classification and Labelling of Chemicals for All Pesticide-related New Substance Registrations and Chemical Import Permits.

Rationale: Currently, there is insufficient verification of hazard data for imported pesticides, risking the approval of unsafe products. By requiring verified hazard classification (GHS, FAO and WHO) and integrating international databases, MoD can ensure that only safe and compliant products are permitted for import, reducing health and environmental risks.

Implementation:

- Require registration and import permit applications to include hazard classification data from international classification systems like GHS, WHO hazard class, FAO hazard classification and USEPA classification.
- Mandate that hazard data be sourced from authoritative international pesticide databases.
- Embed a hazard classification module within the Makudi Portal to store and display acute toxicity, chronic effects, and environmental risks.
- Flag pesticides identified as highly hazardous under WHO hazard classes, FAO hazard classifications, or USEPA classifications, as well as those banned in OECD countries, for automatic review, restriction, or rejection.
- Train reviewers to cross-reference submitted hazard data with international pesticide databases such as FAO Pesticide Information Database, WHO International Programme on Chemical Safety and Pesticide Action Network International Pesticide Database, to validate hazard information.

5. Establish Label and Safety Data Sheet Verification Protocols in the Makudi Portal.

Rationale: Inconsistent pesticide labelling and incomplete Safety Data Sheet (SDS) submissions currently hinder regulatory compliance and enforcement. Establishing a digital verification process for labels and SDS in the **Makudi Portal** ensures consistency, traceability, and accountability, improving safety and regulatory oversight.

Implementation:

- Require labels to be submitted during registration, chemical import permit applications according to labelling requirements aligned with the Globally Harmonized System of Classification and Labelling of Chemicals.
- Modify the Makudi Portal to require structured SDS uploads with mandatory hazard fields and automated validation rules to flag incomplete or inconsistent entries.
- Provide importers with clear guidance on SDS formatting, language, and verification responsibilities.
- Conduct random audits of uploaded SDS and product labels, and take enforcement action for falsified or non-compliant submissions.

6. Strengthen Capacity of Maldives Customs Services and Ministry of Agriculture and Animal Welfare for Hazardous Pesticide Detection and Compliance.

Rationale: At present, MCS and MAAW lacks sufficient tools to detect hazardous pesticides at the point of entry, risking the entry of non-compliant products. Equipping MCS and MAAW with portable hazard detection tools will enhance border control, improve pesticide safety, and align the Maldives with international best practices for chemical safety.

Implementation:

- Procure portable hazard testing kits.
- Train MCS officers and MAAW inspectors in hazard detection.
- Develop standardized inspection protocols.
- Integrate results of hazard detection by MCS and MAAW to the Makudi Portal.

7. Establish Interim Testing Arrangements of Pesticides Quality and Residues through Accredited Regional Laboratories.

Rationale: The Maldives lacks the necessary infrastructure for comprehensive pesticide quality and residue testing. Partnering with accredited regional laboratories will provide critical support in ensuring the safety and quality of imported pesticides, filling the gap until local capabilities can be strengthened.

Implementation:

- Enter into agreements with accredited laboratories in the region.
- Prioritize import testing, highly hazardous pesticides, high-use pesticides, and residues in food and the environment.
- Integrate quality and residue testing results to Makudi Portal.

8. Strengthen National Pesticide Testing for Quality and Residues.

Rationale: Currently, there are limited testing abilities for pesticide quality and residues, leading to potential risks for human health and the environment. Strengthening national testing capabilities, including retrofitting laboratories and ensuring accreditation, will allow for more effective monitoring and regulatory compliance.

Implementation:

- Assess testing abilities and needs of existing domestic laboratories to cater for pesticide testing.
- Retrofit the existing Maldives Food and Drug Authority laboratory or establish a new facility equipped with modern analytical instruments.
- Obtain accreditation for the laboratory to meet international standards.
- Create clear protocols for routine pesticide testing, covering imports, local use, and residue levels.

9. Strengthen Regulations and Inspections for Pesticide Storage Facilities.

Rationale: Lack of systematic inspections of storage facility poses significant safety risks to workers and the community. By implementing routine inspections, the importers can prevent risks to human health, environmental contamination, and ensure that storage practices comply with safety standards.

Implementation:

- Develop a pesticide-related Storage Facility Registry using existing data from Makudi Portal and import data of MCS.
- Implement scheduled inspections of storage facilities.
- Record facility conditions, stock status, and compliance with permit terms during inspections.
- Integrate findings of inspections of storage facilities into the Storage Facility Permit process of Makudi Portal.

10. Inspect Transport & Distribution Vehicles and Vessels for Safety Compliance.

Rationale: Transport vehicles and vessels are crucial in the safe movement of pesticides. Ensuring that vehicles and vessels comply with safety standards is critical to prevent spills, accidents, and contamination. Regular inspections will strengthen oversight, ensuring safe movement of pesticides throughout the supply chain by both land and sea transport.

Implementation:

- Designate the competent authority responsible for conducting compliance checks on vehicles and vessels involved in the transport of pesticides.
- Develop a catalogue of vehicles and vessels carrying cargo, using existing vehicle and vessel registration, and licensing data of the Government.
- Prepare protocols for vehicle and vessel compliance checks and follow ups.
- Train relevant officers to conduct the compliance checks.

11. Implement a Comprehensive System for Tracking Pesticide Stock and Movement Across the Country.

Rationale: In the Maldives, the lack of consistent tracking of both pesticide stock and movement across various locations complicates enforcement and increases the risk of non-compliance. By integrating wholesale distribution logging and stock tracking into the Makudi Portal, regulators can ensure better visibility and control over pesticide inventory and movement. This will enhance transparency, optimize compliance monitoring, and improve enforcement efforts across the entire supply chain.

Implementation:

- Modify the Makudi Portal to allow importers and distributors to regularly enter verified records of pesticide stock and distribution, including quantities, locations, and movement between warehouses, retailers, and storage facilities across the country.
- Require importers, distributors, and storage facilities to report inter- and intra-atoll pesticide shipments and track stock levels at each distribution point.
- Make the submission of verified stock and distribution data a requirement for the issuance of Chemical Import Permits.
- Analyse the collected data on stock levels and distribution to identify discrepancies, track the flow of pesticides across the country, and prioritize compliance checks in regions with high pesticide turnover or stock irregularities.

12. Empower and Protect Women in Pesticide Management Across Agricultural and Household Sectors.

Rationale: Women in the Maldives are involved in pesticide use across various sectors, including farming, home gardening, and household pest control, and are also the main caregivers, particularly for children. This exposure makes them vulnerable to health risks related to pesticide use. It is essential to address their needs with comprehensive support that focuses on safety, education, and resources to reduce risks from pesticide exposure in both agricultural and household contexts. Empowering women through training, access to protective equipment, and creating safer environments will ensure that they can contribute to pesticide management in a way that is both healthy and sustainable.

Implementation:

- Develop comprehensive training programs for women in both agriculture and household pest control that cover safe pesticide use, health risks, and the importance of proper storage and disposal.
- Make training materials available in both Dhivehi and English, mobile-accessible formats, and visual aids.
- Ensure access to appropriate PPE for home and agricultural use.
- Identify financial incentives and subsidies to encourage women to adopt Integrated Pest Management practices and organic farming methods.
- Provide subsidized training and certification for women who engage in both farming and household pest management, encouraging them to become certified IPM practitioners or sustainable farming leaders.
- Empower the Women's Development Committees as advocates of safe pesticide management.

13. Inform and Empower Migrant Workers Managing Pesticides on Appropriate Handling, Use and Disposal of Pesticides.

Rationale: Migrant workers are often unaware of safe pesticide handling practices, which increases the risk of exposure. Providing accessible training and information, particularly in multiple languages and using different communication mediums, will empower workers to use personal protective equipment (PPE) and handle pesticides safely, reducing health risks and improving compliance.

Implementation:

- Prepare standardized labelling, SDS, and Instructions for Use in accordance with the Globally Harmonized System for the most hazardous and commonly used pesticides currently being imported. These should be made available in Dhivehi, English, and other languages widely spoken by migrant workers.

- Ensure broad accessibility of labelling, SDS, and Instructions for Use, for these pesticides through multiple distribution methods and communication channels.
- Develop and disseminate training and awareness materials on the correct use and importance of personal protective equipment (PPE), delivered via online platforms and supported by incentives (e.g., mobile data top-ups) upon successful course completion.

14. Implement Health Monitoring, Medical Support, and Incident Reporting Systems.

Rationale: Communities and migrant workers exposed to pesticides face health risks, and there is insufficient mechanisms for monitoring and reporting pesticide-related health issues. Implementing health monitoring systems, providing training for healthcare providers, and establishing incident reporting protocols will enable better management of pesticide-related health impacts.

Implementation:

- Involve Health Centres, Atoll Hospitals and Regional Hospitals in addition to the main hospitals in Male' area, in health monitoring of migrant workers.
- Implement periodic medical check-ups for workers exposed to pesticides, ensuring early detection of health issues related to pesticide exposure.
- Provide training for healthcare providers to identify and respond effectively to symptoms of pesticide poisoning.
- Ensure local health facilities are equipped with the necessary protocols and antidotes for treating pesticide exposure.

15. Expand on the Promotion of Integrated Pest Management (IPM), Good Agricultural Practices (GAP) Programme and Organic Certification, Building on Ongoing Efforts.

Rationale: IPM, GAP and organic farming share the goal of reducing pesticide dependency, promoting safer and more sustainable farming methods. This combined approach can help the Maldives transition to more sustainable agricultural practices, providing market advantages and aligning with global sustainability trends.

Implementation:

- Identify current IPM, GAP and organic farming training and certification efforts, materials and initiatives.
- Make these materials accessible online in multiple languages and mobile-friendly formats.
- Identify financial incentives that can support IPM and GAP adoption and organic certification such as subsidies for the transition to sustainable practices,

financial support for IPM and GAP-related training, and funding for certification processes.

16. Improve Pesticide Waste Management Through Strategic Data Use and Stakeholder Collaboration.

Rationale: Pesticide waste management in the Maldives is currently fragmented and inefficient. Utilization of Chemical Import Permit records in conjunction with MCS data would enable relevant authorities and stakeholders to identify the principal waste generators, assess national disposal capacity, and implement structured collection systems. Strengthening these processes is critical to minimizing environmental contamination and mitigating associated public health risk.

Implementation:

- Identify major pesticide waste generators through analysis of Chemical Import Permit records and MCS import data.
- Estimate the volume of pesticide-related waste by correlating import data with usage and disposal pattern.
- Collaborate with major importers to determine the flow of pesticides across the atolls and islands.
- Determine the locations where most of the pesticide-related waste is generated.
- Assess the waste collection, stockpiling and disposal options available in the hotspot locations.
- Enable safe stockpiling of pesticide-related waste within Island Waste Management Centres or Regional Waste Management Facilities until proper disposal or export.

17. Establish a Sustainable Pesticide Waste Export Program.

Rationale: Pesticide waste management in the Maldives faces significant challenges due to limited domestic disposal options and the potential environmental risks associated with improper waste management. Exporting hazardous pesticide waste to countries with advanced disposal facilities can reduce local environmental impacts. Export of waste shall be designed in compliance with international environmental standards, such as the **Basel Convention**. A well-structured waste export program will help the Maldives manage its pesticide waste more effectively and reduce the long-term risks associated with improper disposal.

Implementation:

- Establish clear regulations for the export of pesticide waste, ensuring compliance with international treaties and conventions.

- Create a system similar to Makudi Portal to track pesticide waste shipments, including export documentation, waste types, quantities, and destination facilities, to ensure transparency and regulatory compliance.
- Work with international organizations and logistics companies to streamline the export process.
- Provide training for key stakeholders, including government agencies, importers, and waste management facilities, on proper documentation and procedures for exporting pesticide waste.

18. Engage Local Councils in Monitoring Pesticides Management in Residential Islands.

Rationale: Pesticide use in residential islands is challenging to monitor due to dispersed small-holder farms. By empowering local councils with regulatory tools and training, the Maldives can ensure better enforcement of pesticide management practices and reduce risks associated with improper use and storage.

Implementation:

- Review and analyse relevant laws and regulations to identify potential areas for institutional collaboration.
- Establish a register of wholesale and retail pesticide distributors in residential islands, coordinated through respective Island Councils.
- Provide capacity-building and training for Local Councils on enforcement measures, including compliance with stocking standards, provision of customer information, monitoring of PPE use by workers and farmers, and proper segregation and storage of pesticide-related waste.
- Develop an online information-sharing platform for Local Councils to facilitate access to and dissemination of pesticide management and safety information.

19. Streamline Regulatory Framework and Clarify Institutional Roles in Pesticide Management

Rationale: Effective pesticide management is constrained by overlapping mandates, unclear responsibilities, and inconsistencies in existing legislation across multiple agencies. These gaps contribute to inefficiencies, regulatory uncertainty, and weak enforcement, ultimately undermining regulatory effectiveness. Streamlining the regulatory framework, clarifying institutional roles, and addressing overlaps in mandates are essential to strengthen accountability, enhance inter-agency coordination, and ensure more efficient implementation of pesticide regulations.

Implementation:

- Conduct an in-depth legal and institutional audit to identify overlaps, gaps, and inconsistencies in the existing pesticide regulations and the roles of involved agencies, including the Ministry of Defence, Ministry of Agriculture and Animal

Welfare, Ministry of Health, Maldives Customs Service, Ministry of Tourism and Environment and other relevant government agencies.

- Revise existing legislation to clarify institutional responsibilities and eliminate overlapping mandates.
- Define and delineate the roles of all agencies involved in pesticide management, with the designation of a lead authority or coordinating body to ensure effective oversight and enforcement.
- Conduct a comprehensive capacity assessment of key stakeholders in pesticide management, including government agencies, regulatory authorities, and local entities.
- Provide targeted training and capacity-building programmes for relevant personnel to ensure a consistent understanding of pesticide management principles and clearly defined institutional roles.

20. Establish a Comprehensive Research Framework for Informed Pesticide Management.

Rationale: There is a lack of coordinated and collaborative research on pesticide management in the Maldives. Informed pesticide management requires ongoing, localized research. Collaborating with institutions like Maldives National University will ensure continuous, context-specific research, supporting evidence-based policies and enhancing pesticide regulation in the Maldives, ensuring long-term sustainability and safety.

Implementation:

- Develop a comprehensive research framework specific to pesticide management in line with ongoing projects and research in the area.
- Partner with Maldives National University and other relevant institutions to conduct ongoing research.
- Integrate research findings, hazard assessments, and environmental monitoring into a centralized platform (e.g., Makudi Portal) to provide policymakers with accessible, real-time data.
- Establish partnerships with regional agencies and international bodies such as WHO and FAO to engage in joint research projects and share best practices.

10 Trade-off Analysis

This section provides a trade-off analysis of the key recommendations outlined in Chapter 9. The tables are intended to assist decision-makers in weighing short-term resource constraints against long-term benefits in sustainability, regulatory compliance, and public health protection.

Table 10-1 Trade-off analysis table

Recommendation	Key Benefits	Potential Trade-offs
1. Standardise definitions, categorization and terminology across legislation, Makudi Portal and MCS import data.	Improves regulatory clarity and oversight; reduces inconsistencies in compliance monitoring.	High initial administrative burden; possible stakeholder resistance to adapting standardized systems.
2. Implement Agricultural Pesticide Control Act and Regulation with urgency.	Addresses regulatory gaps; strengthen pesticide safety, environmental and public health safeguards.	Requires immediate resource allocation; short-term disruptions during transition.
3. Harmonize data collection and analysis across Makudi Portal and MCS import data.	Enhances data-driven decision-making, risk assessment, and enforcement capacity.	Significant upfront integration effort; increased workload during initial implementation.
4. Require verified hazard data and GHS classification for registrations and import permits.	Minimizes risk of approving hazardous pesticides; ensures regulatory compliance and safety.	Adds complexity and may delay pesticide approval processes.
5. Establish label and SDS verification protocols in Makudi Portal.	Strengthen hazard communication; enhances	Additional administrative tasks; potential delays in pesticide approvals.

Recommendation	Key Benefits	Potential Trade-offs
	regulatory compliance and accountability.	
6. Strengthen MCS and MAAW capacity for hazardous pesticide detection.	Improves border control; reduces risks from unsafe pesticide imports.	Requires upfront investment in equipment and training; may slow clearance processes initially.
7. Establish interim pesticide testing arrangements with regional laboratories.	Provides immediate quality assurance; addresses current domestic testing gaps.	Dependency on external laboratories; potential delays and possible higher testing costs.
8. Strengthen national pesticide testing capabilities.	Builds long-term self-reliance; improves national quality assurance and compliance.	High investment and operational costs; slower implementation timeline.
9. Strengthen regulations and inspections for pesticide storage facilities.	Reduces risks of contamination risks; and enhances overall safety of storage facilities.	Increased administrative burden; possible resistance from operators.
10. Inspect transport & distribution vehicles and vessels for compliance.	Improves safety during transportation; lowers risk of spills and contamination.	Adds logistics and administrative workload; potential pushback from transport operators.
11. Implement comprehensive system for tracking pesticide stock and movement.	Enhances transparency and compliance monitoring; reduces risk of misuse and diversion.	Increased reporting obligations; possible resistance from stakeholders.

Recommendation	Key Benefits	Potential Trade-offs
12. Empower and protect women in agricultural and household pesticide management.	Improves health and safety outcomes; encourages adoption of safer and sustainable pesticide practices.	Resource-intensive outreach and training; logistical complexity reaching dispersed groups.
13. Inform and empower migrant workers on safe pesticide handling.	Reduces health risks; strengthens compliance with safety practices.	Requires multilingual training; logistical challenges in wide-scale dissemination.
14. Implement health monitoring, medical Support, and incident reporting systems.	Enables proactive health management; allows early detection and treatment of pesticide-related issues.	Requires strengthening healthcare infrastructure; additional administrative responsibilities.
15. Expand promotion of Integrated Pest Management (IPM) and organic certification.	Reduces pesticide dependency; promotes sustainability and market advantage.	Requires continuous resource allocation; potential resistance from traditional practices.
16. Improve pesticide waste management through data and stakeholder collaboration.	Enhances efficiency in waste management; reduces environmental contamination risks.	Requires complex coordination; upfront analytical and organizational effort.
17. Establish a sustainable pesticide waste export programme.	Provides safe disposal of hazardous waste; minimizes local environmental impacts.	High logistical complexity and cost; strict adherence to international standards required.

Recommendation	Key Benefits	Potential Trade-offs
18. Engage Local Councils in monitoring pesticide management in residential islands.	Strengthens local-level compliance; improves oversight across dispersed communities.	Varied capacity among councils; increased administrative complexity.
19. Streamline regulatory framework and clarify institutional roles in pesticide management.	Improves regulatory efficiency; clarifies institutional responsibilities; strengthens coordination.	Requires comprehensive review and legislative reform; potential resistance from affected agencies.
20. Establish a comprehensive research framework for informed management.	Supports evidence-based policymaking; ensures continuous improvement of practices.	Requires sustained funding and coordination; primarily long-term impacts.

11 Recommendations for Standards for the Application and Management of Pesticides in the Maldives

The safe and responsible management of pesticides is essential to protecting human health, preserving fragile ecosystems, and supporting sustainable agriculture and public health in the Maldives. This section outlines recommendations for establishing national standards covering the full pesticide life cycle; including importation, transportation, storage, use, labelling, disposal, and wastewater treatment.

The recommendations are aligned with international best practices such as the FAO/WHO International Code of Conduct on Pesticide Management (2014), the FAO Guidelines for Pesticide Storage and Stock Control (2011), the WHO Recommended Classification of Pesticides by Hazard (2019), and the Codex Alimentarius Guidelines on Pesticide Residues. They also reflect the requirements of national legislation, including the Agricultural Pesticide Control Act (Act No. 21/2019), the Agricultural Pesticide Control Regulation (2021/R-12), the Hazardous Chemical Regulation (2019/R-1057), and the Guidelines for Pesticide Disposal, Shop, Godown, Repacking, Factory and Production (2021).

These standards are intended to serve as reference benchmarks for regulators and stakeholders. They can be adapted to the Maldives' unique regulatory capacity, institutional structures, and island-specific environmental challenges. By implementing them, the Maldives can reduce risks from pesticide use, prevent environmental contamination, and strengthen protections for applicators, communities, consumers, and ecosystems; thereby advancing national goals for safer, healthier, and more sustainable pest management.

11.1 Pesticide Import Control

The import of pesticides into the Maldives must be regulated under a robust framework that safeguards human health, food safety, and the environment, while ensuring full compliance with international obligations and national legislation. These recommendations apply to all categories of pesticide imports; including active ingredients, formulated products, samples, and returns; whether arriving by air or sea, and extend to their handling, storage, and distribution once landed.

1. **Alignment with International Conventions and Best Practices**

- FAO/WHO International Code of Conduct on Pesticide Management: Adopt as the overarching framework for responsible import, trade, and distribution.
- Globally Harmonized System (GHS): Apply for classification, labelling, and packaging of pesticides.

- UN Model Regulations on the Transport of Dangerous Goods: Ensure transport safety, with mode-specific compliance:
 - International Maritime Dangerous Goods (IMDG) Code for sea transport¹⁷¹,
 - International Air Transport Association (IATA) Dangerous Goods Regulations (DGR) for air transport¹⁷²,
 - European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) principles for road handling and segregation.
- Adhere to obligations under the Rotterdam and Stockholm Conventions, prohibiting or restricting imports of banned or restricted pesticides.

2. Compliance with National Legislation

- Maintain the Agricultural Pesticides Control Act (21/2019) and the Hazardous Chemicals Regulation (2019/R-1057) as the legal foundation for pesticide import control.
- Require import permits issued by the Ministry of Agriculture and Animal Welfare (MAAW) in coordination with the Ministry of Defence (MoD) and the Environmental Regulatory Authority (ERA).
- Mandate the submission of Safety Data Sheets (SDS/MSDS) in both English and Dhivehi, verified by the competent authority to prevent misinformation.

3. Risk-based Approval and Registration.

- Strengthen and maintain the National Pesticide Register of approved active ingredients and products, aligned with WHO hazard classes and international regulatory lists (e.g., EU approvals).
- Prohibit or restrict Highly Hazardous Pesticides (HHPs) in line with FAO and WHO recommendations.
- Require risk assessment for new products, evaluating persistence, bioaccumulation, toxicity, and suitability for Maldivian island ecosystems.

4. Import Controls and Documentation

- Require detailed customs declarations specifying active ingredient, concentration, formulation, intended use, and importer details.
- Mandate that imports are accompanied by a Certificate of Analysis (CoA) from an accredited laboratory.

¹⁷¹ International Maritime Organization (IMO) 2022, International Maritime Dangerous Goods (IMDG) Code, 2022 Edition (Incorporating Amendment 41-22), IMO Publishing, London.

¹⁷² International Air Transport Association (IATA) 2025, Dangerous Goods Regulations (DGR), 66th Edition, IATA, Montreal & Geneva

- Enforce labelling standards consistent with FAO/WHO guidelines, requiring hazard pictograms, first aid instructions, and safe disposal guidance in Dhivehi and English.
- Ensure that only pesticides listed on the approved national register are eligible for import.

5. Institutional Strengthening and Enforcement

- Enhance the Makudi Portal for pesticide imports by requiring verified SDS/MSDS information and full product details.
- Build the capacity of MCS and MAAW for regular inspections, random sampling, and laboratory testing of consignments.
- Enforce strict penalties for unauthorized imports, mislabelling, or non-declaration of pesticides, including fines, suspension or revocation of permits, and seizure of non-compliant consignments.

6. Special Provisions

- Grant duty exemptions only for agricultural pesticides approved by MAAW, to prevent diversion to other sectors.
- Limit import quantities to verified national demand, reducing stockpiling and the risk of obsolete pesticide accumulation.
- Establish protocols for the re-export or environmentally sound disposal of non-compliant consignments.

7. Inspection and Verification at Ports of Entry

- Customs must inspect all pesticide consignments on arrival, with the authority to detain or reject non-compliant shipments.
- Random sampling and laboratory analysis should be carried out to detect illegal, counterfeit, or substandard products

11.2 Pesticide Transport Control

These recommendations cover the transport of pesticides; including active ingredients, formulated products, samples, and returns; into and within the Maldives by road, sea, and air. They are intended to support the development of enforceable national standards and operational protocols that ensure the safe, secure, and environmentally responsible movement of pesticides across all modes of transport.

1. Legal & Standards Alignment

- Follow the FAO/WHO Code of Conduct on Pesticide Management (transport & distribution).
- Apply GHS for classification/labels and UN Model Regulations for dangerous goods.
- Follow the UN Model Regulations on the Transport of Dangerous Goods, with mode-specific requirements:

- IMDG Code for marine transport,
 - IATA Dangerous Goods Regulations (DGR) for air transport,
 - ADR principles for road transport.
- Ensure consistency with all applicable national laws, permits, and escort requirements.
- Comply with all relevant national legislation, permit requirements, and escort conditions.

2. Authorized Personnel & Responsibilities

- Each consignment must be supervised by at least one trained and authorized individual responsible for compliance, handling, and emergency response.
- Consignors (senders): Ensure correct classification, packaging, labelling, documentation, and carrier briefing.
- Carriers: Provide suitable vehicles/vessels, maintain segregation and placarding, carry emergency equipment, and deploy trained crew.
- Consignees (receivers): Ensure readiness to safely receive pesticides, including designated unloading bays, spill kits, and inventory systems.
- All parties: Must report incidents promptly within defined timeframes.

3. Packaging & Labelling

- Use UN-approved packaging, sealed and intact; no loose mixed containers.
- Labels must comply with GHS, in Dhivehi and English, showing product name, UN number, hazard pictograms, signal word, H/P statements, first aid, and emergency contacts.
- Orientation arrows, stack height, and tamper-evident seals required.
- Each consignment must be accompanied by Safety Data Sheets (SDS) accessible to handlers.

4. Pre-Transport Verification

- Confirm that SDS/COA/MSDS documents are up-to-date and match product labels.
- Inspect packaging for leaks or damage; repackage compromised units in over-packs marked "SALVAGE."
- Verify that quantities are within permitted limits and check for any temperature or special handling requirements.

5. Vehicle & Vessel Requirements

- Cargo spaces must be closed, secure, and weathertight, with spill containment capacity.
- Vehicles/vessels must not be used to carry food, drinking water, or consumables unless pesticides are physically segregated.
- All units must be equipped with:
 - Spill containment kits,

- Fire extinguishers suitable for chemical fires,
- Appropriate PPE for drivers and handlers.
- Vehicles must display hazard signage in Dhivehi and English

6. Logistics, Routing & Handling

- Transport routes must be planned in advance to minimize transit times and avoid environmentally sensitive areas.
- Loading and unloading must occur only in designated, secure areas with spill prevention measures.
- Weather checks are mandatory before departure; marine transport must be suspended during official small craft advisories.
- Cargo should not remain at ports or staging points for more than 24 hours unless in approved secure storage.

7. Stowage & Segregation

- Observe compatibility rules: keep oxidizers, acids, alkalis, and fumigants separated.
- Secure loads centrally and low, using shrink wrap or banding to prevent shifting.
- Maintain ventilation and inspection access.
- On marine vessels, stow cargo below deck or under fixed covers, secured against vessel movement and protected from spray and sunlight.

8. Documentation

- Every shipment must carry both physical and digital copies of:
 - Transport document/consignment note (product, UN number, class, quantity, emergency actions)
 - SDS, permits/clearances, temperature requirements if applicable
 - 24/7 emergency contact in the Maldives
- Maintain a chain-of-custody record from dispatch to receipt.

9. Security & Emergency Preparedness

- Record seal numbers at dispatch and confirm at receipt.
- Transport manifests must be restricted to authorized personnel.
- All transport units must carry spill kits, extinguishers, and emergency response cards.
- Drivers and crew must be trained in emergency procedures, including spill response, firefighting, and first aid.
- Spills, leaks, fires, or marine discharges must be reported immediately to ERA, port, or police authorities.

10. Special Provisions

- Transport of Highly Hazardous Pesticides (HHPs) requires a special permit for transport.

- Damaged, expired, or leaking pesticides must be handled under the same safety standards as usable products and delivered directly to authorized disposal facilities.
- Mode-specific:
 - Sea: Pesticides must be waterproof-sealed, segregated from food and living area; vessels must maintain inventories and emergency equipment.
 - Air: only IATA-approved packaging and declared consignments are permitted.
 - Small craft (inter-island): Limit to 500 kg per trip unless using a designated cargo vessel with secured stowage.

11. Thresholds & Exemptions

- Small quantities (≤ 25 kg/L): May be transported in private vehicles if in original sealed packaging, upright, separated from passengers, with SDS and spill kit available.
- Medium consignments (25–500 kg/L): Must comply fully with packaging, documentation, routing, and emergency preparedness standards.
- Bulk/High-risk consignments (> 500 kg/L or HHPs/fumigants): Require journey plan approval, possible escorts and continuous monitoring.

These threshold values are established as guiding benchmarks, reflecting national enforcement capacity, vehicle usage patterns, and safety considerations, and shall be periodically reviewed and revised in line with international standards and evolving national conditions.

12. Inspection, Records & Enforcement

- Pre-dispatch and post-arrival inspection checklists must be completed and retained for at least three years.
- Competent authorities may conduct random inspections. Non-compliance may result in fines, permit suspension, or seizure.
- All incidents must be reported to MoD and MAAW between 2 – 6 hours of detection (depending on the severity of the incidence) and followed by a final report within 7 days.

11.3 Pesticide Storage

These recommendations apply to all pesticide types, including insecticides, herbicides, fungicides, rodenticides, biopesticides, and any other chemical or biological agents classified as pesticides under national law. They cover all commercial and institutional storage facilities engaged in handling, distribution, or long-term storage of pesticides, including agricultural sites, farmer cooperatives, private enterprises, and government institutions.

1. Risk-Based Approach for Pesticide Storage

To ensure requirements remain proportionate to both the scale of stocks and the hazard level of products, a three-tiered framework is recommended. However, when making national standards, these thresholds should be treated as guiding benchmarks, adaptable to national regulatory capacity and local context, while maintaining the overarching objective of safeguarding human health and the environment.

- **Exemptions for Small Quantities:** Where pesticide stocks remain within the WHO “small quantity” thresholds^{173, 174, 175}; (e.g., less than 2.5 kg/L for highly hazardous formulations, less than 10 kg/L for moderately hazardous, and less than 25 kg/L for slightly hazardous or less hazardous classes), and are intended solely for use within six months, storage may follow simplified safety protocols endorsed by the Ministry of Agriculture and Animal Welfare (MAAW). These simplified measures are acceptable only if risks to health and the environment are effectively minimized and basic secure storage conditions are maintained.
- **Medium Quantities:** For pesticide stocks between 25–200 kg or L of slightly hazardous or less hazardous classes, proportional safeguards are required. Storage should be in a ventilated and lockable facility with impervious, raised flooring to contain spills. Containers must be segregated from food, feed, and drinking water supplies, with clear hazard signage posted. Additional measures such as secondary containment, basic firefighting equipment, spill kits, and restricted access are strongly recommended to reduce risks while ensuring safe handling and storage.
- **Large-Scale and Hazardous Storage:** Where pesticide holdings exceed the “large quantity” thresholds (e.g., more than 2.5 kg/L for highly hazardous formulations, more than 10 kg/L for moderately hazardous, and more than 200 kg/L for slightly hazardous or less hazardous classes), or where Highly Hazardous Pesticides (HHPs) are involved, storage facilities must comply fully with comprehensive structural, safety, and organizational requirements. This includes dedicated and bunded storage areas, fire protection and spill containment systems, controlled access, proper segregation of incompatible products, and robust inventory and emergency response procedures, in line with international standards and national regulatory requirements.

¹⁷³ FAO (1996a) Guidelines for the management of small quantities of pesticides. Rome: Food and Agriculture Organization of the United Nations.

¹⁷⁴ WHO (1998) The WHO recommended classification of pesticides by hazard and guidelines to classification 1998–1999. Geneva: World Health Organization.

¹⁷⁵ FAO (1995c) Prevention and disposal of obsolete and unwanted pesticide stocks in Africa and the Near East. FAO Pesticide Disposal Series No. 2. Rome: Food and Agriculture Organization of the United Nations.

2. Location Selection

- Storage facilities, where possible, should be cited minimum of 30 meters away from water wells, protected areas, beaches, and 60 meters away densely populated residential zones.¹⁷⁶
- Where minimum separation distances are not feasible due to land constraints, facilities must apply enhanced safeguards; such as secondary containment, impervious flooring, reinforced walls, flood protection, and monitoring; to provide equivalent protection for health and the environment.

3. Structural Requirements

It is recommended that all pesticide storage facilities incorporate the following minimum standards:

- **Construction Materials:** Use non-flammable, waterproof materials for walls, ceilings, doors, and racks. Structures should be capable of withstanding fire for at least 90 minutes.
- **Flooring:** Install impervious, bunded flooring designed to contain spills and leaks.
- **Registration:** Facilities must be registered under the Dangerous Chemicals Guidelines managed by the Ministry of Defence.
- **Access:** Provide adequate clearance for land transport and firefighting vehicles, with at least one unobstructed access point (two recommended for larger facilities).
- **Lighting:** Ensure sufficient natural or artificial lighting to make labels clearly visible.
- **Ventilation & Temperature Control:** Maintain storage areas cool and well-ventilated, within manufacturer-recommended ranges; avoid exposure to heat and sunlight¹⁷⁷; exhaust fans should be installed where necessary.
- Physical separation from administrative or office areas.
- **Environmental Protection:** Structures must be designed to withstand strong winds, heavy rain, and flooding risks.
- **Drainage:** Install a dedicated drainage system to collect pesticide-contaminated water, separated from general drainage systems.
- **Safety & Separation:** Physically separate storage areas from administrative or office spaces.
- **Emergency Exits:** At least one exit must be provided (two exits recommended for larger facilities).
- **Waste/Obsolete Stocks:** Designate a secure area for expired pesticides and empty containers, separate from usable stock.

¹⁷⁶ Ministry of Agriculture and Animal Welfare (2021) *Guidelines for Pesticide Disposal, Shop, Godown, Repacking, Factory and Production*. Malé, Maldives: Government of Maldives.

¹⁷⁷ FAO (1995) *Pesticide Storage and Stock Control Manual*. Rome: FAO.

4. Safety Features

- Install fire detection and suppression systems appropriate to the facility's size and hazard level.
- All electrical wiring should be housed in protective conduits to prevent ignition risks.

¹⁷⁸

5. Access Control

- Restrict entry to authorized personnel only.
- Display durable signage in Dhivehi and English, and in other commonly used languages where relevant.
- Signage must clearly indicate hazards, restrictions, and prohibitions (e.g., No Smoking).¹⁷⁹

6. Organization of Storage

To complement the structural and access control measures outlined above, a systematic approach to storage, personnel safety, and context-specific safeguards is proposed. These recommendations ensure that pesticide facilities in the Maldives remain compliant with international best practices while adapting to local conditions:

¹⁸⁰

- Use shelving units not exceeding seven feet in height, with a minimum of three feet spacing for walkways and emergency access.
- Arrange shelving and racking to maintain at least one clear path for emergency evacuation and access.
- Store solid or particulate pesticides above liquid formulations to minimize risks from leaks and spills.
- Keep fertilizers and pesticides separate at all times; they must never be stored in direct adjacency.
- Place lightweight or small containers on upper shelves, while heavy containers should be stored on pallets, stacked no higher than three layers.
- Ensure all pesticides are kept away from direct sunlight and flammable materials.
- Use metal shelving where possible, as it is more durable and easier to decontaminate than wooden shelving.
- Position shelves, pallets, and drums along walls to maximize safety, ventilation, and access.

¹⁷⁸ Ministry of Agriculture and Animal Welfare (2021) *Guidelines for Pesticide Disposal, Shop, Godown, Repacking, Factory and Production*. Malé, Maldives: Government of Maldives.

¹⁷⁹ Ibid.

¹⁸⁰ Ibid.

- Clearly label all storage sections and containers in both Dhivehi and English to ensure correct identification and handling.
- Maintain an updated inventory log of all stored pesticides, including quantities, batch numbers, and expiry dates, to support traceability and safe stock rotation (first-in, first-out principle).

7. Personnel Safety Measures

Protecting the health and safety of personnel working with pesticides is essential. The following safeguards are recommended:

- **Training and Awareness:** Provide comprehensive training on hazard identification, safe handling, and emergency response. Conduct refresher courses regularly to ensure sustained awareness.
- **Personal Protective Equipment (PPE):** Supply chemical-resistant gloves, respirators or masks, protective clothing, and eye protection. Ensure PPE is available, maintained in good condition, and replaced as needed.
- **Hygiene Facilities:** Install washing stations with clean water and soap in close proximity to storage and handling areas.
- **Emergency Preparedness:** Develop written emergency response plans addressing spills, exposures, fires, and related incidents. Conduct regular drills to test readiness. Use industrial vacuum cleaners or absorbent materials for spill clean-up instead of sweeping, to prevent dispersal of hazardous residues.
- **Restricted Access:** Limit entry to storage areas to trained and authorized personnel only. Prominently display safety signage indicating hazard levels, prohibited activities (e.g., no smoking), and emergency contacts.

8. Special Cases and Alternative Safeguards

Considering the Maldives' unique challenges, such as limited land availability, high humidity, and exposure to extreme weather, it is recommended that the MAAW may approve alternative storage arrangements in exceptional cases. Such approvals should require:

- **Demonstrated Safeguards:** Equivalent or enhanced protection measures (e.g., elevated platforms to avoid flooding, use of dehumidifiers, or secondary containment systems).
- **Regular Inspections:** Biannual or annual inspections to confirm continued safety and compliance.
- **Recordkeeping:** Documentation of alternative safeguards and inspection results, available for review by authorities.
- **Periodic Review:** Reassessment of approvals at defined intervals to ensure suitability and ongoing risk management.

11.4 Pesticide Usage

Responsible pesticide use in the Maldives is essential to achieve effective pest control while safeguarding fragile island ecosystems and limited land resources. The following recommendations are provided:

- **Certified Applicators:** Certification of personnel who handle pesticides is strongly recommended, consistent with FAO and WHO guidelines. As most applicators in the Maldives are expatriates with varied prior experience, it is recommended that all applicators complete a government-recognized basic training course delivered in multiple languages commonly spoken by expatriates (e.g., Dhivehi, Bengali, or others as required). Training should include practical demonstrations relevant to locally available pesticide types, application methods suited to island conditions, proper use of PPE, and measures for environmental protection, as well as awareness of pesticide toxicity and potential health impacts. Digital and remote training platforms are recommended to ensure accessibility for the dispersed workforce.
- **Compliance with Guidelines:** Pesticides should be applied strictly in accordance with manufacturer instructions and approved uses. Unauthorized or off-label applications increase the risks of ineffective pest control, pesticide resistance, and environmental contamination. Non-compliance should be subject to regulatory penalties, including fines, suspension of applicator certification, or revocation of licenses.
- **Environmental Protection:** Measures should be taken to prevent contamination of non-target areas. Locally appropriate buffer zones and drift-reduction techniques should be applied, with distances adapted to island land availability and sensitive receptors such as coral reefs, fish ponds, and groundwater wells. Applications should be strictly avoided during strong winds or heavy rainfall to prevent drift and runoff into marine ecosystems.
- **Protective Measures:** Employers are legally responsible for providing, maintaining, and replacing appropriate PPE, and for ensuring that workers are properly trained in its correct use during pesticide mixing, application, and equipment cleaning.
- **Incident Reporting:** All adverse effects, accidental exposures, or environmental incidents should be reported immediately to the relevant authority. This enables timely intervention, mitigation, and lessons learned for future prevention.
- **Application Restrictions and Buffer Zones:** Clear restrictions should be established on pesticide use during adverse weather conditions, and protective buffer zones

should be designated around sensitive areas, including water bodies, coral reefs, agricultural land, and residential zone

11.5 Pesticide Labelling

Accurate and clear labelling is the primary communication tool between manufacturers and users. It provides essential information regarding the identity, usage instructions, and potential risks of a pesticide. A clear instruction to read the safety guidelines before using the product must be prominently displayed. Labels enable users to assess handling risks under specific local conditions.

The label must, at a minimum, provide:

- Contents of the container.
- Acute and chronic hazards, including relevant safety information.
- Clear directions for use and disposal.
- Supplier identification.

1. **Container Specifications:** Containers must be leak-proof, durable, and capable of withstanding handling stresses. Labels must remain intact and legible throughout the product's lifecycle.

2. **Product Content Requirements:**

Labels should include:

- Product name and category (e.g., herbicide, insecticide).
- Type of formulation.
- Active ingredient(s) and their concentrations.
- Name and concentrations of hazardous co-formulants.
- Target pests and approved application areas.
- Detailed instructions for safe use and dosage.
- Manufacturer details, manufacturing date, batch number and expiry date for traceability.
- Storage recommendations.
- Labels should be provided in English and Dhivehi to ensure accessibility for local users.

3. Hazard and Safety Information:

Labels should include:

- Hazard symbols and signal words.
- Hazard and precautionary statements.
- Mandatory GHS pictograms¹⁸¹.
- A tactile warning for the visually impaired.
- First aid instructions and emergency medical advice.
- User category classification.
- Required personal protective equipment (PPE) specifications.
- Potential health hazards and first-aid measures.
- Environmental and potential health hazards.
- Guidelines for spill response and safe disposal.

4. Directions for use:

Labels should include:

- Field of use
- Specific instructions on how, when, and where the product can be legally and effectively applied.
- Storage and disposal

Although detailed instructions may be provided in a separate leaflet, all essential information must always be clearly presented on the product label itself.

11.6 Pesticide Disposal

Proper disposal of water mixed with pesticides, unused formulations, and pesticide waste is essential to prevent environmental contamination, protect human health, and uphold sustainable agricultural practices in the Maldives. The following standards are recommended to guide safe and responsible disposal practices.¹⁸²

¹⁸¹ UNECE (2023), Globally Harmonised System (GHS) of Classification and Labelling of Chemicals.

¹⁸² Ministry of Agriculture and Animal Welfare (2021) *Guidelines for Pesticide Disposal, Shop, Godown, Repacking, Factory and Production*. Malé, Maldives: Government of Maldives,.

1. **Adherence to Label Instructions:** Always follow the disposal instructions provided on the pesticide label. Failure to comply may result in legal penalties and environmental harm.
2. **Rinsing Liquid Pesticide:** Triple-rinsed containers may be considered decontaminated and directed into designated non-hazardous waste streams, subject to MAAW/ERA approval.
3. **Collection of Pesticide Waste:** All pesticide-related waste, including expired products, contaminated PPE, and rinsate, should be collected and coordinated through local councils, waste management agencies, or authorized service providers, in line with national regulations.
4. **Designated Disposal Sites:** In the absence of dedicated pesticide treatment facilities in the Maldives, strategically located pesticide disposal centres should be established on selected islands. These centres would:
 - Serve as collection and temporary storage hubs for unused, expired, or banned pesticides.
 - Incorporate containment systems to prevent leakage, soil contamination, and groundwater pollution.
 - Operate under strict protocols until waste can be transferred for final treatment or export.
5. **Export for Final Disposal:** Given the lack of national hazardous waste treatment infrastructure, hazardous pesticide waste can be exported to certified international facilities. Exportation requires strict adherence to international regulations, such as the Basel Convention, and involves significant costs. To improve cost-efficiency and reduce environmental risks, export should be planned on a scheduled, consolidated basis.
6. **Interim Measures to Minimize Disposal Volume:** Stakeholders should actively promote the use of biopesticides or less hazardous pesticide alternatives, integrated pest management (IPM) practices, and precision application techniques to reduce waste generation and the burden of disposal.
7. **Penalties for Improper Disposal:** A tiered penalty system should be enforced for individuals or companies found illegally dumping pesticides or pesticide waste. This may include initial warnings and education, escalating to fines, suspension of licenses, and imprisonment for repeated or severe violations. A formal reporting mechanism should be established for communities to report unsafe disposal practices.

11.7 Treatment of Pesticide Wastewater

Several methods are available for treating pesticide-contaminated wastewater and related materials, each suited to specific scenarios. Where feasible, these methods should be applied in combination to maximize treatment efficiency and environmental protection.^{183 184}

8. **Removal of Particulate Matter:** Filtration or centrifugation can be used to eliminate solid particles from contaminated water. The addition of coagulants or flocculants may improve separation efficiency.
9. **Evaporation:** Natural evaporation can reduce the volume of pesticide solutions for disposal, but it is effective mainly in hot, dry climates. In the humid conditions of the Maldives, covered evaporation tanks are recommended, while alternative or complementary methods such as biobeds or adsorption systems are preferable for reliable treatment.
10. **Adsorption:** Activated carbon is effective in adsorbing many pesticides from contaminated water. Once saturated, the carbon must be treated as hazardous waste and disposed of according to regulatory standards.
11. **Chemical Treatment:** Techniques such as hydrolysis and oxidation can degrade certain pesticide compounds. These processes are often used in combination with biological treatment and must be conducted under controlled conditions to ensure safety and efficacy.
12. **Biological Treatment:** Microorganisms can degrade pesticide residues under controlled conditions. The effectiveness of microbial degradation may be influenced by co-contaminants. Systems such as biobeds, vegetated filter strips, or soak pits can be employed at small and medium scales.
13. **Incineration:** High-temperature incineration is an effective method for the complete destruction of pesticide residues. To reduce costs, pre-concentration of liquid wastes through methods such as evaporation is recommended prior to incineration.
14. **Wastewater Collection Systems:** Dedicated collection systems should be installed at agricultural fields, storage facilities, and pesticide-handling sites to capture contaminated runoff and cleaning wastewater before it enters the environment.
15. **Wastewater Treatment:** Biological treatment systems (e.g., constructed wetlands, lagoons) should be prioritized in line with FAO guidelines. Where biological methods are not feasible, chemical neutralization techniques (e.g., activated charcoal, advanced oxidation processes) may be adopted.

¹⁸³ Ibid.

¹⁸⁴ Ibid.

16. **Discharge Limitations:** Pesticide-contaminated wastewater must not be discharged into public water sources, including groundwater, lagoons, or coastal waters, unless treated to meet international water quality standards, particularly WHO Water Quality Guidelines, and national requirements under the Environment Protection and Preservation Act (EPPA) 4/93.

12 Enforcement Plan for the Recommended Standards for Pesticide Management in the Maldives

Table 12.1 presents the Enforcement Plan for the recommended Standards for the Application and Management of Pesticides in the Maldives.

Table 12-1 Enforcement Plan

Action	Lead Agency	Enforcement Tools
Governance and Regulatory Control Enforcement: Ensure coordinated, accountable, and transparent regulation of pesticide imports, distribution, storage, use and disposal.		
Establish inter-agency committee on pesticides	MAAW (Lead), Customs, ERA	Joint monitoring framework
Launch centralized pesticide registry platform	MAAW (Lead), MFDA	Digital registry system, mandatory reporting by distributors or retailers
Create pesticide licensing and oversight unit under MAAW	MAAW	Digital licensing system, compliance audits.
Enforce illegal pesticide trade controls	MCS	Training of border officials, rapid test kits at entry points, blacklist offenders
Encourage adopting Extended Producer Responsibility (EPR) for importers and distributors	MAAW (LEAD), ERA	EPR compliance reports, licensing conditions
Risk Management and Safety Protocol Enforcement: Reduce pesticide-related environmental and health risks through structured national policies.		
Encourage IPM adoption for farmers through a voluntary certification program	MAAW	Giving financial aid in the form of subsidies

Action	Lead Agency	Enforcement Tools
Set up pesticide disposal collection points	ERA, Island councils	Collection centres with monthly reporting
Mandate buffer zones for pesticide spraying	ERA	Environmental regulation updates
Require PPE and health checks for handlers	Ministry of Health, ERA	Inspection checklist at farms and stores
Monitoring and Compliance Enforcement: Systematic testing and inspections to ensure compliance with residue limits and safe use.		
Start nationwide pesticide residue testing in agricultural produce.	MFDA, ERA	Randomized quarterly testing program
Standardize sampling protocols for pesticide testing	MFDA	Publish national sampling manual
Expand laboratory capabilities in pesticide residue analysis	MFDA, Ministry of Health	Equipment procurement and international training
Capacity Building Enforcement: Strengthen national expertise and raise public awareness to ensure long-term compliance and safe pesticide management.		
Deliver advanced pesticide analysis training	MFDA, ERA	Annual workshops with international organizations
Encourage farmers to obtain certification for pesticide usage	MAAW, island councils	Training program with a certification exam
Run national public awareness campaigns	ERA, MFDA	Through social media and television programs

Governance and Regulatory Control Enforcement

To establish a strong regulatory framework, the MAAW will take the lead in forming an inter-agency pesticide committee that includes MCS, ERA, MFDA, and Ministry of Health representatives. This committee will meet quarterly to coordinate activities, share data, and resolve enforcement challenges. A joint monitoring framework will be developed, clearly outlining each agency's enforcement roles, reporting lines, and timelines, thereby improving inter-agency accountability and reducing duplication of efforts. A new Pesticide Licensing and Oversight Unit will be established under the MAAW to issue, renew, and suspend licenses for pesticide importers, distributors, and retailers. This unit will work closely with the centralized pesticide registry platform, which will roll out in phases to accommodate capacity limitations and promote compliance.

The centralized pesticide registry platform will be implemented in phases, starting with a simple digital database to record importers and distributors. Mandatory reporting will initially focus on larger distributors and gradually expand to smaller retailers, allowing time for capacity building. The system will be accessible online with user-friendly interfaces to encourage compliance. Training sessions and support hotlines will be provided to distributors and retailers to ensure smooth adoption.

MCS will be trained on pesticide identification using visual guides and rapid chemical test kits, which can be deployed at main ports and airports. These kits allow for quick screening of shipments suspected of containing illegal or banned pesticides. A blacklist of offenders will be maintained and circulated among border agencies and the pesticide committee, with sanctions enforced according to existing customs and environmental laws. Regular audits and unannounced inspections will be conducted to maintain deterrence. Importers and distributors will be encouraged to adopt an Extended Producer Responsibility (EPR) approach, voluntarily managing the entire lifecycle of pesticides, including safe usage and disposals. Incentives and supportive policies will be developed to promote such responsibility without making it mandatory.

Risk Management and Safety Protocol Enforcement

Integrated Pest Management (IPM) adoption will be encouraged through a voluntary certification program, supported by incentives for registered farmers. The Ministry of Agriculture, in partnership with NGOs, will deliver hands-on training workshops in key farming islands. These will be supplemented with printed manuals, instructional videos, and community-based demonstrations. To increase uptake, certified farmers may receive priority access to agricultural subsidies, such as discounts on approved pesticides or farming inputs. Refresher modules and certification tracking can be facilitated through simple mobile apps or SMS-based platforms, allowing farmers to stay updated even in remote islands.

To address pesticide waste management, the ERA and island councils will collaborate to set up monthly disposal collection points, starting with islands that have higher agricultural activity. These points will be staffed by trained personnel responsible for the safe handling

and temporary storage of collected pesticide containers and expired chemicals. Disposal will be coordinated periodically to a centralized or regionally approved treatment facility, potentially through partnerships with neighbouring countries. Public awareness campaigns via local media, community meetings, and agricultural groups will encourage farmers and retailers to use the collection points. The ERA will collect monthly reports from councils to monitor usage and ensure safety.

Buffer zones for pesticide spraying will be introduced through risk-based guidelines developed by the ERA, using local ecological and toxicity data. These will recommend safe distances from critical areas such as water bodies, schools, and homes. Rather than immediate enforcement, the focus will be on educating farmers through visual materials and field demonstrations. Compliance will be monitored during regular farm visits, and adjustments will be made based on island-specific realities. Use of basic visual markers will help farmers adhere to buffer zones with minimal technical burden.

To improve safety of pesticide handlers, the Ministry of Health and ERA will jointly carry out routine farm and shop inspections using simple checklists to verify the availability and use of Personal Protective Equipment (PPE) like gloves, masks, and protective clothing. Periodic voluntary medical screenings will be offered for pesticide applicators, with support from local health centres. Additionally, awareness sessions will be organized to educate handlers on health risks and protective practices. Compliance will be encouraged through recognition programs or small-scale incentives rather than penalties in the early phases, with enforcement mechanisms introduced later based on observed risks and readiness.

Monitoring and Compliance Enforcement

The MFDA and ERA will design a risk-based pesticide residue testing program focused on crops and regions identified as high-risk through data analysis and previous contamination reports. Sampling will be randomized but stratified to ensure representation across islands and seasons. To standardize testing procedures, the MFDA will develop and disseminate a national sampling manual, detailing protocols for sample collection, packaging, transport, and analysis. Training workshops will be conducted for field inspectors and lab technicians on these protocols to minimize errors and improve data quality.

Laboratory capacity expansion will be prioritized by procuring essential analytical equipment like gas chromatography-mass spectrometry (GC-MS) and high-performance liquid chromatography (HPLC). The MFDA and Ministry of Health will partner with regional and international laboratories to train local staff in instrument operation, maintenance, and quality assurance practices. Initial samples may continue to be sent abroad while local capacity is built. Periodic proficiency testing and inter-laboratory comparisons will ensure reliability.

Monitoring results will be compiled into bi-annual reports, which will be publicly released online and shared with stakeholders to promote transparency. Detected violations will trigger follow-up inspections and enforcement actions, including product recalls, fines, or suspension of licenses.

Capacity Building Enforcement

The MFDA and ERA will organize annual advanced training workshops for laboratory analysts, inspectors, and regulators in collaboration with international bodies such as FAO, WHO, and UNEP. These workshops will focus on pesticide residue analysis techniques, risk assessment methodologies, and regulatory frameworks. To maximize impact, a train-the-trainer model will be adopted, enabling a few trained experts to disseminate knowledge locally.

Voluntary farmer training programs on pesticide safety and Integrated Pest Management (IPM) will be promoted through incentives such as access to subsidized pesticides and priority eligibility for agricultural support schemes. The Ministry of Agriculture will lead the development of a structured curriculum covering pesticide handling, environmental protection, and personal safety. Training will be offered through in-person sessions at training centres and mobile-accessible digital content, ensuring accessibility across islands. While certification exams will be offered, participation will remain voluntary but encouraged, and completion will be recorded in the national pesticide registry to inform future policy and support delivery.

National public awareness campaigns will leverage multiple media channels, including social media platforms, TV, and community events, to educate the public on pesticide risks and safe practices. Campaign messages will be tailored for different audiences such as, farmers, retailers, consumers, and school children to maximize relevance and engagement. Partnerships with local NGOs, island councils, and community leaders will support grassroots outreach.

13 Conclusion

The analysis of the pesticide supply chain in the Maldives highlights critical gaps and inefficiencies across all stages, from importation to disposal. The country's reliance on imported pesticides, combined with its unique geographic and ecological context, underscores the urgent need for enhanced regulatory frameworks, improved stakeholder collaboration, and sustainable practices.

Pesticide use, while vital for agricultural productivity, public health, and tourism, poses significant environmental, social, and economic risks. Key challenges include contamination of soil and water, adverse effects on biodiversity, health hazards for workers, and improper disposal practices. The lack of comprehensive implementation of existing regulations exacerbates these issues, leaving the Maldives vulnerable to environmental degradation and economic vulnerabilities.

However, opportunities for improvement are clear. By implementing targeted recommendations—such as strengthening regulatory frameworks, enhancing storage and transport practices, promoting integrated pest management (IPM), and establishing robust disposal infrastructure—the Maldives can mitigate the risks associated with pesticide use. The operationalization of incinerators at RWMF and the adoption of decentralized storage and disposal systems will play pivotal roles in ensuring environmentally responsible pesticide management.

The recommendations provided in this report emphasize the importance of interagency collaboration, stakeholder education, and leveraging technology for monitoring and enforcement. Sustainable pesticide management in the Maldives requires a multi-faceted approach that balances the needs of agriculture, public health, and environmental conservation.

By addressing these challenges, the Maldives can establish a safer, more sustainable pesticide supply chain that protects public health, safeguards ecosystems, and ensures long-term economic resilience. This report serves as a foundation for actionable strategies to achieve these goals, paving the way for a more sustainable future for the Maldives.

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Annex A: Methodology

A.1 Literature Review

A literature review of key documents was conducted to identify existing legislation, policies, and regulatory practices as well as providing background context for the supply chain analysis.

The following documents were reviewed for this exercise:

1. National Legislative and Policy Framework
 - a. Agricultural Pesticide Control Act (Law No 21/2019)
 - b. Agricultural Pesticide Control Regulation (2021/R-12)
 - c. Hazardous Chemical Regulation (2019/R-1057)
 - d. Environmental Protection and Preservation Act (Law No 4/93)
 - e. Import Prohibition Act (Law No 4/75)
 - f. Magey Saafu Raajje National Waste and Resource Management Policy and Strategy 2024-2028
 - g. Waste Management Act (Law No 24/2022)
 - h. Regulation on Protecting and Conservation of Environment in the Tourism Industry Made pursuant to the Maldives Tourism Act
 - i. Regulation on Carriage of Dangerous Goods by Air (MCAR-18)
 - j. Export Import Act (Law No 31/79)
 - k. Maritime Act (Law No 69/78)
 - l. Land Transport Act (Law No 5/2009)
 - m. Vector Control Handbook
 - n. National Fisheries and Agricultural Policy 2019-2029
2. International Conventions and Agreements
 - a. Stockholm Convention on Persistent Organic Pollutants (POPs)
 - b. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal
 - c. Rotterdam Convention on the Prior Informed Consent (PIC) Procedure for Certain Hazardous
 - d. Chemicals and Pesticides in International Trade

- e. Minamata Convention on Mercury
3. International Standards and Best Practices
- a. International Code of Conduct on Pesticide Management (2014) by WHO & FAO
 - b. The WHO Recommended Classification of Pesticides by Hazard (2019)
 - c. Guidelines for Personal Protection When Handling and Applying Pesticides (2020) by WHO & FAO
 - d. Recommended Methods of Sampling for the Determination of Pesticide Residues for Compliance with MRLs (CXG 033e)
 - e. Guidelines on Good Laboratory Practice in Pesticide Residue Analysis (CXG 040e)
 - f. The WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 2019
4. Baseline and Context
- a. The Baseline Assessment on National Use of Chemicals 2022
 - b. Maldives National Chemical Profile 2016
 - c. State of the Environment Report (2016)
 - d. National Implementation Plan Stockholm Convention 2017
 - e. Minamata Initial Assessment Report 2019

A.2 Stakeholder Engagement

A.2.1 Stakeholder Mapping

A mapping exercise was undertaken to identify all stakeholders, taking into account their roles and responsibilities in relation to the management of pesticides in the country. Stakeholders were mapped to include government policy institutions, local government regulators, manufacturers, importers, retailers, distributors, key end user groups, private sector, and civil society organizations and vulnerable groups.

A stakeholder matrix was then developed to map stakeholders based on their influence and interest in the pesticide supply chain. This involved the identification of key players, potential allies, and groups requiring engagement.

Key informants were identified amongst importers through the initial stages of supply chain mapping and using data provided by MCS.

A.2.2 Interviews with Key Institutions

Face to face or online consultations were undertaken with the following institutions.

1. MoCCEE
2. MoD
3. MNDF
4. MoAAW
5. MCS
6. WAMCO

It was not possible to conduct face to face consultations with the following institutions at the time of report writing

1. MoH
2. HPA
3. MFDA

A.2.3 Interviews with Key Informants

Face to face interviews were conducted with the following key informants

1. Pestterminators – provide private pest control services as well as supplier of agricultural and general pesticides
2. AgriGo – supplier of agricultural products including pesticides
3. Alividha – supplier of agricultural products including pesticides
4. PestEx – provide private pest control services as well as supplier of agricultural and general pesticides

In addition, other experts in the area were also interviewed with the condition to remain anonymous.

Indepth open-ended interviews were held with each of these key informants. Key informants were reluctant to provide information about their imports, and suppliers and answered more general questions.

A.2.4 Interviews with Key Informants and Institutions

The following is a list of interviews with key informants and institutions. The key informants have been given a code for anonymity.

Table 2 Dates of stakeholder consultations

Stakeholder name/code	Stakeholder type	Date(s) of interview
B1	PCO	20 Dec 2024
B2	PCO	26 Dec 2024
B3	PCO	26 Dec 2024
B4	PCO	30 Dec 2024
MoD	Govt institution	20 Nov 2024
MoAAW	Govt institution	20 Nov 2024; 2 Jun 2025; 22 Jun 2025
MoTE – Waste Department	Govt institution	17 Apr 2025

MCS	Govt institution	21 Nov 2024; 21 Jan 2025
WAMCO	SOE	5 December 2024
Laamu Farmers	Farmer	2 Mar 2025
Addu Farmers	Farmer	Feb and Apr 2025

A.3 Data Collection and Analysis

A.3.1 Data Collection

Data was requested from key institutions through the consultation process. The following data was received at the time of report writing (Table 2.1)

Table 3 Details of data received by institutions

Institution	Data Received
MoAAW	Pesticide Register – approved pesticides
	Pesticide Board details
	Farmers register
	Islands registered for long term commercial agricultural use
	Existing laws/regulation/standards/guidelines related to pesticides management
MCS	Pesticide import data (2019 – now) by type, quantity, sector, and importer.
MoD	Current information requirement and list of documentation needed for pesticide approval process
	Information requirements and list of documentation needed for new substance approval
	Information requirements and list of documentation need for storage facility approval

Criteria used to decide if pesticides are controlled
Pesticide open list, controlled list
Pesticide import permits by type, frequency, quantity and importer

A.3.2 Data Cleaning and Analysis

Data Cleaning

The dataset included the following information

1. Year
2. HS code
3. HS description
4. Importer/exporter code
5. Importer name
6. Sector
7. Country of consignment
8. Unit
9. Quantity
10. CIF
11. Rate

New fields were created as below:

1. Category – to categorise the information by categories of pesticides, based on the HS codes and descriptions. The HS codes and descriptions were not always consistent throughout
2. Usage – to classify whether the pesticide was brought for agricultural or general use

Data Analysis

Pivot tables were created to identify pesticide imports by weight, volume and numbers, as well as to identify top source countries for pesticides.

A.4 Supply Chain Analysis

This supply chain exercise included a mixed methodology, combining supply chain mapping with institutional mapping and identifying the environmental and social risks through the development of the supply chain map.

The scope of this supply chain has been limited from importers to end-users, and did not include raw material suppliers and manufacturers.



The supply chain analysis will take place in 4 phases.

Phase 1: Supply Chain Scoping

Key players and entities were identified and mapped at each stage of the supply chain. These stages will be:

1. Import
2. Storage
3. Distribution
4. End-use
5. Disposal

Key players were identified for stages through customs and agricultural data, and key informant interviews. The flow of pesticides were traced throughout every stage of importation, storage, and distributions and the respective geographic locations identified, where possible. It was not possible to identify logistics providers transporting the pesticides between the stages as importers utilised public boats and rented vehicles as well as private vehicles.

The supply chain was divided into manageable segments, reflecting each of the stages, to allow for the assessment of the environmental and social risks in each segment.

Phase 2: Mapping Data Collection

An attempt was made to collect detailed information on each importers environmental practices, regulatory compliance status and capacity for safe pesticide. As the Maldives operates further downstream in the supply chain and are not purchasing primary production directly from producers, it was challenging to get specific information about supply chain. Key Informants were asked to identify:

- Number of suppliers
- If possible, identities of suppliers
- Position in supply chain
- Country of origin for each delivery (with supporting evidence)
- If possible, identities of suppliers
- Transportation route upto the primary supplier
- Range of pesticides supplied to specific downstream buyer and volumes
- Type of buying relationship (Type of contract)
- Sustainability information (e.g., certification, sustainability contract clauses), if applicable

Majority of the informants were reluctant to share detailed information and answered general questions about their processes and supply chain.

Checkpoints where pesticides are assessed for regulatory compliance were identified detailing the permits and documentation required to pass these checkpoints. The literature review will already have identified these checkpoints.

A.5 Impact Assessment

The objective of this assessment is to determine the potentially significant impacts that may arise during the various stages of pesticide life cycle. This section explains the general approach used in the assessment.

The methods used in the assessment are based on a structural approach that:

- a. Draws from the guidance contained in EIA Regulations, World Bank/IFC Guidelines and Guidelines for Environmental Impact Assessment (IEMA, 2004);
- b. Considers the key issues raised by key stakeholders during consultations;
- c. Uses expert judgement based on experience

The specific methods used in the assessment are:

- d. Impact Identification Checklists
- e. Impact detailing matrices

The approach is generally qualitative but varies across different environmental values. Quantitative assessments are used where deemed necessary.

The categories of potentially affected environmental values considered are: air quality; noise; water quality, marine flora and fauna, terrestrial flora and fauna, solid waste and hazardous materials, soil condition, natural hazards, employment, mitigation and adaptation aspects of climate change, public infrastructure and utilities, socio-economic factors, and community and occupational health and safety.

Significance for each environmental value is considered using the sensitivity of the existing baseline environment against the magnitude of change anticipated. Additionally, the likelihood or probability of the impact materializing was also factored in where relevant.

The general criteria used to define Sensitivity is presented in Table 2.10.

Table 4 Generalised Sensitivity Criteria

Sensitivity	Definition
-------------	------------

Very High	The receptor has little or no ability to absorb change without fundamentally altering its present character, is of very high environmental value, or of national/atoll/regional importance.
High	The receptor has low ability to absorb change without fundamentally altering its present character, is of high environmental value, or of atoll/regional importance.
Medium	The receptor has moderate capacity to absorb change without significantly altering its present character, has some environmental value, or is of local importance.
Low	The receptor is tolerant of change without detriment to its character, is of low environmental value, or local importance.
Negligible	The receptor is resistant to change and is of little environmental value.

The magnitude of change and potential negative impacts on baseline conditions due to the pesticide use are evaluated based on the scale of change anticipated, deviation from recommended regulatory standards and optimum conditions, duration of change, potential for reversibility and spatial extent of change. The definitions used in the assessment are summarized in Table 2.11.

Table 5 Factors used to determine magnitude of impact

Criteria		Description
Extent: Spatial extent or population extent.	Local	Impacts that affect receptors in areas close to the source of impact.
	Regional	Impacts that affect receptors beyond the defined local level, but are not experienced at the national level.
	National	Impacts that affect receptors at a national scale.
	Transboundary	Impacts that affect receptors, beyond the boundaries of the country in which the project is located.
Duration: Period of time over which an impact will	Short term	Impacts that are predicted to last only for a limited period but will cease either on completion of the activity or soon afterwards.
	Medium term	Impacts that are predicted to last for a longer time period. Examples include impacts occurring during a

Criteria		Description
interact with receptor.		period of extended activities which may occur over 2 or 3 years.
	Long term	Impacts that are predicted to continue over an extended period, (e.g., noise from operation of a development, impacts from operational discharges or emissions). These include impacts that may be intermittent or repeated rather than continuous if they occur over an extended time period (e.g., impacts resulting from annual maintenance activities).
Frequency: How often the impact will occur.	Infrequent	Impacts are predicted to be rare in nature over a certain period (see 'Duration' above).
	Periodic	Impacts are predicted to be recurring over a certain period (see 'Duration' above).
	Constant	Impacts are predicted to be permanent during a certain period (see 'Duration' above).
Reversibility: Restoration of the pre-impact status of a receptor.	Reversible	Restoration of the pre-impact status of a receptor as a result of mitigation/reinstatement measures and/or natural recovery. The time periods over which impacts may reverse link to the duration over which an impact is experienced (see 'Duration' above).
	Irreversible	Impacts that cause a permanent change in the affected receptor.

Table 6 Impact magnitude

Magnitude	Definition
High	Total loss or major alternation to key elements /features of the baseline conditions such that post development character/composition of baseline condition will be fundamentally changed.
Medium	Loss or alteration to one or more key elements/features of the baseline conditions such that post development character/composition of the baseline condition will be materially changed.
Low	Minor shift away from baseline conditions. Changes arising from the alteration will be detectable but not material in that the underlying character /composition of the baseline condition will be similar to the pre-development situation.
Negligible	Very little change from baseline conditions. Change is barely distinguishable, approximating to a “no change” situation

Based on the above discussed sensitivity and magnitude (and probability) assessment, a matrix system was used to define the significance of impacts. The result is expected to yield a significance level in line with that shown in Table 2.13. Impacts with moderate to high significance require mitigation.

Table 7 Derived impact significance matrix

Magnitude	Sensitivity/Probability				
	Very High	High	Medium	Low	Negligible
High	Major	Major	Moderate	Moderate	Minor
Medium	Major	Moderate	Moderate	Minor	Negligible
Low	Moderate	Moderate	Minor	Negligible	Negligible
Negligible	Minor	Minor	Negligible	Negligible	Negligible

The significance is eventually described based on the following scale:

- Major Adverse;
- Moderate Adverse;
- Minor Adverse

- Negligible
- Minor Beneficial
- Moderate Beneficial
- Major Beneficial

Potential impacts predicted to be Minor or Negligible are considered to be “Not Significant” and impacts predicted as Major or Moderate are considered “Significant”.

Other definitions used in the assessment are listed below:

- Direct impacts: Those that may occur through direct interaction of an activity with an environmental, social, or economic component.
- Indirect, or secondary impacts: Those that may occur remote as they are in distance or time from the actual proposed project.
- Cumulative impacts: Those occur in situations where individual projects or actions may not have a significant effect, but when combined with other projects or actions, the individual project's incremental contribution of adversity may cause an overall adverse cumulative effect.

Cumulative Impact Assessment

The cumulative impact assessment covers the following:

- definition of the region
- identification of existing or proposed activities
- identification of potential cumulative impacts
- assessment of significance of potential cumulative impacts

A.6 Life Cycle Assessment

An LCA was conducted for both Diafenthiuron and Deltamethrin. The LCA for Diafenthiuron evaluated its environmental impacts across different stages of its lifecycle in the Maldives, with a specific focus on water pollution, soil health, and biodiversity. The LCA for Deltamethrin focused primarily on its use in public health interventions within the Maldives, while also acknowledging its secondary use in agriculture. However, public health remains the primary lens of analysis.

The methodology follows internationally recognized LCA frameworks, specifically ISO 14040 and ISO 14044 standards, and has been adapted to the local context and data availability in the Maldives.

1. Goal and Scope Definition

This stage defines the goal and scope of the assessment. The main objective is to identify the specific environmental and health impacts associated with the high-market-share pesticides Diafenthiuron and Deltamethrin. The analysis covers each stage from storage to waste disposal, highlighting environmental aspects that may guide regulatory improvements and the promotion of sustainable practices. Importation and transportation stages are excluded from the scope.

Key elements of the scope include:

- **Functional Unit:**
 - For Diafenthiuron, the functional unit is the total quantity imported into the Maldives in one calendar year (2024), intended for agricultural application over an estimated area of 44 hectares.
 - For Deltamethrin, the functional unit is similarly the quantity imported in 2024 for public health purposes.
 - All input and output flows are normalized to the functional unit to enable consistent comparisons across lifecycle stages and impact categories.
- **System Boundaries:** The assessment includes storage, application, and waste disposal stages. Upstream production and raw material extraction are excluded, as neither Diafenthiuron nor Deltamethrin is produced domestically.
- **Impact Categories:** Water pollution; Soil health; Biodiversity and; Human health (specific to Deltamethrin).
- **Geographic and Temporal Scope:** The study considers typical practices in the Maldives and uses 2024 importation data.

2. Inventory Analysis

The inventory analysis stage involves collecting and quantifying data on all inputs and outputs associated with the lifecycle of Diafenthiuron and Deltamethrin within the defined system boundaries. This includes data related to storage, application, and waste disposal stages in the Maldives context.

Following the ISO 14040 and ISO 14044 standards, the inventory analysis aims to compile a Life Cycle Inventory (LCI) that captures material and energy flows (inputs) and emissions

or waste (outputs) for each lifecycle stage, normalized to the functional unit defined. Data sources used in the LCA included data from the Government agencies, published literature, or estimates based on similar practices.

3. Lifecycle Impact Assessment (LCIA)

The inventory data was translated inventory into potential environmental and human health impacts. Impact categories are:

- Human health
- Soil health
- Biodiversity
- Water pollution

4. Interpretation

The results are analysed to identify the stages and activities that contribute most significantly to environmental and health impacts. Based on the findings, targeted recommendations are made to support improvements in regulatory practices and promote sustainable pesticide management.



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