# Cadmium and New Zealand Agriculture and Horticulture: A Refreshed Strategy for Long-Term Risk Management

**Prepared by the Cadmium Management Group**
**December 2019**

ISBN 978-1-99-001730-8 (online)

# Contents

Page

# Executive Summary

1. Cadmium is a naturally occurring heavy metal in soils. Cadmium is only acutely toxic at high levels of intake, but it can accumulate in kidneys and livers which can lead to chronic toxicity problems. Current dietary surveys for New Zealanders indicate that the daily intake of cadmium is well below the World Health Organization (WHO) tolerable monthly intake guidelines. It is unlikely that at current levels in food there are adverse health implications for the New Zealand population. However, there is some potential for the intake guidelines to change in the future as new science comes to hand, and there is a need for continued vigilance.

2. Phosphate fertiliser is the primary source of cadmium accumulation in agricultural soils, and the fertiliser industry has enacted a voluntary limit on the levels of cadmium in fertilisers. However, low cadmium sources of phosphate rock are limited in supply and uncertain in their long-term availability. Moreover, there are currently no commercially viable processes for removing cadmium from rock phosphate. The accumulation of cadmium in New Zealand soils is therefore likely to continue in the immediate future under current practices. Cadmium uptake by crops can be reduced by crop and variety choice and management, but it cannot be eliminated entirely, and cadmium will still need to be managed.

3. The Cadmium Management Group (CMG) is a multi-stakeholder group convened by the Ministry for Primary Industries (MPI) to manage cadmium in the primary sector. Following its establishment in 2011 it has overseen the Cadmium Management Strategy (CMS) which sets out the approach and programme for managing cadmium in New Zealand. The CMS was revised after a review in 2018. This document sets out the CMG's revised strategy for managing cadmium over the long term; it is intended to stand until it is reviewed again in 2026.

4. **Strategy Objective:** ***To ensure that cadmium in rural production poses minimal risks to health, trade, land use flexibility and the environment over the next 100 years.***

5. **Strategy Approach:** Focus on research, monitoring, education and supporting practices which enable food standards to be met and that control soil cadmium accumulation in order to:
   - Maintain trade access and a vibrant productive primary sector;
   - Protect human health;
   - Maintain flexibility in land use options; and
   - Protect the environment.

6. **The objectives of the strategy,** including protection against the risks posed by cadmium, will be achieved by:
   - Governance and oversight of cadmium management in New Zealand agriculture and horticulture;
   - Monitoring to ensure the risks are being managed appropriately, and to contribute to the knowledge base of where and how risks from cadmium arise;
   - Controlling the accumulation of cadmium in soils;
   - Management of priority produce to protect against non-compliance to food standards;
   - Research on ways to manage cadmium risks;
   - Scanning of the trade, regulatory and research sectors to identify new emerging issues and solutions.

**Table 1: Summary of Cadmium Management Strategy Work Programmes**

| Strategy framework | Framework area | Risks addressed | Work programme | Key features | Responsibility | Implementation targets and milestones |
|---|---|---|---|---|---|---|
| Governance | Manage | Food standards,<br>trade, human health,<br>land use flexibility (soil Cd accumulation)<br>environment (water, sediment, soil) | Strategy management | CMG with all key stakeholders | MPI | Meet 6 monthly and/or use Skype meetings |
| | | | Reporting | Report to MPI Deputy Director General Policy & Trade, regional councils, Chief Executives Environment Forum, CMG members and other stakeholders | CMG, MPI | Annual reporting |
| | | | Review | Strategy and CMG to be reviewed | MPI | 2026 |
| Risk management | Monitor | Food standards: human health, trade | Food monitoring | Total Diet Study (TDS) | MPI (NZ Food Safety) | TDS completed. CMG seek reports and review of progress on priority products by 2026[1] |
| | | Food standards: human health, trade | Food monitoring | Monitoring products in regulatory role | MPI | Annual reporting |
| | | Food standards: human health, trade | Food monitoring | Industry self-monitoring of key products | Industry | Annual reporting |
| | | Soil cadmium | Soil monitoring | State of the Environment (SOE) soil monitoring, agricultural soil testing | Regional councils, fertiliser industry testing | Ongoing, annual reporting |
| | | Environment (water, sediment) | Environmental monitoring | SOE environmental monitoring | Regional councils | Reporting when undertaken<br>Development of consistent methodology across councils by 2020 |
| | | Soil cadmium accumulation | Fertiliser monitoring | Regular industry testing<br>auditing by FQC | Fertiliser industry,<br>Fertiliser Quality Council | Ongoing, annual report to CMG against long term average<br>Audit results |

[1] Some specific primary produce may have an occasional mild exceedance of food standards and Periodic Specific Priority Product Surveys are proposed to address this risk. The currently known priority produce are: wheat, leafy vegetables, potatoes, onions and offal. See Section 1.1 Food monitoring for more information.

| | | | | | | |
|---|---|---|---|---|---|---|
| | Manage | Soil cadmium accumulation, land use flexibility | Tiered Fertiliser Management System (TFMS) | Advice to farmers on management of fertiliser according to cadmium status, promote the adoption of the TFMS | Fertiliser industry<br>Primary sector groups | Ongoing, annual reporting |
| | | Food standards (human health) | | Advice to farmers on management of crops according to cadmium status | Primary sector groups | Information sheets to be developed by December 2020 |
| | | Food Standards (trade) | Priority produce management programme | Programme to minimise the risk of exceedance of food standards in priority produce | MPI, industry, with oversight from CMG | Annual reporting |
| | | Land use flexibility (soil cadmium accumulation), environmental standards (water, sediment, soil) | Communications | Awareness raising, promotion of testing, TFMS. Ensuring currency of training institutions and rural professionals | MPI, Ministry for the Environment (MFE), fertiliser industry | Communications strategy delivered and implemented by 2020 |
| | | Food standards, trade and health | | Best practice agronomy guidelines | Food producing industries, MPI | To be developed by key industry product groups by 2026 |
| Research | | Food Standards, land use flexibility (soil Cadmium accumulation) | Research | Research to address immediate requirements as well as longer term needs | CMG with support from MPI, MfE, Ministry of Business, Innovation & Employment, industry | Research priorities have been identified by 2020<br>Revised Cadmium balance model 2020; priority produce management requirements 2021 – 2023, cadmium dynamics for nil soil accumulation by 2026<br>Reprioritisation and reporting as needed |
| Scanning | | Food standards, land use flexibility (soil cadmium accumulation)<br>Environmental standards (water, sediment, soil) | Scanning | Scanning of international trade environment, environmental regulation, new research to identify emerging issues and problems | MPI, MFE to lead, all parties to contribute | Research priorities have been agreed<br>Reporting as needed |

# Background

Cadmium is a naturally occurring heavy metal in soils. It is not thought to be essential to life, but can be toxic at high concentrations. Cadmium largely enters the human food chain by being taken up by plants from the soil, then either directly by ingestion of these plants or by accumulating in the kidneys and livers of animals that eat pasture and crops and are subsequently eaten by humans. Smoking and some industrial processes are also a source of cadmium. Cadmium is only acutely toxic at high levels of intake, but its accumulation in kidneys and livers can lead to chronic health problems.

The total lifetime accumulation of cadmium is important. Current dietary surveys for New Zealanders indicate that the intake of cadmium is well below the World Health Organization (WHO) tolerable monthly intake guidelines. It is unlikely that at current cadmium levels in food there are any adverse health implications for the New Zealand population. However, there is some potential for the intake guidelines to change in future as new science comes to hand, and there is a need for continued vigilance.

Cadmium concentrations are on average not high in New Zealand soils, and are at levels comparable with our overseas trading partners. Monitoring data generally does not show statistically significant trends in soil cadmium, but evidence from long-term fertiliser trials suggests that levels are likely to be gradually increasing on land that has high application rates of phosphate fertiliser. This increase comes primarily from cadmium that is present in phosphate fertilisers applied to our soils to maintain forage production. Monitoring data indicates that the national average concentration across all agricultural land classes is 0.4mg/kg of soil (range 0 – 2.5 mg/kg). The concentrations of cadmium in soil are driven largely by phosphate fertiliser use history and soil tillage. Regions with a long history of intensive agriculture and soils with a high phosphatic fertiliser demand tend to have higher cadmium concentrations, with Waikato, Taranaki and Bay of Plenty recording the highest average soil concentrations.

The fertiliser industry has had a voluntary limit of 280mg Cd/kg P in place since 1997. This limit has significantly reduced the rate of Cd accumulation. Fertilisers are now sourced from lower cadmium sources of phosphate rock, and the level of cadmium is dependent on the source at any particular time. The average phosphate fertiliser cadmium concentration between 2003 and 2015 was 184 mg Cd/kg P.

There is currently no commercially viable process for the removal of cadmium from phosphate rock. Some cadmium is removed as a result of the manufacturing process in the production of high analysis fertilisers. Cadmium is likely to be a contaminant of phosphate fertilisers for the foreseeable future, and the risk of gradual accumulation of cadmium in New Zealand soils is likely to continue to be an issue for some time.

In response to concerns about the likely continued accumulation of cadmium, the Chief Executives Environmental Forum established the Cadmium Working Group (CWG) in 2007, which was tasked with assessing the potential risks surrounding cadmium in New Zealand's agriculture and food systems, and to develop a response. This led to the development of the Cadmium Management Strategy (Ministry of Agriculture and Forestry, 2011). The Cadmium Working Group was superseded by the Cadmium Management Group (CMG) which was established to implement the strategy.

Since the CMG was established there has been ongoing monitoring of soils and the environment which has identified where the highest soil cadmium levels occur, and that there does not appear to have been any significant occurrence of cadmium in surface or groundwater. A number of food products have been identified as having the potential to be occasionally non-compliant with food standards, but the last Total

Diet Survey indicated that typical dietary consumption of cadmium is well below WHO acceptable dietary intakes.

The Tiered Fertiliser Management Strategy is being implemented, and the amount of cadmium in fertilisers continues to be well within acceptable limits. In addition, we now know that some crops and forage species will uptake cadmium even at low soil cadmium concentrations. To manage all the risks from cadmium will require a systems approach that addresses the fertiliser applied, the accumulation of cadmium in the soil, the types of crops and varieties grown, and the agronomic management practices used.

The initial strategy was reviewed after 7 years (McLaughlin & Miller, 2018), and information and recommendations in that review suggests that some of the issues are no longer a priority and others are more important than thought when the strategy was first developed. This document responds to that review and refreshes the Cadmium Management Strategy, with the intention it should continue until 2026, and then be reviewed again.

# Strategy Objectives

The Cadmium Management Group is convened by MPI and brings together the major industry and regulatory stakeholders in the management of cadmium in New Zealand's primary sector. The Cadmium Management Strategy is the CMG's statement of how and why cadmium will be managed.

The national Cadmium Management Strategy's objective is:

***To ensure that cadmium in rural production poses minimal risks to health, trade, land use flexibility and the environment over the next 100 years.***

This will be achieved by ensuring:

- Regulators, industry sectors, and other stakeholders are engaged in a collaborative approach to managing cadmium;
- Food exported from New Zealand complies with the cadmium standards existing in the relevant export markets;
- New Zealanders will continue to consume less than the internationally-agreed Provisional Tolerable Monthly Intake for cadmium over the period of the strategy as evidenced by the New Zealand Total Diet Study (NZTDS)[2];
- Food Safety New Zealand will provide sufficient information for consumers to maintain confidence that food standards are not being exceeded;
- That cadmium does not unduly limit foreseeable land use options, and work towards nil soil accumulation where possible, by following the guidelines in the Tiered Fertiliser Management System (TFMS);
- Management and mitigation of cadmium does not pose an unnecessary or inequitable cost to New Zealand producers such that it renders them uncompetitive in world markets;
- Long-term protection of the environment from any potential risks of cadmium;
- Further development of the knowledge base of cadmium risks and their mitigation to inform cadmium risk management, including fertiliser application and agronomic best practice.

[2] Noting that the current PTMI of 25 ug/kg bw was approved by JECFA in June 2010.

# Approach

Because the build-up of soil cadmium is slow, taking a risk-based approach allows recognition of the issues and implementation of an approach to manage the most immediate risks, without imposing potentially unnecessary costs on the industry and regulators. The strategy addresses the following specific risk areas:

- Maintaining trade access and a vibrant productive sector;
- Protecting human health;
- Maintaining flexibility in land use options;
- Protecting the environment.

This strategy has five parts:

- Governance and oversight of cadmium management in New Zealand;
- Monitoring to ensure the risks are being managed appropriately, and to contribute to the knowledge base of where and how risks from cadmium arise;
- Management of the accumulation of cadmium in soils and of priority produce for non-compliance with food standards;
- Research on ways to manage cadmium;
- Scanning of the trade, regulatory and research sectors to identify new emerging issues.

The risks to ***domestic human health*** will be managed primarily by minimising the risk of non-compliance with food standards and by non-regulatory measures based on data gathered via food monitoring programmes, with the emphasis on the TDS. The TFMS and wider communication strategy includes measures that will assist growers to minimise cadmium uptake in produce.

Risks to ***trade*** will be primarily achieved through minimising risk of non-compliance with food standard. This includes more detailed monitoring of priority produce where occasional non-compliance with food standards may occur. Industry programmes will be implemented to ensure that the risks of cadmium levels in food exceeding allowable standards is minimised.

***The governance*** part of the strategy, particularly communicating with trading partners and customers about New Zealand's approach to management of cadmium, will also be of key importance in providing confidence in this approach.

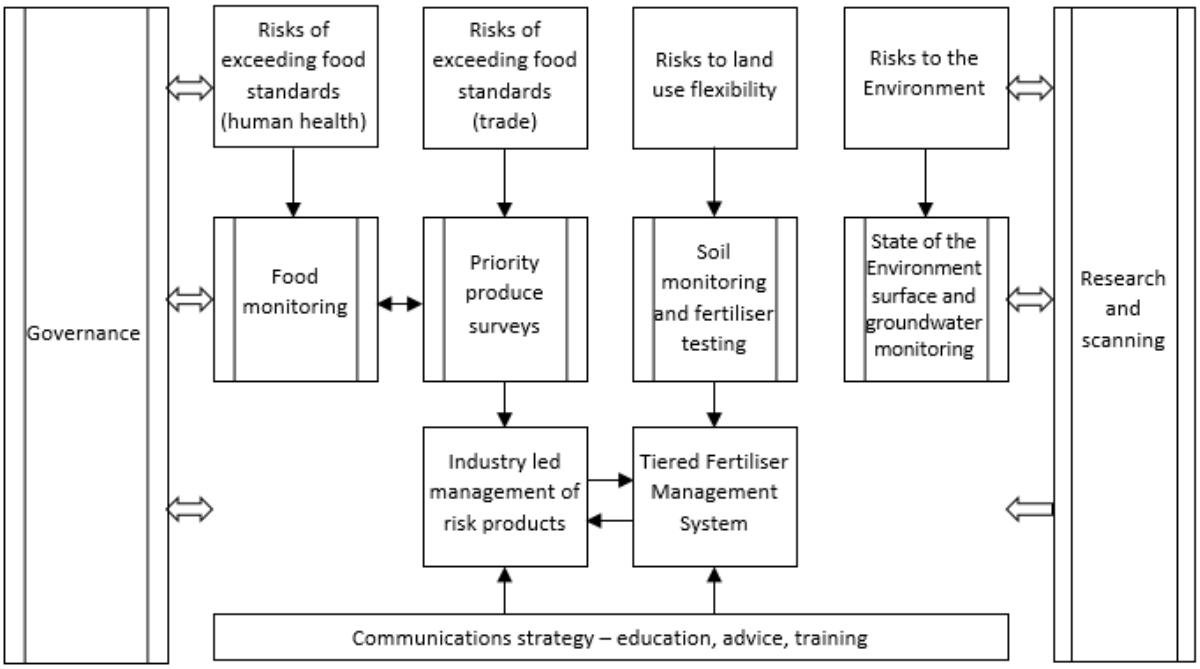
Maintaining ***land use flexibility*** through managing risk from soils and fertilisers will be ensured through monitoring of soils and fertilisers, and through the TFMS that limits the build-up of cadmium in soils.

The impacts of cadmium on the ***environment*** appear minimal from monitoring information to date, but the off-site movement of cadmium is not currently well understood in the New Zealand context. These risks will be managed through an ongoing monitoring and research programme to understand pathways of cadmium movement in the environment.

***Research*** is required on the most appropriate ways of minimising these risks. Research will be required to develop models of cadmium stocks and flows in soils and the environment, to assist the TFMS in the short term, and in the long term to enable the nil cadmium accumulation goal to be achieved. The risks to the environment will be managed through an ongoing monitoring and research programme to understand pathways of cadmium movement in the environment.

The structure of the strategy is shown in Figure 1 below and each of the five parts of the strategy is discussed in the sections following.

**Figure 1: Structure of the national Cadmium Management Strategy**



# Governance

Governance of the programme aims to oversee the strategy and ensure that the component workstreams, organisations and agencies are coordinated and resourced. The governance workstream will ensure that priorities, actions and resources are in place to meet the objectives of the strategy. Its major elements are discussed below.

The CMG will liaise with representative sectors to seek national consistency in managing cadmium to ensure the protection and sustainability of our agricultural systems as well as the wider ecosystems in which they operate.

***The Cadmium Management Group*** comprises all key stakeholders in rural production and environmental management. This group includes representatives from:

- Beef + Lamb New Zealand
- DairyNZ
- Foundation for Arable Research
- Horticulture New Zealand
- Fertiliser industry
- Federated Farmers of New Zealand
- Potatoes New Zealand
- Regional councils
- Ministry for Primary Industries (including New Zealand Food Safety)
- Ministry for the Environment

Members represent sectors rather than organisations, and the group is convened and resourced by MPI which will provide the role of chair. The continuity of and facilitation undertaken by the chair over the initial period of the strategy has been critical to the good functioning of the CMG, and MPI should endeavour to ensure that this is replicated over the next period. The CMG is able to cover the need to ensure relevant expertise by co-opting or appointing appropriate additional members or observers.

The CMG will continue to advocate for consistency of regulatory approach among agencies managing cadmium. The CMG will ensure that all agencies are acting in a coordinated manner to deliver on the aims of the strategy. It will define requirements and set priorities for each of the work areas in the strategy.

The CMG will meet every 6 months and more frequently if necessary. The CMG will prepare a written report annually to MPI through the Deputy Director General, Policy and Trade, the Regional Council Chief Executives Forum, and relevant stakeholders. Sub groups will meet as necessary. The CMG will organise a review of the strategy and CMG governance in 2026.

***Milestones:***

- ***MPI will convene and appoint a chair to the CMG in consultation with members;***
- ***The CMG will meet at least annually (preferably every 6 months) and annually set work programme priorities to implement the strategy;***
- ***The CMG will report annually to MPI's DDG Policy & Trade, the Regional Council Chief Executives Forum, and relevant stakeholders, on progress on the strategy, and on emerging issues in the regulatory, human health, trade and environmental spheres;***
- ***The CMG will lead a review of the Cadmium Management Strategy in 2026. This review will assess the:***

- **Performance of the strategy in managing risks related to cadmium;**
- **New information on cadmium impacts and management to determine whether the objectives or work programmes should be altered;**
- **The effectiveness of the governance arrangements.**

# Monitoring

The monitoring programme aims to provide assurance that the risks to human health, trade, land use flexibility and the environment continue to be managed. It also provides valuable information for the management programme to understand how and where problems are occurring, and for the research programme to assist in developing the cadmium balance model and management practices for priority produce. The monitoring comprises food monitoring through the TDS and priority produce surveys, soil monitoring, environmental monitoring and fertiliser monitoring.

## 1.1. FOOD MONITORING

Food monitoring is the primary tool for ensuring that risks from cadmium to human health and trade that derive from food for sale are adequately managed. Since these risks could be significant, both to the community and the economy, it is essential that the food monitoring programme is well formulated and able to address all foreseeable risks, but it needs to do so in a cost effective manner.

The Total Diet Study (TDS) is the best indicator available for the status of cadmium in typical New Zealand diets. The TDS is undertaken on a 5 yearly basis, and involves sampling of representative foods in the New Zealand diet from supermarkets and other retail outlets. The data is collated on an individual food product basis and calculated on a whole diet basis. The TDS continues as the first line risk management approach for cadmium and other constituents in food from a dietary perspective. It is of key importance that over the long-term we are able to discern trends in the data from this survey, because good trend information will give the CMG longer lead times to understand what action is required. This trend information is needed both at a dietary level and for individual food products where possible.

The objectives for the TDS are to:

- *Determine the estimated dietary exposure for selected agricultural compounds, contaminants and nutrient elements in the New Zealand food supply through collecting and analysing foods that represents the diet of New Zealanders;*
- *Compare estimated dietary exposure with internationally recognised acceptable exposure standards or recommended levels;*
- *Identify dietary exposure trends in New Zealand over time and compare these estimates with those in other countries.*

The TDS has to date identified that the typical diet of New Zealanders is well within the World Health Organization recommended limits, however, some specific primary produce may have an occasional mild exceedance of food standards. This does not present any specific risk to human health as food standards provide for safe consumption of produce over a lifetime.

Occasional non-compliance with food standards does, however, present an immediate market and trade risk. The means of identifying and responding to exceedances of food standards may be through a number of approaches, including through the TDS or other studies. Periodic specific priority produce or sector surveys are proposed to address the risk of occasional exceedance of food standards in primary produce. The currently known priority food products are some vegetable products and offal.

The priority vegetable products are wheat, leafy vegetables, potatoes and onions from a dietary perspective; potatoes and onions are also important export crops. It is therefore prudent to support additional monitoring to understand the variability in cadmium content and the risk of occasional non-compliance with food standards in these vegetable products.

Offal products, such as kidney of ruminant livestock, are currently managed by requiring offal from livestock older than 30 months to be discarded from human consumption. There is an increasing trend for alternative forage crops (some with increased cadmium uptake) being utilised for finishing young stock. It is therefore also prudent to investigate the impact this may have on offal products by undertaking additional surveys of offal as a priority product.

If new priority food products are identified through the course of the strategy, the CMG will consider the need for additional monitoring to address any risks they pose.

***Milestones:***

- ***TDS is used to inform an assessment of the current dietary risk by 2026;***
- ***Testing programmes for cadmium levels in identified priority produce groups be developed and undertaken as needed.***

## 1.2. SOIL MONITORING

Soil monitoring has two parts – State of the Environment (SOE) monitoring undertaken by regional councils across a range of landscapes, and fertiliser industry testing of cadmium and other nutrient levels in agricultural soils. This may be added to by occasional research organisation systematic testing of project based samples. The soil monitoring information will also contribute to the detailed understanding of cadmium accumulation in soils, which is critical for underpinning the aspiration of zero net accumulation.

The SOE monitoring in relation to soil cadmium is intended to provide verification of the cadmium status of soils across a range of domains that is independent of the agriculturally focused soil monitoring undertaken by the fertiliser industry. This SOE soil monitoring programme is undertaken by regional councils as part of their normal SOE monitoring, but the status of soils in key regions will be reported separately to the CMG. Key regions include those with a long history of phosphate fertiliser use and where monitoring indicates elevated soil cadmium is likely, e.g. Waikato, Taranaki, and Bay of Plenty.

The SOE monitoring will require the development of a protocol so that results are consistently collected and analysed, and the nature of the variability in samples is able to be understood. A National Environmental Monitoring Standard for Soil Quality is currently under development, and this is likely to include cadmium.

The fertiliser industry is currently promoting routine soil sampling for cadmium in the 'legacy areas' where there has been a long history of phosphate fertiliser application, i.e., Waikato, Taranaki and Bay of Plenty. This testing programme supports implementation of the Tiered Fertiliser Management Programme, and the industry will report progress to the CMG.

Landholders are able to opt out of this soil cadmium testing, but the programme is a key part of managing soil cadmium accumulation. The CMG will assess if there are further targeted soil types, land uses and locations in other regions where comprehensive soil surveys are desirable. A consistent message targeting farmers and landowners is required to ensure any required comprehensive soil surveys are achieved.

## 1.3. ENVIRONMENTAL MONITORING

Monitoring information so far indicates there has been no significant increase in cadmium in groundwater and aquatic systems. However, it is valuable to continue to monitor the status of cadmium in sediments and key surface and groundwater bodies in the regions with the highest agricultural soil cadmium status. This will need to be undertaken by those regional councils over the long-term to provide reassurance the low cadmium status currently being experienced continues.

***Milestones:***

- ***Support for a nationally consistent soil monitoring and analysis protocol for State of Environment monitoring being developed by regional councils by 2020;***
- ***Regional councils to report any soil monitoring data collected to CMG;***
- ***Fertiliser industry to report annually on the number of soil samples tested by tier, and after five years on the number of properties;***
- ***Regional councils to report any environmental cadmium monitoring data for sediment, surface water and groundwater to CMG when it becomes available and prior to the review in 2026.***

## 1.4. FERTILISER MONITORING

The fertiliser industry supports the aspiration of nil net accumulation in soil, but recognises that new technology may be required to achieve this objective. In the interim the CMG strategy is focused on limiting accumulation in soils. Fertiliser monitoring is an important part of the base information for a mass balance approach to understanding cadmium in agricultural soils.

Fertiliser companies will continue to test cadmium levels in products using Fertmark testing methods, and this will be reported to the CMG annually. The Fertiliser Quality Council (FQC) will also report annually on their auditing results.

The voluntary industry agreed limit of 280 mg Cd/kg P has been in place since January 1997. However, the lowest possible cadmium levels are sought, subject to availability of low cadmium rock phosphate. The average concentration in phosphate fertiliser products between 2002 and 2015 was 184 mg Cd/kg P. This represents a significant reduction in cadmium levels in phosphate fertiliser relative to pre-1990s fertiliser cadmium levels. There is a need to retain some flexibility for industry in sourcing fertiliser, so the current maximum should remain. However, it is also desirable that over time the levels of cadmium in fertiliser should decrease, allowing for some year to year variability. Reporting to the CMG on cadmium levels in phosphate fertiliser should be set in the context of long-term average.

***Milestones:***

- ***Fertiliser industry to continue to undertake testing of fertilisers for cadmium and to annually report to the CMG on average cadmium fertiliser levels against long-term average;***
- ***FQC to continue to audit cadmium content in Fertmark certified products and report to CMG;***
- ***Cadmium levels in fertilisers not to exceed 280mg Cd/kg P.***

# Manage Cadmium

The objective of the Cadmium Management Strategy is to ensure that cadmium in rural production poses minimal risks to health, trade, land use flexibility and the environment over the next 100 years. However, no single management measure will address all risks of cadmium uptake into food products or soil accumulation. The Cadmium Management Strategy engages three areas of management which apply to agricultural production systems, to achieve the strategy objectives. They are:

- Tiered Fertiliser Management System (TFMS);
- Industry led priority produce management programme;
- Communications and training.

## 1.5. TIERED FERTILISER MANAGEMENT SYSTEM (TFMS)

TFMS is an approach developed by the fertiliser industry and endorsed by the Cadmium Working Group as an appropriate management programme to control the accumulation of soil cadmium in agricultural production land. Management of soil cadmium is required because there is currently no commercially viable mechanism to entirely remove cadmium from phosphate fertiliser.

The system is a voluntary approach for identifying the soil cadmium concentration through soil testing, controlling the choice and rate of phosphate fertiliser application. The TFMS is available on the Fertiliser Association of New Zealand website (http://www.fertiliser.org.nz/site/resources/tools.aspx).

The soil cadmium tiers represent soil cadmium levels ranging from within the spread of natural background levels (Tier 0) up to an agreed maximum threshold (Tier 4). The current TFMS seeks to ensure that cadmium in soils do not progress from Tier 0 to Tier 4 within 100 years. This is achieved by increasing the restrictions on choice and rate of phosphate fertiliser as soil cadmium increases. At the Tier 4 threshold of 1.8 mg Cd/kg soil, no net accumulation of cadmium in soils is allowed unless there is a detailed site-specific investigation to identify risks and pathways for potential harm.

Landholders are able to opt out of soil cadmium testing and the TFMS, but the programme is a key part of managing soil cadmium accumulation. A consistent message targeting farmers and landowners is required to ensure any soil surveys needed and TFMS implementation are achieved.

***Milestone:***

- ***Fertiliser industry to report annually on the uptake of TFMS, including the number of soil samples tested by tier and number of properties, and advice given.***

## 1.6. INDUSTRY LED PRIORITY PRODUCE MANAGEMENT PROGRAMME

The priority produce are those that represent an ongoing risk of food standard exceedance, particularly for domestic and international trade. Management of plant uptake of cadmium is required because non-compliance with food standards can occur for some products even when grown in low cadmium soils.

The CMG will work with the relevant industry bodies (arable industry, Horticulture New Zealand product groups, beef and lamb sector) to develop a priority produce management programme that ensures cadmium is adequately managed. This programme should incorporate the information from priority produce surveys and may include further testing to understand the extent of variability and ensure that the programme is performing appropriately. In addition it may include:

- Identification of context (when, where, under what circumstances) for each food product's risk of non-compliance with cadmium food standards;
- Cultivar screening programmes to inform growers of the cadmium uptake characteristics of different cultivars;
- Agronomic management practices that minimise cadmium uptake;
- Programmes to target and upskill growers.

Such a programme fulfils two aims – it ensures that the risk of exceeding food standards are adequately managed, and gives the industry a ready response to any concerns that appear in the public sphere over the management of cadmium in its food products. It is recognised that for some products there is currently insufficient information to adequately identify and manage potential risks, but the programme should manage known and possible risks given current knowledge, and research should be considered where there is insufficient knowledge. There should be sufficient reporting to the CMG to ensure that the programme is being undertaken and is working.

***Milestones:***

- ***Encourage food product groups to define and implement a programme for managing cadmium levels in priority products by 2026;***
- ***Food product groups to report annually on its performance in monitoring and managing cadmium levels in priority produce;***
- ***Develop factsheets for agronomic best practices.***

### 1.7. COMMUNICATIONS AND TRAINING

There is a need to ensure that landholders, regulators, educators and stakeholders are aware of the Cadmium Management Strategy and are managing the risks associated with soil cadmium appropriately. The aims of the communications and training programme are:

- Raise awareness of the CMG and Cadmium Management Strategy;
- Awareness of cadmium as an issue to be taken account of in decisions on land use, system management, and crop types;
- Promotion of the use of the risk management tools, including soil testing and the TFMS, and industry risk produce management programmes;
- Ensuring that universities and professional development groups are updated and current with the Cadmium Management Strategy and latest knowledge in managing cadmium risks.

The initial priority for the communications and training work programme is to support the soil testing and management programme by targeting landholders' participation in the TFMS. This needs to be a proactive programme rather than relying on passive provision of information. However, it is also important that existing knowledge on management of the risks from cadmium is incorporated into training of land managers and rural professionals.

MPI is currently developing a communications strategy in conjunction with the CMG to ensure that the CMG strategy is fully understood and implemented by stakeholders and landholders.

***Milestones:***

- ***MPI will lead the development of a communications strategy by early 2020 which will coordinate and prioritise awareness raising, education and advice activities amongst the CMG stakeholders;***
- ***MPI and industry will engage with training providers to ensure that the latest information on management of cadmium risks is incorporated into training of landholders and rural professionals by 2021;***
- ***Each member of CMG to report annually on their contribution to the communications strategy.***

# Research

The research workstream underpins the other work programmes and is linked to the monitoring and scanning programmes which will provide information that may be used in modelling, assessing and overcoming risks including non-compliance of food standards. The research stream can be divided into three work areas:

- Cadmium management
- Cadmium dynamics
- Emerging issues

- ***Cadmium management*** – understanding the responses of crops to soil cadmium, and animals to forage cadmium, and mitigation methods for minimising the uptake of cadmium. This information is needed to support the management of cadmium risks in priority produce as well as the setting of soil guideline values. This is a medium-term priority for the research programme and should be implemented within 2 - 4 years.
- ***Cadmium dynamics*** – understanding the deposition and loss of cadmium in soils and the integration of these into an improved and calibrated cadmium balance model. This information is important to understand the requirements to work towards the goal of nil soil cadmium accumulation in a farm system. The cadmium dynamics research has a shorter-term timeframe in which it should be achieved, to support implementation of a cadmium balance model to be used in the TFMS. This modelling will help inform the potential for any shift from accumulation on primary production land into the wider environment. In conjunction with on-going monitoring, consideration will continue to be given to the wider environmental impacts, however this remains a low priority for research.
- ***Emerging cadmium issues*** – addressing any emerging issues regarding human health, trade and the environment, identified through scanning activity.

The CMG will consider a programme of research that responds to CMG priorities, and that programme will be incorporated into a separate document to this strategy and be updated as required. The priorities have not yet been established (December 2019). The CMG will as required update the research priorities that respond to priorities described above and other information needs as required.

Different parts of the research programme will be implemented according to the priorities of the member bodies. The CMG will be responsible for seeing that a full portfolio of research is implemented and will take an active role in pursuing funding and ensuring that agencies put more research emphasis into cadmium. This will involve co-ordination among the bodies represented on the CMG, and communication with all key research funding and provision organisations.

***Milestones:***

- ***CMG to develop a programme of research work that responds to the priorities in the strategy and facilitate their funding;***
- ***CMG to update as required the CMG research priorities, and MPI to annually collate reports from providers and industry bodies on cadmium research relevant to the CMS, and any progress towards achieving CMG research priorities.***

# Scanning on cadmium issues

The CMG needs to stay abreast of developments in human health, trade and environmental impacts of cadmium, and scanning of the international context, research literature, regulatory environment, and other areas that may impact on cadmium is crucial.

MPI scanning of the trade and human health issues is currently undertaken for a range of reasons, and CMG will ensure that cadmium continues to be an issue for priority in their scanning programme. MPI will ensure that information on any emerging cadmium risks is presented to the CMG annually.

MFE has responsibility for management of the environment and are members of the CMG. It is appropriate that they also maintain a watching brief on any internationally emerging environmental issues with respect to cadmium, either from the research literature or from policy or regulatory functions in other jurisdictions. MFE will ensure that information on any emerging cadmium risks for the environment is presented to the CMG annually.

Members of the CMG will contribute information to the scanning of cadmium related issues in the regulatory, trade, policy and research spheres as appropriate.

***Milestones:***

- ***MPI to report annually to CMG on the international state of policy, regulation and research related to cadmium for human health and trade;***
- ***MFE to report annually to CMG on any emerging environmental risks from cadmium.***