Regional Guide to Develop and Strengthen National Pesticide Residue Monitoring Programmes in ASEAN Member States

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Regional Guide to Develop and Strengthen National Pesticide Residue Monitoring Programmes in ASEAN Member States

The ASEAN Secretariat
Jakarta

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FOREWORD

In ASEAN, food safety is a shared undertaking and responsibility which requires a multi-disciplinary approach and necessitates active participation and collaboration of different stakeholders along the food supply chain, from the primary producer to the consumer. The ASEAN Food Safety Policy provides guidance to ASEAN Sectoral Bodies and ASEAN Member States (AMS) in protecting the health of consumers, ensuring fair practices in food trade and in facilitating the free movement of safe food products within the region. Relevant to this direction are the establishment of implementing food safety measures, fostering the process of harmonisation of food safety measures and control and supporting the efforts of AMS in strengthening food control systems.

This undertaking by the ASEAN Health Sector, through the ASEAN Health Cluster 4 (AHC 4) on Ensuring Food Safety is aligned with the aim of the ASEAN Food Safety Policy. Food safety has been on the agenda of the ASEAN Health Sector for years through the ASEAN Strategic Framework on Health Development for 2010-2015 and the Post-2015 Health Development Agenda for 2015-2020 and 2021-2025. AHC 4 has also been collaborating with agriculture and trade sectors on the overall approach of ASEAN on food safety.

As one of the projects under AHC 4 Work Programme strategy on providing scientific advice for developing evidence-based food safety risk management measures is the development of this publication, the ASEAN Guide to Develop and Strengthen National Pesticide Monitoring Programmes. With the support of the Food and Agriculture Organization (FAO) of the United Nations, the ASEAN Guide aims to assist AMS to implement effective pesticide residue monitoring systems.

Since ASEAN has a broad spectrum of pesticide risk management approaches given the AMS' frameworks, this publication provides practical solutions and management options for AMS with different levels of capacities to develop and/or advance effective pesticide residue monitoring systems.

I congratulate AHC 4 particularly lead countries Thailand and Malaysia as well as FAO, for developing a relevant regional guideline to further support the principles of the ASEAN Food Safety Policy as well as to enhance national capabilities on effective pesticide residue monitoring systems which contribute to achieving a healthy, caring and sustainable ASEAN.

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PREFACE

The ASEAN Guide to Develop and Strengthen National Pesticide Residue Monitoring Programmes was developed under the 5-year work programme (2016-2020) for the ASEAN Health Cluster 4 Ensuring Food Safety led by Thailand (Food and Drug Administration, Ministry of Public Health,) and co-led by Malaysia (Food Safety and Quality Division, Ministry of Health) with technical and financial supported from the Food and Agriculture Organization of the United Nations Regional Office for Asia and the Pacific (FAO RAP) under the FAO Project: GCP/RAS/295/JPN funded by The Ministry of Agriculture, Forestry and Fisheries (MAFF), Japan.

This guide was one of the successful activities of the ASEAN Health Cluster 4 (AHC 4) Ensuring Food Safety. AHC 4 is one of the health clusters under the Senior Official Meeting on Health Development (SOMHD) to achieve the regional health strategy to *"Strengthen capabilities, capacities, and advocacy in food safety related to elements towards the strengthening of food control system"*. As one of five elements in the national food control system, monitoring and inspection programme is an essential component along the supply chain to foster consumer health protection and trade facilitation given that pesticide residue is one of common food safety issues raised by all ASEAN Member States.

The main objective of this guide is to strengthen capacities of relevant authorities of ASEAN Member States in the area of monitoring and surveillance. This is to enhance scientific and risk-based data in order to develop evidence-based food safety risk management measures related to pesticide residue. The output from the national monitoring and surveillance programme will fulfill the ultimate goal of ensuring food safety across this ASEAN region.

This Regional guide was developed based on international principles and best practices as general practices and will be further adapted by each Member State based on their national experience and level of development. Hence, this ASEAN guide is not intended to be a full or binding statement. The application of this guide at national level is based on the current situation and capacities of each ASEAN Member State.

AHC 4 Country Coordinators of Thailand and Malaysia

ACKNOWLEDGMENTS

The Food and Agriculture Organization of the United Nations (FAO) would like to express its appreciation to the many people who contributed to this guideline, which was developed by Ian Reichstein, and prepared and developed for an FAO initiative coordinated by Masami Takeuchi under the overall direction of Sridhar Dharmapuri. Technical and editorial inputs provided by various FAO colleagues, including Panpilad Saikaew (Project Coordinator) and Isabella Apruzzese. The guide was would not be be developed without valuable inputs and feedback provided by the experts and delegates from the Association of Southeast Asian Nations (ASEAN) countries through the ASEAN Health Cluster 4: Ensuring Food Safety committee as well as the ASEAN secretariat members. The overall project was financially supported by an FAO project financed by the Government of Japan.

ABBREVIATION AND ACRONYMS

ADI	Acceptable Daily Intake
ARfD	Acute Reference Dose
ASEAN	Association of Southeast Asian Nations
FAO	Food and Agriculture Organization of the United Nations
GAP	Good Agricultural Practice
IFIP	Imported Food Inspection Programmes
ILAC	International Laboratory Accreditation Cooperation
IMS	Information Management System
LOD	Limit of Detection
LOQ	Limit of Quantification
MRL	Maximum Residue Limits
NRMP	National Residue Monitoring Programme
WHO	World Health Organisation
TAT	Turn-around-time

DEFINITIONS AND TERMINOLOGIES

Maximum residue limit (MRL)

The highest residue level of a particular pesticide that is legally allowed on a particular commodity when pesticides are applied correctly in accordance with Good Agricultural Practice (GAP).

The MRL is set at a level that is not likely to be exceeded if the pesticide is used in accordance with approved product label instructions. At the time the MRL is set, a dietary exposure evaluation should be undertaken to ensure that the level does not pose an undue hazard to human health.

MRLs for a pesticide are set by regulatory authorities in many countries and the Codex Alimentarius Commission, and are based on crop residue trial data and the potential risks the pesticide poses to human health.

Illegal residue

There are two instances when a pesticide residue is illegal:

1. The country has established a MRL for that pesticide on the commodity on which the residue was found, but the level of the residue exceeds the MRL; or
2. The country has not established any tolerance for that pesticide on the commodity on which the residue was found, and therefore any residue detection above the LOQ is deemed to be an exceedance.

In both cases, health regulations should make it illegal to sell the commodity.

Limit of Detection (LOD)

The lowest concentration of a chemical that a given analytical procedure can detect and identify, but not necessarily quantitate as an exact value. For pesticide analysis, the LOD is expressed in ppm or ppb. The LOD may be lower than the Limit of Quantitation (LOQ), because the analytical procedure might be able to detect and identify trace amounts of a chemical even when the concentration is too low to be measured accurately.

Limit of Quantification (LOQ)

The lowest concentration of a chemical that a given analytical procedure can measure (quantitate) with suitable precision and accuracy. For pesticide analysis, the LOQ is expressed in ppm or ppb. The LOQ may be higher than the limit of detection (LOD), because the analytical procedure might be able to detect and identify trace amounts of a chemical even when the concentration is too low to quantitate.

Lot[1]

A quantity of a food material delivered at one time and known, or presumed, by the sampling officer to have uniform characteristics such as origin, producer, variety, packer, type of packing, markings, consignor, etc.

A suspect lot is one which, for any reason, is suspected to contain an excessive residue. A non-suspect lot is one for which there is no reason to suspect that it may contain an excessive residue.

Note

a. Where a consignment is comprised of lots which can be identified as originating from different growers, etc., each lot should be considered separately.

b. A consignment may consist of one or more lots.

c. Where the size or boundary of each lot in a large consignment is not readily established, each one of a series of wagons, lorries, ship's bays, etc., may be considered to be a separate lot.

d. A lot may be mixed by grading or manufacturing processes, for example.

Consignment

A consignment is a quantity of some commodity delivered at one time. It may consist in either a portion of a lot, either a set of several lots.

Sample, sample size and unit[2]

One or more units selected from a population of units, or a portion of material selected from a larger quantity of material. For the purposes of these recommendations, a representative sample is intended to be representative of the lot, the bulk sample, the animal, etc., in respect of its pesticide residue content and not necessarily in respect of other attributes. The number of units, or quantity of material, constituting the sample.

A unit is the smallest discrete portion in a lot, which should be withdrawn to form the whole or part of a primary sample. For fresh fruit and vegetables, a unit is identified as follows: each whole fruit, vegetable or natural bunch of them (e.g. grapes) should form a unit, except where these are small. Individual fresh fruit or vegetables must not be cut or broken to produce units.

Representative sample

The representative sampling is a procedure used for drawing or forming a representative sample.

Random sampling involves the collection of n items from a lot of N items in such a way that all possible combinations of and items have the same probability of being collected.

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1 Codex Alimentarius Commission: Recommended methods of sampling for the determination of Pesticide Residues for compliance with MRLs, CAC/GL 33-1999.

2 Codex Guideline – Codex Alimentarius Commission: Recommended methods of sampling for the determination of Pesticide Residues for compliance with MRLs, CAC/GL 33-1999.

In order to avoid any dispute over the representativeness of the sample, a random sampling procedure should be chosen, whenever possible, alone, or in combination with other sampling techniques.

The collection of samples is to be performed in a random manner, whenever possible during the loading or unloading of the lot.

If the lot is heterogeneous, a random sample may not be representative of the lot. In such cases, stratified sampling may be a solution. Stratified sampling consists of dividing the lot into different strata or zones, each stratum being more homogenous than the original lot. Then a random sample is drawn from each of these strata, following specified instructions which may be drafted by the Codex product committees. Each stratum can then be inspected by random sampling which usually includes from 2 to 20 items or increments per sample. (see the sampling plans of ISO 2859-1 of letter-codes A to F at the inspection level II). But before sampling, it is necessary, where appropriate, to refer to the specific instructions of the Codex product committees.

False positive result

Where a residue testing result reports detections of a pesticide which are unexpected and later via confirmatory testing are found to be false.

False negative result

Where a residue testing result fails to report a detection of a pesticide when there is a relatively high chance of a detection because a particular pesticide had been used during production.

Point of entry

A location where produce from other countries enters a specific country including airports, seaports, and roadway border crossings.

Point of origin

A site where a country's grown produce is packed prior to shipment. The point of origin may be located at the production field for commodities such as lettuce, or at a packing shed for commodities such as citrus.

Good Agricultural Practice (GAP)

Good agricultural practice is a certification system for agriculture, specifying procedures that must be implemented to create food for consumers or further processing that is safe and wholesome, using sustainable methods.

For the purposes of this Guide, GAP relates to a pesticide risk management framework which facilitates the production of fruit and vegetables which a safe to consume.

Acute Reference Dose (ARfD)

The estimate of the amount of a substance in food or drinking water, expressed on a body weight basis, that can be ingested in a period of 24 h or less without appreciable health risk to the consumer. It is derived on the basis of all the known facts at the time of evaluation. The ARfD is expressed in milligrams of the pesticide per kilogram of body weight.

Acceptable Daily Intake (ADI)

The ADI is the estimate of the amount of a substance in food or drinking-water, expressed on a body weight basis, that can be ingested daily over a life-time without appreciable health risk to the consumer. It is derived on the basis of all the known facts at the time of the evaluation. The ADI is expressed in milligrams of the pesticide per kilogram of body weight (a standard adult person weighs 60 kg).

GEMs Food

Since 1976, the Global Environment Monitoring System - Food Contamination Monitoring and Assessment Programme, commonly known as GEMS/Food, informs governments, the Codex Alimentarius Commission and other relevant institutions, as well as the public, on levels and trends of contaminants in food, their contribution to total human exposure, and significance with regard to public health and trade. WHO implements the programme in cooperation with a network Collaborating Centres and recognized national institutions located all around the world.

WHO developed an approach to describe the various diets around the world based on the analysis of per capita supply available from the FAO Food Balance Sheets. The GEMS cluster diets consist in national dietary patterns grouped by similarities. These 17 cluster diets updated in 2012 are commonly used by international committees for exposure assessment to food contaminants and pesticide residues. WHO and FAO also collect national individual food consumption data. At date individual data representing more than 40% of the world population were made available to WHO. The GEMS Food Programme supports the collection of food consumption data in ASEAN Countries as well as the harmonization of existing data.

International Laboratory Accreditation Cooperation (ILAC)

ILAC is the international organisation for accreditation bodies operating in accordance with ISO/IEC 17011 and involved in the accreditation of conformity assessment bodies including calibration laboratories (using ISO/IEC 17025), testing laboratories (using ISO/IEC 17025), medical testing laboratories (using ISO 15189), inspection bodies (using ISO/IEC 17020), proficiency testing providers (using ISO/IEC 17043) and reference material producers (using ISO 17034).

Accreditation is the independent evaluation of conformity assessment bodies against recognised standards to carry out specific activities to ensure their impartiality and competence. Through the application of national and international standards, government, procurers and consumers can have confidence in the calibration and test results, inspection reports and certifications provided.

Accreditation bodies are established in many economies with the primary purpose of ensuring that conformity assessment bodies are subject to oversight by an authoritative body. Accreditation bodies, that have been peer evaluated as competent, sign regional and international arrangements to demonstrate their competence. These accreditation bodies then assess and accredit conformity assessment bodies to the relevant standards.

ISO/IEC 17025 enables laboratories to demonstrate that they operate competently and generate valid results, thereby promoting confidence in their work both nationally and around the world. It also helps facilitate cooperation between laboratories and other bodies by generating wider acceptance of results between countries. Test reports and certificates can be accepted from one country to another without the need for further testing, which, in turn, improves international trade.

ABSTRACT

Countries in Asia and the Pacific region of the Food and Agriculture Organization of the United Nations (FAO) recognize the need to have a comprehensive framework for pesticide residue management though science-based risk assessment, management and communication. The framework incorporates a range of functions and activities including pesticide registration, Maximum Residue Limit (MRL) setting, approval of a pesticide product label, farmer education, pesticide control-of-use regulation, food traceability, verification of good agricultural practice, national residue monitoring programmes, facilitation of trade and market access, traceback investigation and pesticide review. The frameworks tend to be operated as a continuum seeking ongoing improvement in good agricultural practice and enhancements to food safety.

A sound pesticide residue framework does not rely only on residue monitoring but importantly includes at the very least pesticide registration, chemical control-of-use, traceback investigation and a chemical review process. An increasing focus on harmonization of the pesticide risk management framework elements including the setting of MRLs is a key strategy to assist countries in the region. FAO received an official request from all ten countries participating in an FAO project entitled, "Support for capacity building for international food safety and implementation in Association of Southeast Asian Nations (ASEAN) countries" to assist the countries in developing the basis for countries to implement effective pesticide residue monitoring systems which are in line with the overall framework of the ASEAN food safety policy.

Noting the broad spectrum of pesticide risk management frameworks present in ASEAN countries, the ASEAN Health Cluster 4: Ensuring Food Safety (AHC 4) committee and FAO worked collaboratively to develop this regional guide, which is based on an in-depth situation analysis of the ASEAN countries in terms of their capacities and knowledge levels. The present guide provides practical solutions and management options for countries at different capacity levels to develop or improve effective pesticide residue monitoring systems.

Keywords:
Risk analysis, pesticide residues, food safety, maximum residue limit, monitoring, regulation, compliance, ASEAN Health Cluster 4, FAO.

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1 INTRODUCTION

1.1 BACKGROUND

Pesticides are used worldwide in agriculture to control or prevent pests, diseases, weeds and other plant pathogens. In almost all countries, pesticid e use is regulated and all pesticides must be registered by a national competent authority prior to launching in the market. During the process of the registration, most competent authorities establish the maximum residue limits (MRLs) as highest residue levels legally allowed on a specific commodity when pesticides are applied correctly in accordance with Good Agricultural Practice (GAP). Before a MRL can be established, human health risk assessments must be conducted to ensure the food supply is safe. Thus, agricultural commodities that comply with the respective MRLs are intended to be safe for human health.

The establishment of a national pesticide monitoring program is essential for a country to be able to confirm/verify that pesticides are used in accordance with GAP. While it may sound ideal to have a perfect pesticide residue monitoring system, it is not realistic to monitor each and every user of pesticide at the farm level as well as check the residue level of every single agricultural commodity. Many low- and middle-income countries would face a tremendous difficulty in meeting the requirements for resources. Therefore, it is recommended to develop a risk-based residue monitoring programme to have a specific focus in terms of the desired outcome of the residue monitoring system, in conjunction with implementation of GAP at the farm level so that the informed management decisions can be made in the limited-resource situations, while not posing unacceptable risks to consumers. Additionally, Codex Alimentarius Commission established a guideline entitled “Recommended methods of sampling for the determination of Pesticide Residues for Compliance with MRLs” (CXG 33-1999) as a reference for countries to enable the collection of a representative samples from a lot, for analysis to determine compliance with MRLs for pesticides.

However, the residue monitoring programme is not the only approach for managing the pesticide residue. The Figure 1 explains the pesticide risk management framework adopted in many countries in the world, as a continuum of functions focused on GAP, food safety and market access. It can be seen that a sound pesticide residue framework does not rely only on residue monitoring but importantly includes at the very least pesticide registration, chemical control-of-use, traceback investigation and a chemical review process. An increasing focus on harmonization of the pesticide risk management framework elements including the setting of MRLs is a key strategy to assist countries in the region.

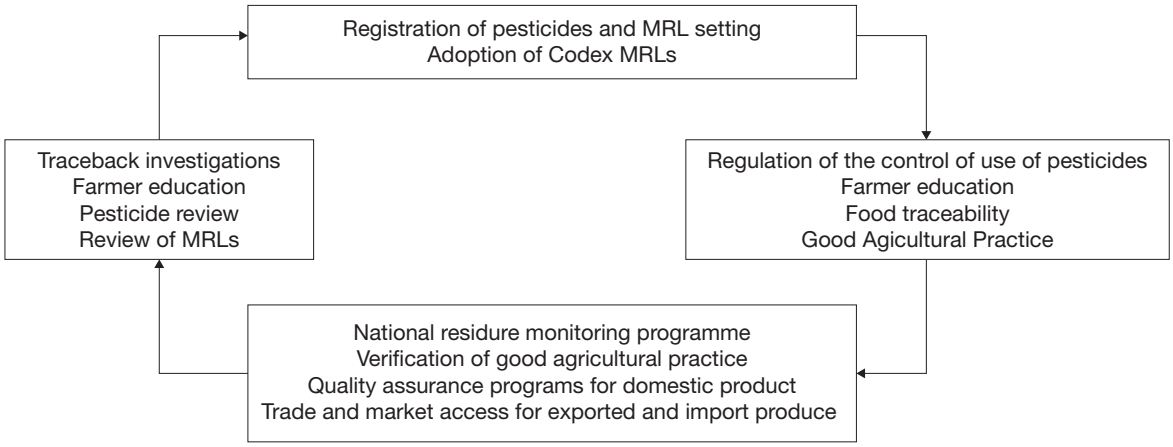

Figure 1. Pesticde risk management framework

FAO has received an official request from all 10 countries participating in an FAO project entitled, "Support for capacity building for international food safety and implementation in Association of Southeast Asian Nations (ASEAN) countries" to assist the countries in developing the basis for countries to implement effective pesticide residue monitoring systems which are in line with the overall framework of the ASEAN Food Safety Policy.

Noting the broad spectrum of pesticide risk management frameworks present in ASEAN countries, the ASEAN Health Cluster 4: Ensuring Food Safety (AHC 4) committee and FAO worked collaboratively to develop this guide, which is based on an in-depth situation analysis of the ASEAN countries in terms of their capacities and knowledge levels. The present guide provides practical solutions and management options for countries, not only with in the ASEAN region but also countries apart from this region, at different capacity levels to develop or improve effective pesticide residue monitoring systems.

1.2 OBJECTIVES

The principal purpose of this guide is to describe the essential elements and processes for developing and implementing effective compliance national pesticide residue monitoring programmes.

The guide has been developed as an aide for those aiming to develop or strengthen and implement a compliance programme and references the elements and functions which are critical to undertake this work.

The present guide considers that the key objective to develop or strengthen a national compliance pesticide residue monitoring programme are to: 1) facilitate the design an effective yet feasible compliance programme which verifies GAP; 2) implement the programme; and 3) increases consumer confidence in food safety and consumer health aspects.

1.3 SCOPE

This guide encompasses several elements of the pesticide risk management framework which are essential to support a compliance national pesticide residue monitoring programme. At the very least, these should include a database of adopted MRLs, a system for regulating the control-of-use of pesticides, food traceability, traceback investigation and farmer education.

1.4 TARGET AUDIENCE

The present guide has been prepared primarily for government authorities responsible for pesticide risk management frameworks and the establishment of compliance residue monitoring programmes. They shall utilize the guide with the goal of implementing such a programme. Meanwhile, public sector officials serve as the main target audience of the guide, the information included in this guide may also be useful for other relevant stakeholders such as primary producers, food business operators, food importers/ exporters and academia/researchers.

1.5 HOW TO USE THE GUIDE

The guide provides a step-by-step explanation of the principal types of residue monitoring programmes undertaken around the globe. While the guide is sufficiently comprehensive to utilize the information, a specific emphasis has been put on a compliance, as per the objectives of the guide.

In order to assist those using the guide, some key elements of the guide provide both desirable and minimum requirements. The purpose of such tiered requirements is to assist those countries which self-assessed their capacity to undertake a residue monitoring programme. However, those deemed as intermediate would be able to benchmark against the guide.

1.6 EXPECTED OUTCOMES

By reading and utilizing the guide, it is expected that the target audience will:

- be able to obtain a set of tools and knowledge to develop/strengthen and implement a national residue monitoring programme (NRMP) with a clear understanding of the minimum requirements;
- be able to verify the existing NRMPs with the guide with a view to enhancements to respective compliance programmes;
- be able to determine where information sharing and exchange can be undertaken, with a better understanding of the desirable and minimum requirements for a NRMP; and
- be able to execute continuous improvement of the pesticide risk management framework which is in line with the internationally or regionally harmonized guidelines and policies.

1.7 RELATED CODEX DOCUMENTS

Codex Alimentarius established the following set of standards, guidelines and tool which can be references for the development of the national residue montitoring programme:

- Codex Online Database for Pesticides Residues in Food;
- Classification of Foods and Animal Feeds (CXA 4-1989);
- Recommended Methods of Sampling for the Determination of Pesticide Residues for Compliance with MRLs (CXG 33-1999);
- Guidelines on Good Laboratory Practice in Pesticide Residue Analysis (CXG 40-1993);
- Portion of Commodities to which Maximum Residues Limits Apply and which is Analyzed (CXG 41-1993);
- Guidelines on the Use of Mass Spectrometry (MS) for Identification, Confirmation and Quantitative Determination of Residues (CXG 56-2005);
- Guidelines on Estimation of Uncertainty of Results (CXG 59-2006);
- Principles and Guidance on the Selection of Representative Commodities for the Extrapolation of Maximum Residue Limits for Pesticides to Commodity Groups (CXG 84-2012);
- Guidelines on Performance Criteria for Methods of Analysis for the Determination of Pesticide Residues in Food and Feed (CXG 90-2017); and
- General Guidelines on Sampling (CXG 50-2004).

2 TYPES OF NATIONAL RESIDUE MONITORING PROGRAMMES (NRMP)

There are six main types of residue monitoring programmes undertaken around the globe including compliance, quality assurance, export food monitoring, imported food inspection, dietary intake surveys and emergency incident responses.

The primary objective of respective countries for MRL compliance and food safety will determine which NRMPs are undertaken.

2.1 COMPLIANCE PROGRAMMES

Compliance programmes are generally designed to verify GAP as an element of a pesticide risk management framework. Compliance programs will have a regulatory element to, where required, provide enforcement capacity in certain cases where residue detected exceed the applicable MRL. In other cases where enforcement may not be necessary, education programs may be implemented. Compliance programs are generally supported by traceback investigation capability to identify the producer or to determine the cause of the MRL exceedance.

Over a period of time, all commodities produced within a country will be sampled and analysed. Each year, government authorities responsible for residue monitoring programmes will identify commodities to be tested in a particular year. The number of samples to be collected and the analytical screen will be dependent on the specific commodities to be included in a particular year. Consideration may need to be given to data requirements to provide a statistical representation of pesticide residues present in the food supply.

Compliance programmes are normally undertaken with random sampling to a specified total sample number for each commodity. Given the number of farmers involved in the production of particular commodities it would not be logistically and financially feasible to sample every farmer's produce. The random nature of the program promotes good agricultural practice as a particular famer will not be aware of impending sample collection until it occurs.

Where a residue-related issue has been identified, the compliance programme may incorporate a targeted sampling approach to either improve the understanding of the presence of high residue detection or to determine on a regional basis the source of the high residues.

2.2 QUALITY ASSURANCE

Food safety programmes provide for integrated food assurance which covers all elements of farm production including pesticide use and residue management. In general, a farmer may attain GAP accreditation/certification following an audit/verification process. The audit will include provision of annual residue testing results for commodities produced.

A quality assurance residue monitoring programmes would be developed to allow all farmers access to sampling and analytical services to obtain a specific residue testing report. The primary objective of a quality assurance (QA) programme is to allow producers meeting QA/food safety requirements to trade freely within the domestic market.

In some cases, the QA programme may also support to export certification. A QA programme will not necessarily include a regulatory element for enforcement against MRL exceedances.

2.3 EXPORTED FOOD MONITORING

Most exported food monitoring will be conducted via full consignment testing, random consignment testing or monitoring plan (possibly with the agreement with a trading partner) to ensure compliance with the importing country's consumer health and safety requirements.

Consignment testing: as the name suggests, exported food is on the point of origin This may be undertaken for all export consignments or a random selection of the consignments. At the commencement of trade, an exporting country may arrange for the sampling of all consignments. Should the residue testing results indicate high degrees of compliance with the relevant overseas MRLs, an exporting country may reduce the sampling rate to random status. For all consignment testing, a representative sample is collected from the consignment. Refer Codex Guidelines on Sampling.

Export certification (agreed monitoring plan with overseas market). To achieve export certification for certain markets, an importing country may specify requirements for a NRMP. The importing country may specify an export consignment testing programme for high risk commodities and markets. However, in many cases, the importing country may request a NRMP with specific sample numbers and analytical screens which for example ultimately demonstrates a 95% probability of a less than 1% MRL exceedance rate. In this scenario, the importing country would expect 300 random samples of a commodity to be collected throughout a 12-month period. The exporting country would be required to notify the importing country of any MRL exceedances and provide an annual report in due course.

2.4 IMPORT FOOD INSPECTION

The key objective of an imported food inspection programmes (IFIP) is to check that imported food products meet the importing country's requirements for consumer health and safety and is compliant with its food standards. Most IFIPs take a risk-based approach to regulating imported food and involve the cooperation of agriculture and health authorities to monitor food entering the country at the point of entry.

Given an IFIP requires sampling and analysis of products exported by an exporting country, it is customary for the programme to be supported by government legislation/regulation or written authority. An IFIP operates in accordance with an agreed Monitoring Plan which stipulates the rate of testing (e.g. 5% of all consignments), the analytical screen, MRL references and response protocol for non-compliance.

The monitoring plan may include determinations on low, medium and high risk consignments based on the commodity and exporting country. The monitoring plan should be reviewed annually. In non-compliance cases, international food safety incidents, post border domestic food safety incidents and high risk consignments, an importing country may increase the inspection rates. Importing and exporting countries may establish country recognition agreements or food import compliance agreements. These agreements involve:

- the exporting country documenting its food safety management systems including sampling and residue analysis of consignments to be exported. The exporting country would seek a mutual recognition agreement (MRA) which would be subjected to review periodically; or
- importers within the importing country demonstrating food safety systems through import compliance agreements. The importers would be regularly audited by the department.

2.5 DIETARY INTAKE SURVEYS

The key objective of a dietary intake survey is to monitor the food supply to ensure that existing food regulatory measures provide adequate protection of consumer health and safety. These surveys should be a comprehensive assessment of consumers' dietary exposure (intake) to pesticide residues, contaminants and other substances in food.

To achieve the most accurate dietary exposure estimates, a Total Diet Study should be conducted where food list should cover at least 90% of food intake and the foods examined are representative of a typical diet in a particular country, with foods prepared as they are typically consumed prior to analysis. As a consequence, both raw and cooked foods are examined.

Dietary exposure for various age groups representing the general population are estimated by multiplying food chemical concentrations analysed in survey by food consumption amounts recorded in national food consumption survey, or if not available, in the most recent GEMS/Food. These estimated dietary exposures are compared to health-based

guidance values (ADI or ARfD) to help characterise the risks for consumers. For the purposes of this guide, the likelihood of a country conducting a dietary intake survey in the first instance is relatively low.

2.6 EMERGENCY INCIDENT RESPONSES

Responses to emergency residue incidents are highly variable. Reasons to implement an emergency incident response include:

- an identified or perceived domestic food safety issues;
- an identified food safety issue arising from imported food testing; and
- a report from a trading partner identifying a food safety issue arising from a consignment exported from a particular country.

For the purposes of this guide, the likelihood of a country conducting a emergency incident response programme in the first instance is relatively low.

3 PREREQUISITE ELEMENTS

This section provides an overview of the residue monitoriong programme requirements which are consistent across all types of programme described in the section 2. The common requirements include government approvals, resourcing/funding considerations and assessment of program and technical parameters.

3.1 GOVERNMENT ENDORSEMENT

Given trade/market access and food safety/consumer health sensitivities, all NRMPs require the consideration and endorsement of the relevant government agencies.

It is expected that agriculture, health, food safety and trade departments or ministeries will have a vested interest in NRMPs. Government approval/endorsement would be preceded by consultation between some or all of these departments.

Government endorsements/approvals should take into account:

- rationale for a residue monitoring programme including expected outcomes and benefits;
- the type of programme to be implemented;
- funding/resource requirements;
- responsible departments; and
- monitoring plan.

3.2 RESOURCES AND FUNDING

The development of a NRMP and associated monitoring plan requires consideration of resource/funding arrangements. The type of NRMP will determine whether resources/ funding are derived from government, industry (farmers, packers), importers and/or exporters.

Governments may consider funding NRMPs to seek improvement in pesticide risk management and in turn enhance trade and market access. Given NRMPs focus on sound agricultural production and support food safety/consumer health initiatives, coordination between relevant government ministries/departments is essential.

Suggested funding arrangements for each programme:

- compliance programme involving random sampling on farm, packhouses and markets (government plus levy on industry);
- quality assurance programme designed to obtain certification to sell produce into the market (levy on industry);

- exported food monitoring designed to sample and analyse produce at point of export (exporters/marketers);
- imported food inspection designed to sample and analyse produce at the port of entry (importers/government);
- dietary intake surveys (government); and
- emergency incident responses (government).

3.3 ASSESSMENT OF PROGRAMME CONSIDERATIONS

3.3.1 Trade and market sensitivities

An exporting country may have trade/market access arrangements with a range of overseas markets. Each market is likely to have its own specific requirements and trading standards including MRLs.

With multiple overseas markets, an exporting country should conduct its risk assessment against the strictest marketing requirements. For example, the country with the lowest MRLs and highest rate of imported food testing would be deemed to have the strictest marketing requirements.

3.3.2 Domestic concerns regarding food safety of imported produce

Importing countries are expected to communicate respective specific market requirements and trading standards to all prospective trading partners. Some exporting countries may conduct residue testing of export consignments while others may not. Some overseas countries may use pesticides which are not registered in the importing country. To address domestic consumer health/food safety concerns, an importing country should consider the establishment of an imported food testing system.

3.3.3 Domestic pesticide use patterns and pest pressures

Depending on climatic conditions (rainfall, temperature, global zone etc.), each country is likely to produce a specific range of fruits and vegetables. As such, the range of pesticides, pesticide use patterns aligned to plant pest pressures are likely to vary. Each of these variables must be considered in assessing pesticide risks.

3.3.4 Consumer concerns regards public health

Consumer concerns are expected to align with science-based public health objectives. However in some cases, consumer concerns may arise where media focus has raised issues which are not necessarily science-based. The development of a NRMP may need to consider these situations.

3.4 ASSESSMENT OF TECHNICAL PARAMETERS

The assessment of technical parameters such as MRL, food standards, pesticides to be included in the analytical screen for residue testing and the commodities to be selected for sampling require specific expertise and knowledge.

The lead departments within a country would be expected to engage with the relevant agricultural industries, universities, agricultural research organisations to obtain expertise covering residue chemistry, pesticide physico-chemical properties, plant physiology and international food standards.

3.4.1 Difference in MRLs

Countries with a pesticide registration authority may, during assessment of pesticide dossier, establish MRLs. In other cases, Codex MRLs or regional standards such as harmonized ASEAN MRLs may be adopted. In a few cases, countries may adopt trading partner's MRLs. For example some countries trading with the European Union will adopt EU MRLs to ensure agricultural products destined for the EU meet specific food standards. A major concern for all exporting countries is missing/differing MRLs applying in a trading partner's food standards.

3.4.2 Pesticides of concern

There are approximately 500 different pesticide active ingredients formulated into thousands of herbicide, insecticide, fungicide and other pesticide products. It is impractical from financial and analytical capability perspectives to consider a residue monitoring program which includes analytical screens for all active ingredients.

In most cases, the pesticide use patterns on a particular commodity indicate that a subset of pesticides are registered or authorized for use on that crop. Therefore, a monitoring programme could consider an analytical screen covering only the pesticides registered for a specific crop. However, this approach may overlook situations where unregistered pesticides are used on a specific commodity. This is normally viewed as on 'off-label' use.

Pesticides of concern is also dependent on the type of residue monitoring program. For export-focused residue monitoring programmes, some importing countries may specify, as a condition of market access, an analytical screen covering pesticides which may be registered for use on a commodity and a range of other pesticides for which trade sensitivities apply. The trade-sensitive pesticides may include organochlorine pesticides (no longer registered around the globe), glyphosate (non-science-based consumer concerns) and organophosphate pesticides for which heightened awareness of hazards to consumer health apply.

3.4.3 Commodities of concern

In an NRMP, the importance of residues in a food commodity should be weighted by the amount of the commodity consumed as this has impacts on consumer health. High production volume staple foods such as rice, cabbage and mango form a significant

proportion of the diet of the total population. Commodity production figures should be readily available and provide a practical method of estimating consumption and thus potential human exposure to pesticide residues.

Some crops require relatively higher use of pesticides for plant protection and wider selection of insecticides, fungicides and herbicides. Pest pressures, plant physiology and climatic conditions may influence the volume of pesticides used. The edible portion of fruit and vegetables will also influence the pesticide residue risk potential. For example, banana and mango have inedible peel has a higher proportion of the residues should be found in the peel, unless the pesticide is systemic,. On the other hand, pesticide that is applied directly to the edible portion of spinach and apple, thus, the pesticide residue risk potential is likely to be higher.

When selecting commodities to be included in a monitoring plan, these matters should be considered.

However, noting the above, the selection of commodities to be sampled and analysed in your national residue monitoring programme is ultimately dependent on the type of program to be undertaken.

While a compliance programme should include all commodities produced within a particular country, an export-focused programme will only need to cover those being exported. Similarly, an imported food testing programme need only cover those commodities being imported into the country. As is the case with developing an analytical screen covering 500 active ingredients, the cost of a residue monitoring programme covering all commodities produced in a country will be prohibitively high.

Moreover, the number of samples to be collected for each commodity requires close consideration and awareness of the type of programme to be undertaken particularly if statistical validity is a requirement.

The capacity to make decisions on priority commodities will be restricted by the level of resourcing available for a national residue monitoring programme. The methodology/ measures utilized by a country to make that decision may vary but still be based on food safety and verification of GAP.

Starting Point:

A proposal for a NRMP must consider the level of funding/resources available. To this end, a country with limited funding would consider one group of commodities with the same classification and a pesticide screen of insecticides requiring the same analytical method.

The 'pilot' national residue monitoring programme could be developed and implemented within the limited budget. The programme would provide a source of review to determine positive outcomes in regard to good agricultural practice and food safety. A cost-benefit analysis would provide the relevant country with greater confidence to allocate-additional funding for an expanded programme.

4 DEVELOPING/IMPLEMENTING/STRENGTHEN A COMPLIANCE PROGRAMME

This section provides guidance on each element of a compliance residue monitoring programme. Developers of compliance programmes will be provided with a detailed explanation of technical and operational requirements to be considered.

The process of the development of a compliance residue monitoring programme is provided as a operational guide at Appendix 1. As countries have different capacity and capability, this guide provide a highly desirable and fundamental requirements for each element.

4.1 PROGRAMME CONSIDERATIONS

Risk Profile can be used as a basis for national pesticide residue monitoring programme. Risk Profile is a description of the food safety problem and its context which requires gathering relevant information related to matter of concern, in this case pesticide residues for further consideration and action. A typical risk profile includes a brief description of the situation, product or commodity involved; information on pathways by which consumers are exposed to the hazard; possible risks associated with that exposure; consumer perceptions of the risks; and the distribution of possible risks among different segments of the population.

4.1.1 Risk profiles of relevant pesticide-commodity combinations

The risk profiling considers:

- which pesticides are registered/authorised to be used on a particular commodity.
- likelihood of residues occurring in the product (potential for misuse; persistence in the crop, extent of use; use patterns).
- results of previous monitoring for the pesticide-commodity combination.
- availability of suitable sampling and analytical methods including limits of detection/ quantification.
- perceptions of a pesticide-commodity combination as a possible public health hazard.
- relevant MRLs/food standards applying to the pesticide-commodity combination; and market access requirements of trading partners.

Risk profiling process shall also consider several factor in prioritising for the national pesticide residue monitoring programme. A country shall determine among significant factors in prioritising the selection of analytical screen such as risk of hazard, prevalence data, data gap, high consumption, commodity production, availability of budget, laboratory capability and capacity, new regulation in place etc. For prioritization purpose, a country may develop risk matrix or ranking those factors and where available use suitable risk categorization for ranking risk of food hazards tool.

4.1.2 Proposal approval

A proposal to conduct a national compliance residue monitoring programme will require cross-government coordination noting that at least two government authorities (agriculture and health) having responsibility for agricultural production, pesticide risk management, good agricultural practice, food safety and consumer health. These are the key considerations of a compliance programme. The proposal must consider programme elements which are explained in more detail within this section of the Guide. The proposal is expected to identify resource and funding sources and outline potential collaborations. The collaboration can be among competent authorities in countries as well as with other countries both in the region and outside of the region. The collaboration is expected to include analytical laboratory capability and capacity.

Starting Point:

A proposal for a NRMP requires details on a monitoring plan, source of funding and availability of skills/capacity including analytical laboratories.

4.1.3 Programme objectives

A compliance program can involve sampling at farm level including packhouse, at a domestic market or both. At the planning stage, a decision should be made on where compliance is to be measured.

To be able to verify GAP a compliance programme requires a set of MRL. In most cases, most countries defer to Codex MRLs or regional MRLs. Countries with a pesticide risk management framework including pesticide registration will set MRLs for pesticides in agricultural produce, particularly produce entering the food chain. These MRLs are set at levels that are not likely to be exceeded if the pesticides are used in accordance with approved label instructions, that is, good agricultural practice.

At the time the MRLs are set, the pesticide regulator will undertake a dietary exposure evaluation to ensure that the levels do not pose an undue hazard to human health. Therefore, while an MRL is not specifically a food safety standard, the verification of GAP, which confirms residues in food are below the MRL, provides confidence to the community that food is safe to consume and consumer health considerations are adequately managed.

Compliance programs should have a regulatory element to, where required, provide enforcement/education capacity in certain cases where residue detected exceed the applicable MRL. In the absence of legislation or regulation, government authorisation may be sufficient to adequately support the Compliance programme. Compliance programs are generally supported by traceback investigation capability to identify the producer or to determine the cause of the MRL exceedance.

4.2 COMPLIANCE MONITORING PLAN

Compliance programmes are normally undertaken with random sampling to a specified total sample number for each commodity. Given the number of farmers involved in the production of particular commodities it would not be logistically and financially feasible to sample every farmer's produce. The random nature of the program promotes good agricultural practice as a particular famer will not be aware of impending sample collection until it occurs.

Over a period of time, all commodities produced within a country could be sampled and analysed. Each year, government authorities responsible for residue monitoring programmes will identify commodities to be tested in a particular year. The number of samples to be collected and the analytical screen will be dependent on the specific commodities to be included in a particular year.

Where a residue-related issue has been identified, the compliance programme may incorporate a targeted sampling approach to either improve the understanding of the presence of high residue detection or to determine on a regional basis the source of the high residues.

4.2.1 Scope of analytical screen

The guide assumes that the selected analytical laboratory has demonstrated requisite capability and capacity. This includes accreditation of analytical methods to be utilized and demonstrated proficiency using the accredited method. An analytical screen is developed through risk profiles of relevant pesticide-commodity combinations.

4.2.2 Agricultural commodities

The selection of commodities to be included in the NRMP needs to consider whether the produce will sampled directly off farm, from a fruit/vegetable pack-house, markets or a port of departure/arrival.

This will help determine whether the sampled commodity will be raw produce or processed produce which may have been treated with post-harvest/storage pesticides and/or biocides.

4.2.3 Analytical capability for specific commodities

The analytical method includes sample preparation (pesticide residue extraction is dependent upon the type of pesticide and the commodity matrix and further chemical reactions including acid or alkaline hydrolysis) followed by application to the analytical instrumentation which also varied dependent upon the type of pesticide.

Analytical method accreditation and proficiency is generally commodity-specific and in some cases commodity group specific. For example, method accreditation for almonds may differ from macadamias given the differing oil content of the latter. Accreditation

for canola testing is not comparable to wheat testing for the same reason. However, the analytical method for apples is likely to be comparable to the other pome fruits including pear.

Starting Point:

The Monitoring Plan should detail all agreed elements of the residue monitoring programme.

Minimum requirement for a Monitoring Plan:

- Programme objective: verification of GAP.
- Official approvals: Departments of Health and Agriculture.
- Funding arrangements: government, industry or mix of both.
- Roles and responsibilities: Agreement between participating government agencies at national and local level.
- Scope of programme: Sample numbers, mode of collection, collection locations: e.g. farm, market etc.
- Commodities: Within the agreed budget, prioritise commodities on the basis residue potential, consumer health concerns.
- Pesticide screen: Within the agreed budget, prioritise pesticides to be included in the analytical screen. Alternatively, an accredited multi-residue screen may allow a broader screen to be utilized.
- Analytical laboratory: The selection of a preferred laboratory will take into account availability of a government-managed central laboratory, ASEAN regional laboratory, or another laboratory with an accredited analytical method and demonstrated proficiency.
- Sample Plan: sample locations, distribution of samples, sampling equipment, handling and treatment of samples.
- Sample transport: Formal arrangements for the transfer of samples from the collection point to the analytical laboratory taking into consideration handling of samples and chain of custody.
- Reporting: Agreed reporting frameworks for participants in the NRMP including farmers. pack-houses, markets and consumers.
- Traceback investigations: Agreed roles and responsibilities at national and local government levels for the conduct of traceback investigations when required and schedule of regulatory actions.

4.3 SAMPLE COLLECTION PLAN

Reference should be made to the Codex Alimentarius Commission: Recommended methods of sampling for the determination of Pesticide Residues for compliance with MRLs, CAC/GL 33-1999.

A sample collection plan is established to give clear direction on sample numbers, location of samples, sampling timeframes and breadth at a national, regional or local level.

Designated samples shall represent a given number of units, volume, or weight of a specific commodity collected at an assigned site on an assigned date. Each commodity sample is unique associated sample information including at the least collection date; collection site; lot number; and origin of grower, packer, or distributor.

Sample integrity between point of collection and arrival for residue analysis is critically important for the following reasons:

- A compliance programme is generally supported by pesticide and food safety laws and regulations.
- The sample condition is maintained from collection to arrival at the laboratory.
- There is a chain of custody for the sample free from tampering and interference.
- Authorised and trained officials conduct the operational aspects of the programme.
- Appropriate sampling equipment is available to facilitate sample integrity.

Sample numbers will largely be dependent on available funding for the programme. Apart from the available funds, the type of commodity, breadth of agricultural production across a country and production volumes will also determine the required sample numbers.

Sample locations depend on the purpose of NRMP. It can include directly on farm, fruit and vegetable markets, pack-houses, processing plants and supermarkets. Given the large number of farms, on-farm sampling is considered more difficult than sampling at a pack-houses or market which services large numbers of farmers in one location. Random sampling from markets and pack-houses should provide a reasonable spread of sampling across a particular commodity.

Sampling timeframe for a specific commodity will be determined by the growing season and availability of product in the market or pack-house. In some cases where commodity is kept in cool stores to extend availability of a product to the consumer, the timeframe of availability of samples is lengthened.

Sample traceability is critically important to support a pesticide risk management framework. In some cases, where produce may be aggregated before entering the market e.g. rice, traceability may not be possible. The sample collection plan should be developed to support traceability where practicable. The ability to collect farmer information, contact details and description of the commodity will allow the NRMP managers to conduct

traceback investigation in cases where residue detected exceed the MRL. Whether samples are collected directly from farms, at pack-houses or markets, every effort should be made to collect all sample information including producer and contact details.

Prior to sample collection, the sample collector should provide advance notice of attendance at a farm, pack-house, market or other sampling location, as appropriate. Appropriate coordination ensures an efficiently coordinated sample collection.

4.4 LOGISTICS PLANNING

4.4.1 Authorized sample collectors

To ensure appropriate chain of custody and sample integrity, it is preferable for the sample collector to be authorized by the responsibility government department to collect samples of fruit and vegetables. It is highly desirable that the sample collector has received adequate training in the use of sampling equipment, taking representative samples, recording all necessary sample information, appropriate packaging of samples and preparing for freight to the analytical laboratory.

Starting Point:

Sample collectors should be provided with an authorized set of instructions covering the use of sampling equipment, how to collect a representative sample and appropriate packaging in preparation for transport to the laboratory.

4.4.2 Sampling equipment

Sample equipment is dependent on the type of commodity to be sampled. Commodities with short shelf-lives such as raspberries require careful handling to ensure the sample integrity is maintained. Large size commodities such as durian require sample equipment suited to accommodate the fruit. Leafy vegetables may need to kept cool or frozen for the period between sampling and arrival at the laboratory.

For those commodities which need to be stored cooled or frozen in transit between sample collection and arrival at the laboratory, lined insulated boxes with chill sheets may be required.

Starting Point:

Sampling equipment should include plastic sample bags which can hold between 1-5 kg of fruit and vegetable, security bags or boxes, official tape to seal bags and boxes, disposable gloves. For perishable commodities, lined insulated boxes and chill sheets are required.

4.4.3 Sample collection

The principal objective of sample collection is to ensure the selected commodity is representative of the lot whether it be directly off farm, from a box/carton, consignment of boxes/cartons or supermarket shelf. Given this is a guide for a Compliance NRMP, it is assumed that fresh commodities refer to raw, whole produce (i.e., whole carrots, heads of lettuce, celery stalks, etc.). In the first instance, it is assumed that the prepared produce, such as salad mixtures, sliced carrots or chopped celery are not included. Items that are merely washed, brushed, or bagged are acceptable (i.e. leaf spinach, apples). However, the process of washing should be noted by the sample collector. The term delicate commodities refer to fresh produce (e.g., strawberries, raspberries, peaches, etc.) that are highly susceptible to bruising, crushing and/or deterioration during the sampling, packaging, and shipping process.

Random sampling involves the collection of number of samples (n) from a lot size (N) items in such a way that all possible combinations of n items have the same probability of being collected. The collection of samples is to be performed in a random manner, whenever possible during the loading or unloading of the lot.

There is no mathematical relationship between n and N. Therefore, the sample collector should focus on taking a reasonable number of units (leaves, pieces of fruit etc.) from the lot to be sampled.

The type/size of sample to be collected is dependent on the type of commodity (see Appendix 3). For example, a reasonable sample of pome fruit would be 10 pieces weighing approximately 1.5 kg and for spinach a bunch of 20 leaves.

The sample collector will prepare the representative sample by randomly taking a set number of items from the specified lot. For example, one spinach leaf could be taken from 20 bags of product to prepare a representative sample. If there are 60 bags of spinach, one leaf would be taken from every third bag and so forth. It is not desirable to take all 20 leaves from one bag.

When collecting more than one sample, the sample collector should ensure that cross-contamination does not occur. Wearing disposable sample gloves during the collection of a sample then discard prior to taking the next sample is preferable.

Appendix 3 provides some guidance on sample size and number of units. The guidance is based on Codex Alimentarius Commission: Recommended methods of sampling for the determination of Pesticide Residues for compliance with MRLs, CAC/GL 33-1999 but simplified for this Guide.

Starting Point:

The sample collector will survey the ‘lot’ (farm plot, container of fruit or vegetable or produce at a specific supermarket) and take units of produce from as many parts of the lot as is practicable to achieve a representative sample.

Starting Point:

Simple sampling procedure:

Survey the 'lot' to be sampled. This could be a patch of spinach, an orchard of guava, a bin of apples, a box of cabbage or a tray of mangosteen. By surveying the lot, the sample collector can determine where in the lot, units of commodity can be selected to achieve a representative sample from the entire lot.

Prepare your sample bags, sampling gloves and other equipment required to collect the sample.

Commence completion of the sample form. This will record the unique sample number, sample location and contact details (farm, pack-house, city market, distribution centre or supermarket), sample date, type of commodity and sub group (for example: apple – granny smith), spray diary availability (has the farmer kept records of pesticide use).

Commence selection of commodity units. For an example if sampling apples from a box, take 3-4 units from the top, from the middle and from the bottom of the container. If sampling a patch of spinach, take a leaf from 20 plants from the outer areas and inner areas.

It is preferred that whole fruit/vegetable samples are collected. However this may not be possible. Therefore, the sample collector must record the nature of the sample, e.g. whole, cut, peeled etc.

Place the units in a sealable plastic bag. Label the bag with the unique sample number on the corresponding sample form.

At the least, place the sample in a cooled container.

If collecting a second sample, replace the sample gloves to avoid cross contamination and repeat the process.

4.4.4 Sample packaging

Each sample shall be packed by the sample collector. Sample collectors shall use precautions to prevent samples from being contaminated by compounds that will affect the analytical results.

The next steps are dependent on the management of samples prior to arrival at the laboratory.Samples may be placed in boxed and prepared for shipment at the collection site, or transported to a local government office, shipping facility, or other location for packing.

At all times the samples must be kept at refrigerated temperatures in a cooled container until they are packed for shipment to the laboratory. This helps to maintain sample integrity. Frozen cold packs can be placed in the sample container to ensure refrigerated temperatures of the product during transit. Loose, wet ice is not an acceptable coolant material.

Sufficient room should be provided inside the shipping box so that samples are not squeezed, broken, bent, or bruised and there is no danger of rupturing sealed bags. The collector should use a sufficient amount of packing materials to prevent movement of the produce during transit, thereby protecting the samples from bruising or damage. These packing materials also help provide insulation.

If commodities have been grouped for collection, it is permissible for more than one commodity type to be placed directly in the same shipping container. However, when packaging more than one fresh commodity type, collectors should attempt to package together fresh commodities that have similar temperature, moisture, packaging, and shipping requirements to minimize product degradation. Demonstrated chain of custody is important. The sample collector should place guidance notes about sample handling on the sample container to ensure the transporter is aware of requirements.

4.4.5 Sample transportation

Sample transportation may occur several times between sample collection and arrival at the analytical laboratory. Samples may be transported to aggregation points prior to final freight to the laboratory. The key objectives are to maintain the sample conditions established by the sample collector at all times, maintain chain of custody and ensure the samples is delivered to the laboratory within the shortest possible period of time.

It is preferable for one freight company to be engaged to transport samples from the point of collection to the analytical laboratory. Contracting one freight company helps with uniformity in sample handling, transport and management.

Starting Point:

The NRMP plan will set roles and responsibilities for sample integrity and chain of custody from sample collection to arrival at the analytical laboratory.

Those responsible for sample freight will be accountable for sample integrity and chain of custody once the sample collector has delivered the samples to the aggregation point.

4.5 INFORMATION MANAGEMENT SYSTEM (IMS)

Web-based IMS is preferable to allow NRMP managers, sample collectors, analysts and regulators to enter data. The IMS allows storage of all relevant data and should contain a database of MRLs (domestic and relevant overseas). The IMS should allow data interrogation and reporting.

Alternatively a paper-based system coupled with excel spreadsheets could be adopted. Any data management system adopted should include at least the following data fields:

- Unique sample number;
- Commodity type e.g. apple;

- Sub product name e.g. granny smith;
- Nature of the sample, e.g. whole, cut peeled etc.;
- Name of commodity owner: farmer/pack-house;
- Contact details of commodity owner (physical address, phone etc.);
- Sample collection date;
- Type of sample (refer Codex Guidelines on Sampling);
- Location of sample collection e.g. farm, pack-house, market;
- Details of farm, pack-house, market;
- Sample analysis date;
- Analytical screen e.g. multi-residue screen;
- Pesticide residues detected plus result; and
- Relevant MRL.

Starting Point:

An electronic database such as an excel spreadsheet supported by a paper-based forms for sampling, freight and laboratory analysis is essential. A paper sample form is required to accompany the sample from point of collection to arrival at the analytical laboratory.

Coordination between the sample collector, analytical laboratory and the designated responsible department/lead agency is essential. Electronic solutions which facilitate coordination include accessible file sharing IT packages could allow electronic sample date entry instead of a paper sample form.

The analytical laboratory, with access to the sample data file, could enter the residue testing result electronically. Others involved such as the traceback investigator could access the sample data file to add results on the residue incident investigation.

4.6 ANALYTICAL LABORATORY

This section focuses on issues relating to the involvement of the analytical laboratory in the national residue monitoring programme. The guide does not include the requirements related to the method of analysis for pesticide residue.

While sample integrity, traceability, supporting regulation and resourcing are some of the important elements of a robust national compliance residue monitoring programme, the selection of the most suitably qualified analytical laboratory is critical to ensure a sound science-based approach which is defensible to the consumer and domestic/export markets.

The contracted analytical laboratory needs to be an integral part of the national residue monitoring programme to ensure sample integrity is maintained, chain of custody is upheld and the commercial-in-confidence status of sample information/residue results is assured.

4.6.1 Accreditation of the laboratory and analytical methods

Laboratory accreditation (or international equivalent) is generally required by any analytical laboratory providing pesticides analytical services to government agencies undertaking national residue monitoring programmes. Laboratory that conducting analysis must be accredited and comply with ISO/IEC 17025.

Government agencies may recognise accreditation by bodies that are signatories to the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement (often referred to as the ILAC Arrangement).

4.6.2 Analytical proficiency

The analytical laboratory is expected to have approached a proficiency scheme testing provider, as assessed against ISO/IEC 17043, to demonstrate analytical proficiency against the accreditation of the analytical method. For example, the laboratory which has been accredited for a multi-residue screen method to be used for the national residue monitoring programme must be able to demonstrate proficiency to international standards for the accredited multi-residue screen.

Documentation supporting the accredited multi-residue screen will specify limits of detection, limits of quantification and procedures for confirming false positive and false negative results.

4.6.3 Sample handling and integrity

As is the case with the sample collector, the analytical laboratory is responsible for the chain of custody of each sample upon arrival at the laboratory. In accordance with sample collection protocols, the sample collector will have recorded all requisite details relating to the sample. The laboratory will be responsible for ensuring these data are assigned correctly to the residue testing result.

4.6.4 Blind samples for ongoing proficiency testing

While the analytical laboratory, prior to commencement of a NRMP, will have demonstrated analytical method accreditation and analytical proficiency for that method, most NRMPs will include the capacity to enter ‘blind samples’ into the sample collection system. Blind samples cannot be distinguished from normal samples submitted to the analytical laboratory. The blind sample will contain spiked residues at known concentrations which the laboratory must identified and quantify to specific standards. In doing so the laboratory will have demonstrated ongoing proficiency.

4.6.5 Data handling

What methodology/measures can be utilized to collect, manage and process data? The possibilities range from a paper-based system, to an excel spreadsheet through to a web-based information management system which is accessible by sample collectors, analytical laboratories and relevant government departments.

4.6.6 Analytical timeframes (turn-around-time)

Laboratory turn-around-time (TAT) refer to the time elapsed from sample receipt at the laboratory through to the presentation of a residue testing result. TATs are highly dependent on the type of monitoring programme and the shelf-life of the commodity. A shorter TAT normally attracts a higher cost of sample analysis. This may need to be taken into consideration during programme planning. Export and import programmes are likely to need a shorter TAT to be able to quickly receive a residue testing result which allows the commodity to enter the exporting country or depart the exporting country.

4.6.7 Data checking

All residue testing results must be checked to minimize the possibility of false positives and negatives or unusual results. Over time, as residue testing data is accumulated and trend analysis can be undertaken. From this, data checkers have increasing capacity to assess data for false or unusual results.

4.6.8 Confirmatory testing

For a range of commercial and regulatory reasons, confirmatory testing to verify an original result may be necessary to address residue testing results classified as unusual and false positives/negatives.

Starting Point:

The foundation of any successful NRMP is access to appropriate analytical laboratory capacity and capability. The selection of an analytical laboratory should take into consideration: accreditation of analytical methods, demonstrated proficiency using the analytical method and sound internal quality assurance.

4.7 TRACEBACK INVESTIGATION

Traceback investigations are an integral element of a country's pesticide risk management framework. A successful NRMP will be supported by a country's pesticide risk management framework. The main objective of a compliance NRMP is to verify good agricultural practice, that is to demonstrate farmers are adhering to the instructions on the pesticide product's label.

Should detected pesticide residues exceed the MRL, a traceback investigation is essential to ensure the country's pesticide regulator can determine the source and cause of the MRL exceedance. A traceback investigation will involve an authorized inspector identifying the

source of the residues and undertaking regulatory action consistent with the severity of the MRL exceedance. Regulatory powers may determine that the specific sample contains 'illegal residues'. Accordingly, regulatory action will range from prosecution to an education program but ultimately seek continuous improvement of pesticide use and minimization of future occurrences.

The inspector will have prepared a report on the investigation which explains all relevant detail about the residue incident along with regulatory action taken. The investigation report should be shared with each responsible government ministry/department.

Starting Point:

When a traceback investigation should occur, a NRMP, which supports a country's pesticide risk management framework, should have the capacity to identify the owner of sampled fruit/vegetable to enable interaction between farmer and government authority.

4.8 REPORTING

The management of residue testing results is dependent upon the type of NRMP, the responsible authority and a particular country's commercial-in-confidence/privacy regulations. In most NRMPs, the details of a farmer, exporter or importer will have been recorded against a commodity sample. This is a key component of traceability and chain of custody.

The relevant government authority, which is bound by privacy/non-disclosure laws, will be in receipt of the residue testing result and may only share the commercial-in-confidence information with other responsible government authorities and the specific importer or exporter. In the case of a compliance NRMP, the same privacy provisions would apply with the specific farmer/packer being the only non-government recipient.

There are exceptions to the commercial-in-confidence approach to residue data management. Some countries have adopted a 'name and shame' approach whereby MRL exceedances are reported on government authority websites. Apart from reporting of commercial-in-confidence information from compliance NRMPs, government authorities may produce periodic reports on a monthly or annual basis. Normally, these reports do not identify private persons or companies.

Starting Point:

Reporting capability will be dependent on the NRMP's IMS. An excel spreadsheet should be sufficient to generate a range of reports including information to farmers and to conduct traceback investigations.

4.9 DATA ARCHIVE, ANNUAL REPORTING AND COMMUNICATION

A web-based IMS which allows sample collectors, laboratories and regulators to enter residue testing data is highly desirable as it potentially allows programme managers to access, interrogate and generate data reports, trend analysis and forms of communication. An excel spreadsheet or other database is another option but the system is more reliant on manual data entry and data handling.

Starting Point:

An electronic database such as an excel spreadsheet supported by a paper-based forms for sampling, freight and laboratory analysis is essential.

4.10 ADDITIONAL CONSIDERATIONS

- Consultations (of the Plan) with trade partners?
- Consultation with relevant government departments.
- Consultation with exporters and farmers.
- Outreach/communication with the general public?
- Data-sharing among countries in the region and, if possible, outside the region.
- Monitoring program review.

APPENDIX

APPENDIX 1: OPERATIONAL GUIDE FOR GUIDE TO DEVELOP/ STRENGTHEN NATIONAL PESTICIDE RESIDUE MONITORING PROGRAMMES

1. Determine primary objective: verification of good agricultural practice/ food safety

e.g. Compliance Program to verify Good Agricultural Practice;

- Samples of produce will be collected on a random basis to determine whether farmers are using pesticides in accordance with the pesticide product label.
- MRL reference: National MRLs, Codex MRLs.

2. Seek in-principle government support

Management commitment is the key starting point for development of national residue monitoring program (NRMP). NRMP requires the consideration and endorsement of the relevant government agencies. Government support would be preceded by consultation between some or all of these departments. Some countries would have the top down policy on the NRMP. Alternatively, technical officers from the main agencies can be start to have the consultation and request the in-principle government support.

3. Inter-departmental consultation

The consultation between relevant government agencies (e.g. Department of Health and Department of Agriculture) need to be conducted for discussing on the residue monitoring programme.

- Some following issue would be discussed during the consultative meeting.
- Pesticides/commodities to be included in the scope of the NRMP.
- Lead agency.
- Budget.
- Sample sizes and locations.
- Data sharing and level of accessibility to the database.

4. Government – industry consultation

If possible, the government-other stakeholders consultation should be conducted in order to gain full support of participants and agreement on the management/ operation of the NRMP. The stakeholders include, but not limit to, representative of producers/farmers, market, modern trade, pesticide industries.

5. Consider resources and funding sources

Resource and funding sources could be considered during the Inter-departmental consultation. For the compliance purpose, lead agency may consider funding NRMPs to seek improvement in pesticide risk management and in turn enhance trade and market access.

6. Develop scope of programme – commodities and pesticide analytical screen

Agricultural commodities and pesticides to be included in the monitoring programme have to be scoped. Some following criteria can be used for selection:

a. pesticides registered or authorized for use on a specific commodity;

b. registered pesticides not authorized for use on a specific commodity (off-label use);

c. unregistered pesticides that are used on a specific commodity (off-label use);

d. information from rapid alert system;

e. pesticides with high residue potential;

f. pesticides of market access concern; and

g. recent monitoring data.

Proposed: possibly a standard multi-residue screen including insecticides and fungicides on commodities to be selected by the participating countries.

7. Develop sampling plan – location of samples, sample numbers

Sample numbers: It is recommended that the number of samples should be a balance between available resources and a reasonable representation of the commodity at a national level.

Sample locations: e.g. farms, fruit markets and supermarkets.

8. Contract approved analytical laboratory on the basis accreditation, proficiency and price

The selection of a preferred laboratory will take into account availability of a government-managed central laboratory, ASEAN regional laboratory, or another laboratory with an accredited analytical method and demonstrated proficiency.

9. Develop programme budget taking into consideration analytical costs, sampling costs, sampling equipment and freight costs and staff resources

- *Analytical costs*: per sample to be determined. The selected analytical laboratory will provide a quote based on total number of samples and analytical pesticide screen.

- *Sampling costs*: sampling costs cover staff time and travel to obtain defined number of samples.
- *Sampling equipment*: inner sample bags, security satchel bags, ice packs, boxes, gloves and tape need to be costs.
- *Freight costs*: a reliable national freight company should be contracted to transport samples safely from point of collection to the analytical laboratory within strict timeframes to ensure sample integrity is maintained.
- *Staff resources*: 'time and materials' costing is required.

10. Prepare Monitoring Plan

The Monitoring Plan should detail all agreed elements of the residue monitoring programme. The minimum requirements for a draft Monitoring Plan are as follows. The example of draft monitoring plan is as Appendix 2.

a. Programme objective

b. Official approvals

c. Funding arrangements

d. Roles and responsibilities of the stakeholders

e. Scope of programme

f. Commodities

g. Pesticide screen/listing

h. Analytical laboratory selected

i. Sample Plan

j. Sample transport arrangement

k. Reporting line for NRMP participants

l. Traceback investigations needs, procedures as appropriate

11. Seek Government approval/endorsement

Lead agency is the main responsible agency for seeking government approval. The process depends on country protocols.

The following information should be taken into account and submitted for Government approval:

- rationale for a residue monitoring programme including expected outcomes and benefits;
- the type of programme to be implemented;
- funding/resource requirements;
- responsible departments; and
- monitoring plan.

12. Data management

Residue monitoring information must be entered and maintained in an electronic format available to the responsible agency, sample collector, analytical laboratory and any other official with an official role in the programme.

An excel spreadsheets should be established as a data management system with the following data fields:

- Unique sample number
- Commodity type e.g. apple
- Sub product name e.g. granny smith
- Nature of the sample, e.g. whole, cut peeled etc.
- Name of commodity owner: farmer/pack-house
- Contact details of commodity owner (physical address, phone etc.)
- Sample collection date
- Type of sample (refer Codex Guidelines on Sampling)
- Location of sample collection e.g. farm, pack-house, market
- Details of farm, pack-house, market
- Sample analysis date
- Analytical screen e.g. multi-residue screen
- Pesticide residues detected plus result
- Relevant MRL

The excel spreadsheet should be placed on an accessible facility with secure access to specified personnel.

A hard copy of the sample information must accompany the sample from point of collection to the analytical laboratory. It is highly desirable to utilise adhesive labels on the sample form and sample to clearly match each pair to ensure no possibility of mixing.

The hard copy and label support the sample's chain of custody.

13. Prepare an operational plan – authorised sample collectors, equipment distribution, and sample collection

- Sample collectors should be provided with an authorized set of instructions covering the use of sampling equipment, how to collect a representative sample and appropriate packaging in preparation for transport to the laboratory.
- Reference should be made to the information and procedure provided in Appendix 2, 3 and 4.

- Sampling equipment should include plastic sample bags which can hold between 1-5 kg of fruit and vegetable, security bags or boxes, official tape to seal bags and boxes, disposable gloves. For perishable commodities, lined insulated boxes and chill sheets are required.
- The sample collector will survey the 'lot' (farm plot, container of fruit or vegetable or produce at a specific supermarket) and take units of produce from as many parts of the lot as is practicable to achieve a representative sample as detailed in the Appendices.

14. Freight samples to analytical laboratory

- Select a freight company capable of handling samples of agricultural produce from collection point to analytical laboratory.
- Freight may include air travel.
- The freight company must ensure that the official samples are maintained in the pre-specified environment (temperature, physical characteristics).
- The freight company must have a system supporting chain of custody which could include barcoding.

15. Analyses of samples

Analytical laboratories to be chosen.

16. Confirmation testing

The foundation of any successful NRMP is access to appropriate analytical laboratory capacity and capability. The selection of an analytical laboratory should take into consideration: accreditation of analytical methods, demonstrated proficiency using the analytical method and sound internal quality assurance.

17. Management of analytical laboratory results

Reference is made to the section on data management.

- Each sample must arrive at the analytical laboratory with the associated paper sample form.
- Extreme care is required to ensure forms and samples are not mixed. Each sample form and sample should have matching adhesive labels.
- The analytical laboratory will have access to the relevant excel spreadsheet on a accessible platform or any system which allows controlled multiple access.
- Coordination between the sample collector, analytical laboratory and the designated responsible department/lead agency is essential.
- The analytical laboratory, with access to the sample data file, will enter the residue testing result electronically.

18. Lead agency assesses residue testing result against the relevant MRL/ food standard and considers appropriate action in the case of a MRL contravention (Section 20)

To be considered noting decisions made pre-commencement. The reference MRL will be stipulated by the NRMP participant and will already be widely circulated to all agriculture stakeholders.

There are two decision points once a residue testing result has been received from the analytical laboratory.

The confirmed residue testing result will be compared to the relevant reference MRL. If the residue level in mg/kg is higher than the MRL, the sample is deemed to be an exceedance or contravention. If the residue level is lower than the MRL, no further action is required at this stage.

For all exceedances, the lead agency will delegate a suitable government official to conduct a traceback investigation (see Section 20).

A MRL exceedance may occur where the chemical user (farmer):

1. did not follow the pesticide product label instruction relating to concentration of active ingredient in the spray mixture;
2. did not adhere to the withholding period (pre-harvest interval). The commodity was harvested within the withholding period;
3. did not adhere to the label instruction by applying more spray applications within a specific period of time than are authorised;
4. used a registered pesticide which is not authorised for use on a specific commodity. No MRL is set and therefore zero tolerance applies;
5. used an unregistered (possibly banned) pesticide on a specific commodity. No MRL is set and therefore zero tolerance applies; or
6. was subject to pesticide spray drift on their property as a result of a neighbouring farmer using a pesticide for a different crop.

The traceback investigation will seek to confirm the source and reason.

The lead agency will need to consider thresholds for specific actions following an exceedance which may include farmer education, product recall, certification for market, suspension of market access or financial penalty.

For example, where the residue level is significantly higher than the MRL and the lead agency determines there is a potential food safety risk, a product recall and financial penalty may be appropriate[3].

In cases where the residue level slightly over the MRL (e.g. residue 1.1 mg/kg and MRL 1.0 mg/kg, the regulator may opt for a warning or farmer education.

[3] An MRL exceedance is not necessarily a food safety risk. The relevant food safety authority should be approached to make a determination prior to any regulatory action.

19. Reporting

To be considered prior to commencement.

The electronic database (possible spreadsheet) will contain data consistent with that listed in section 12.

The reporting form (suggested example at Appendix 4) can be developed following consultation with NRMP participants. It will contain information gathered during sample collection and analysis.

Agreed reporting frameworks for participants in the NRMP should be listed in the monitoring plan.

20. Traceback investigation

For NRMPs focused on verification of good agricultural practice, any samples with residues detected above the official MRL should be subjected to a traceback investigation by an government investigator.

Refer to Section 18 for likely MRL exceedance reasons.

The investigation will seek to confirm why the MRL exceedance occurred.

Where required, investigations will be conducted by a government official.

In general, the official will interview the farmer/producer and the fruit/vegetable market.

The official may need to interview neighbouring farms to take into account possible spray drift. This is particularly important if the farmer being investigated can demonstrate that a certain pesticide is not used in their farm.

The official will report to the responsible agency.

Investigation recommendations will include farmer education and advice, followed by a warning and, with ongoing contraventions, a financial penalty or market access block.

The lead agency should identify roles and responsibilities at national and local government levels for the conduct of traceback investigations when required and schedule of regulatory actions noting Section 18.

APPENDIX 2: EXAMPLE OF DRAFT MONITORING PLAN

Programme objective:	Verification of good agricultural practice. Assessment of programme considerations including those in Section 3.3 should be briefly included to provide information on the purposes and objective of the monitoring plan.
Official approvals:	Departments of Health and Agriculture.
Funding arrangements:	Government, industry or mix of both.
Roles and responsibilities:	Department of Agriculture: lead agency for the NRMP, responsible for sampling at farm levels. Department of health: responsible for sampling at at the market and modern trade. (Agreement between participating government agencies at national and local level).
Scope of programme:	Sample numbers: mode of collection: collection locations: e.g. farm, market etc.
Commodities:	Leafy vegetables (commodities to be decided)
Pesticide screen:	xxx List of pesticides to be analyzed. Accredited multi-residue screen covering insecticides and fungicides.
Analytical laboratory:	xxx lab. (The selection of a preferred laboratory should take into account availability of a government-managed central laboratory, ASEAN regional laboratory, or another laboratory with an accredited analytical method and demonstrated proficiency).
Sample plan:	Sample locations: at farm. Distribution of samples: random sampling. Sampling equipment: knives. Handling and treatment of samples: put the sample in the plastic bag, sealed and put in the ice box and delivery to the laboratory within 24 hrs. Sample form: triplicate - farmer, collector and with sample to laboratory, as appropriate.

Sample transport:	by car (Formal arrangements for the transfer of samples from the collection point to the analytical laboratory taking into consideration handling of samples and chain of custody).
Confirmatory testing:	xxx (In case the confirmatory testing to verify an original result is necessary (the result show unusual), the archive samples should be sent to XXX Laboratory for confirmation testing).
Reporting:	To Department of Agriculture and further enter the results in the shared database). (Agreed reporting frameworks for participants in the NRMP including farmers. pack-houses, markets and consumers as appropriate).
Traceback investigations:	Refer procedures or include related information. Where required, investigations will be conducted by a government official. For NRMPs focused on verification of good agricultural practice, any samples with residues detected above the official MRL should be subjected to a traceback investigation by an government investigator/official. Agreed roles and responsibilities at national and local government levels for the conduct of traceback investigations when required and schedule of regulatory actions. In general, the official will interview the farmer/producer and the fruit/vegetable market. The official will report to the responsible agency. Investigation recommendations will include farmer education and advice, followed by a warning and, with ongoing contraventions, a financial penalty or market access block.

APPENDIX 3: ADDITIONAL GUIDANCE ON SAMPLE COLLECTION

This guidance is based on Codex Alimentarius Commission: Recommended Methods of Sampling for the Determination of Pesticides Residues for Compliance With MRLs, CAC/GL 33-1999 but simplified for this document.

Survey the 'lot' to be sampled.

This could be a patch of spinach, an orchard of guava, a bin of apples, a box of cabbage or a tray of mangosteen.

By surveying the lot, the sample collector can determine where in the lot, units of commodity can be selected to achieve a representative sample from the entire lot.

Separate samples should be sent for distinct lots of produce.

Prepare your sample bags, sampling gloves and other equipment required to collect the sample.

Submit separate samples to the laboratory if you are dealing with: different fruits or vegetables, different cultivars or varieties; areas of crop which have had different pesticide treatments, or which have been sprayed on different days; produce sourced from different growers for repacking or processing.

Commence completion of the sample form. This will record the unique sample number, sample location and contact details (farm, pack-house, city market, distribution centre or supermarket), sample date, type of commodity and sub group (for example: apple – granny smith), spray diary availability (has the farmer kept records of pesticide use).

Commence selection of commodity units. For an example if sampling apples from a box, take 3-4 units from the top, from the middle and from the bottom of the container. If sampling a patch of spinach, take a leaf from 20 plants from the outer areas and inner areas.

Avoid taking diseased or under-sized crop parts or produce at a stage when it would not normally be harvested.

It is preferred that whole fruit/vegetable samples are collected. However, this may not be possible. Therefore, the sample collector must record the nature of the sample, e.g. whole, cut, peeled etc. Take samples in such a way as to be reasonably representative of typical harvesting practice. Sample the parts of the crop that normally constitute the marketable produce.

Sampling at farm and packhouse

Avoid taking diseased or under-sized crop parts or produce at a stage when it would not normally be harvested.

For bulb, root and tuber vegetables, adhering soil should be removed to ensure a representative sample of the raw commodity. This may be done by brushing and, if necessary, gentle rinsing with cold running water. However, take care not to remove surface residues through excessive washing.

For vegetables like carrots, trim off tops and details of any trimming should be recorded.

For Brassica vegetables, leafy vegetables, legume vegetables, fruiting vegetables and stalk vegetables, record any trimming of damaged leaves etc. and sample crops where the unit have been exposed to pesticide spray and not exposed to spray.

Place the units in a sealable plastic bag. Label the bag with the unique sample number on the corresponding sample form.

At least, place the sample in a cooled container.

Do not freeze fresh produce. As a general rule all samples, especially samples of perishable fresh produce, should be kept cool but not frozen. However, samples of already frozen foods should be kept frozen until they reach the laboratory.

If collecting a second sample, replace the sample gloves to avoid cross contamination and repeat the process.

Note: The sample collector must reference the Codex Guideline CAC/GL 41-1993 'Portion of the commodities to which maximum residue limits apply and which is analyzed'.

Table 1: Quantity of commodities to be collected

Commodity	Quantity, method of collection
Citrus fruit, pome fruit, mango, papaya, litchi, avocado, guava	10 fruit from 10 different trees If the sample weight is less than 2 kg, take more fruit to yield a 2 kg sample
Durian	Take 6 fruit and cut into half – sample to comprise 6 halves
Jackfruit	Take 10 fruit from 10 different trees in the orchard
Grapes	10 bunches from 10 different vines to yield a 2 kg sample
Berries – currant, raspberry, strawberry other berries	A total of 1 kg from 10 different bushes or locations
Dates and figs	One kg sample from at least 10 trees
Pineapples	6 fruit from 6 different locations on the farm
Bananas	10 fruit from 10 different bunches to yield a 2 kg sample

Commodity	Quantity, method of collection
Coconut	6 fruit from 6 different locations on the farm
Coffee	1 kg of beans from random selection of plants
Potato, taro, sweet potato	Take 10 tubers from 10 different plants located around the plot up to 2 kg sample
Carrot, sweet potato, celeriac, chicory and others	Take 10 units from 10 different locations around the plot up to a 2 kg sample
Leeks, onions, garlic, shallot	Take 10 plants from 10 different locations around the plot up to a 2 kg sample
Large brassica crops e.g. cabbage, cauliflower, kohlrabi	Take 10 plants from 10 different locations around the plot
Broccoli	Collect 1 kg from 10 different plants
Brussels sprouts	Collect 1 kg from 10 different plants
Cucumber, gherkin, squash, courgettes	10 fruits from 10 different plants
Melons, gourds, pumpkins, watermelon	Collect 5 units from 5 different locations around the plot
Aubergines	10 fruits from 10 different plants
Sweet corn	10 ears from 10 different plants
Mushrooms	1 kg from different locations around the plot
Tomato, pepper	At least 10 fruits from 10 different plants to a sample weight of 2 kg
Lettuce	12 plants from different locations around the plot
Spinach, chicory leaves, kale	1 kg from 10 different plants
Grains: wheat, rice, peas etc.	1 kg from harvested crop with subsamples collected from various parts of the lot
Herbs, spices, tea, hops	0.5 kg from various locations around the crop

APPENDIX 4: EXAMPLE OF SAMPLE FORM

Department logo

Agency: Department of Agriculture

Unique sample number: 123456A

Sample:
Commodity type: sweet potato Variety name: okinawan
Sample type: raw, processed, treated
Sample size: 2 kg
Nature of sample: whole, cut, peeled etc. (the nature of the sample must be recorded)
Sample treatment: light washing to remove soil before packaging

Collection information:
Collection date: 05 November 2020
Collection location town/city: Chiang Mai
Collection location: Farm, pack-house, market, other

Commodity owner:
Identity of farmer: Frank Sinatra
Contact details: physical address, phone and email address

Identity of pack-house: Thai fruit company
Contact details: physical address, phone and email address

Identity of market: Bangkok fruit and vegetable market
Contact details: physical address, phone and email address

Laboratory:
Name: Science Lab
Sample analysis date: 10 November 2020
Analytical screen: multi-residue screen

Result:
Pesticide residues detected plus result

Signature of laboratory analyst:

Sample collector:
Name:
Designation:
Signature:

For Office Use only:
Relevant MRL
Traceback investigation y/n
Action taken:

Instructions: completion of sample form (duplicate copies)

(1) Each sample form will have a unique sample number prefilled.

(2) Record the sample details: commodity, variety, weight, etc.

(3) Record the collection date, sample location. The location should be as specific as practicable.

(4) Record the commodity owner and contact details. Record as many details as are available: physical address, phone number, email address. If the proposed sample is from unidentified commodity at a market, do not collect a sample. Traceability is important.

(5) One copy of the sample form should be packed with the sample before sealing the sample box or bag.

(6) Ensure the sample is in the condition as specified/required (cool, chill , etc) related to the commodity.

(7) Arrange for transport of sample to the laboratory. Ensure instructions are placed on the sample box for the transport company to ensure the sample remains in the specified conditions upon arrival at the laboratory.

(8) The analytical laboratory will check the condition of the sample and commence analytical sample preparation. The date of analysis is recorded on the sample form.

(9) The laboratory records the analytical screen to be undertaken.

(10) Once analysis is completed, the laboratory will record the residue result on the form, scan the document and email to the respective sampling officer.

(11) The regulatory authority will review the result against the MRL and undertaken action as required (recorded on the form).

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