Application report: reassessment of hydrogen cyanamide

APP203974

SEPTEMBER 2021

Environmental Protection Authority
Te Mana Rauhī Taiao

New Zealand Government

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Executive summary

Background

Hydrogen cyanamide is a plant growth regulator used in the production of kiwifruit and other fruit. Using hydrogen cyanamide in kiwifruit production ensures that growth of shoots (known as 'bud-break') happens in a controlled way. It is also applied to some apple, cherry, apricot, and kiwiberry crops for the same bud-breaking purpose, but to a much lesser extent than kiwifruit.

Bud-break happens naturally when a plant experiences sufficient frost but can also be stimulated chemically using the likes of hydrogen cyanamide. This type of stimulation offers practical advantages and leads to profitability for growers. Warmer regions where kiwifruit are grown are increasingly dependent on hydrogen cyanamide in order to maintain crop viability, due to frosts becoming milder with climate change.

Newly available information on the effects of hydrogen cyanamide led to reassessment grounds being established in September 2019. The new information included regulatory action by the European Food Safety Authority (EFSA) and their human health and environmental risk assessments. The EFSA review, other assessments published by regulatory authorities in the United States (US) and Europe, and risk assessments provided by stakeholders have been used to inform the EPA's current assessment of risks and benefits of hydrogen cyanamide use in New Zealand.

This document contains the EPA's review of both the positive and adverse effects of hydrogen cyanamide. The application has been prepared by the staff of the EPA on behalf of the Chief Executive, who has initiated this reassessment. It includes risk and benefit assessments and preliminary proposals for the affected substances based on the results of those assessments and the information currently available.

It is important to note that the proposals in this reassessment application may or may not be supported by the Decision-making Committee for this application. The Decision-making Committee can choose to accept, reject, or modify the recommendations. For this reason, the EPA encourages submissions on the proposals, particularly to provide information to address the uncertainties, assumptions, or data gaps identified throughout this document.

Risk assessment

The EPA has assessed the risks posed to people and the environment from the use of hydrogen cyanamide, using the endpoint data available and standard risk assessment methodologies, including refinements where appropriate.

Human health risk assessment

Risks to bystanders were determined to be above the level of concern, but risks could be mitigated through the use of buffer zones.

Risks to operators using hydrogen cyanamide were determined to be above the level of concern, and risks could not be mitigated even with the prescribed, modified, and additional

controls, or considering the lowest current label application rates. Overall, without further refinements, the risks are above the level of concern for operators.

Environmental risk assessment

Risks to the aquatic environment, non-target plants, pollinators, and non-target arthropods as well as chronic risks to birds were determined to be above the level of concern. Risks to these receptors can be mitigated through the use of buffer zones, restrictions on application rate and timing, and prohibiting application when bees are present.

Acute risks to birds were determined to be above the level of concern and cannot be mitigated even with the prescribed, modified, and additional controls.

Māori impact assessment

The continued use of hydrogen cyanamide is likely to support the ability and capacity of Māori to enhance their economic and social development well-being in terms of prosperity, livelihoods, and lifestyles, but is likely to adversely affect their cultural and social well-being in terms of protecting cultural values, health and welfare, and environmental quality.

Furthermore, the continued use of hydrogen cyanamide is likely to adversely affect the relationship of Māori and their culture and traditions with their environment and taonga, including culturally significant species, resources, and places, and the customary values, practices and uses associated with these taonga.

Benefit assessment

Hydrogen cyanamide use currently makes a measurable and significant beneficial contribution to gross domestic product (GDP), and significant regional benefits. The consequences of reducing availability of hydrogen cyanamide would therefore lead to a reduction in GDP, and regional negative economic impacts. The overall level of benefit is considered medium-high.

Preliminary proposals

While finely balanced, the benefits associated with hydrogen cyanamide use are assessed as being medium-high, the risks to operators are medium and the risks to birds are high, and accordingly the overall adverse effects are considered to outweigh the positive effects.

Based on this weighing up of the risks and benefits as currently assessed, it is proposed that the approvals for hydrogen cyanamide should be declined. A phase-out period of five years from the date of the decision is proposed. The gradual phase-out will allow using up of existing stock of products, acquiring experience in use of existing alternatives, carrying out further research and development, and introduction of additional alternatives to the New Zealand market.

In view of the identified risks to human health and the environment from the use of hydrogen cyanamide, it is proposed that updated hazard classifications and additional controls are set during the interim phase-out period to minimise those risks as far as possible.

Therefore, based on the currently available information, the following proposals are recommended:

Substance	HSNO Approval number	EPA proposal	Proposed HSNO classification
Hydrogen cyanamide	HSR002949	**Revoke approval with medium-term phase-out period (up to 5 years)**	Acute oral toxicity Category 3, Acute dermal toxicity Category 3, Acute inhalation toxicity Category 4, Skin corrosion Category 1C, Serious eye damage Category 1, Skin sensitisation Category 1, Carcinogenicity Category 2, Reproductive toxicity Category 2, Specific target organ toxicity (repeated exposure) Category 2, Aquatic ecotoxicity – chronic Category 3, Hazardous to soil organisms, Hazardous to terrestrial vertebrates, Hazardous to terrestrial invertebrates
Soluble concentrate containing 520 to 540 g/L hydrogen cyanamide	HRC000001	**Revoke approval with medium-term phase-out period (up to 5 years)** - apply additional controls during phase-out period (see Appendix G)	Acute oral toxicity Category 3, Acute dermal toxicity Category 4, Acute inhalation toxicity Category 4, Skin corrosion Category 1C, Serious eye damage Category 1, Skin sensitisation Category 1, Carcinogenicity Category 2, Reproductive toxicity Category 2, Specific target organ toxicity (repeated exposure) Category 2, Aquatic ecotoxicity – chronic Category 3, Hazardous to soil organisms, Hazardous to terrestrial vertebrates, Hazardous to terrestrial invertebrates

The EPA notes that the proposals may change if additional information can be provided to refine the risk assessments and/or demonstrate that the risks can be adequately and practically managed with alternative risk mitigation measures.

Information requested

Throughout this application report, key questions or assumptions that submitters may wish to address have been identified. If further information in these areas is provided through the public consultation process, aspects of the risk assessments and the proposed mitigation measures may be revised. Any revisions to the recommendations resulting from information provided during the submission period will be presented in an Update Report, which will be made publicly available prior to any hearing on this reassessment application.

Submitters are requested to provide information in these key areas (see report for full details):

- Feedback on selection of human health risk assessment input values for the quantitative modelling.
- Input on proposed maximum application rate restrictions, and information on effectiveness of lower application rates.
- Information on advances in closed cab application, closed systems for mixing and loading, and other technological developments.
- Occupational exposure monitoring data, if available.
- Crop-specific spray drift curve information with full supporting data, or refined risk assessments.
- Information on bird behaviour in New Zealand orchards, or further data to refine the modelling of risks to birds.
- Information on alternatives to hydrogen cyanamide, their relative cost and effectiveness, and any recent developments.

Boxes

Boxes have been used throughout the main body of this reassessment application report to indicate where there are questions or assumptions which submitters may wish to address. The information provided on these topics may inform further refinements to the risk assessments and result in updated proposals.

Submissions

Submissions are invited on the proposed changes to the hydrogen cyanamide approvals, including the appropriateness and workability of the revised management measures (controls). Submissions received will be used to inform a Decision-making Committee who will decide this application. Full details of how to submit on this reassessment application are provided in the accompanying Summary and Submission guidance document and on the EPA website.

Contents

1. Application report

1.1 This is a supporting document for the reassessment of hydrogen cyanamide and is supplementary to the application form. Appended to this document are human health and environmental risk assessments, a Māori impact assessment, and an economic benefits assessment. A report prepared by WorkSafe New Zealand (WorkSafe) is also appended to this document. The content of the appendices is summarised in this document. The information in the appendices has been used to weigh up the risks and benefits, and results in various proposals on changes to the hydrogen cyanamide approvals.

2. Background

2.1 Hydrogen cyanamide is a plant-growth regulator used in the production of kiwifruit. It is applied to ensure that growth of shoots, or 'bud-break', occurs in a controlled fashion. It is also applied to some apple, cherry, apricot, and kiwiberry crops for the same bud-breaking purpose, but to a much lesser extent than kiwifruit.

2.2 Successful bud-break results in a successful crop. Bud-break happens naturally when a vine experiences sufficient frost but can also be stimulated chemically using the likes of hydrogen cyanamide. Chemical stimulation of bud-break offers several practical advantages, which translate to profitability for growers. Crops treated with hydrogen cyanamide result in the more desired "king flowers" (which produce higher quality fruit) and will flower in a condensed period (for example, over one week, rather than four) which reduces harvest costs, and increases overall yield. Warmer regions where kiwifruit are grown are increasingly dependent on hydrogen cyanamide in order to sustain the viability of the crop. These regions already have mild, infrequent frosts, and these are becoming less frequent and milder with climate change.

Approvals and approval chronology

2.3 The substances in the following table are subject to this reassessment.

Table 1: Approvals subject to this reassessment

Approval name	Approval number	Active ingredient	CAS number of active ingredient	Concentration
Hydrogen cyanamide	HSR002949	Hydrogen cyanamide	420-04-2	100%
Soluble concentrate containing 520 to 540 g/L hydrogen cyanamide	HRC000001	Hydrogen cyanamide	420-04-2	520 – 540 g/L

2.4 Hydrogen cyanamide was first registered for use in New Zealand by the Pesticides Board in 1988. In the early 2000s, the approvals for hydrogen cyanamide as an active ingredient and a formulated substance were transferred into the Hazardous

Substances and New Organisms (HSNO) regime.[1] The substances are now regulated under the Hazardous Substances and New Organisms Act 1996 (HSNO Act) by the Environmental Protection Authority (EPA).

2.5 The approvals have recently been reissued under Schedule 7 of the HSNO Act to reflect the EPA's implementation of a new hazard classification system based on the seventh revision of Globally Harmonised System of Classification and Labelling of Chemicals (GHS). The current controls associated with the substances in their approval documents are included as Appendix A.

2.6 In New Zealand, all pesticides are required to have both a HSNO approval and registration under the Agricultural Compounds and Veterinary Medicines Act 1997 (ACVM Act). Six commercial products are registered under the ACVM Act, including the well-known product name, Hi-Cane. The registered labels for all six of the commercial products refer to the HSNO approval number for the formulation HRC000001. This indicates that all formulated products have broadly similar compositions with a similar concentration of active ingredient, so that they can all use the same HSNO approval. Details of the ACVM registered products are provided in Table 2.

Table 2: ACVM registered hydrogen cyanamide products

ACVM registration number	Trade name	Date of registration	Registrant	Concentration of active ingredient
P003566	Hi-Cane	01-06-1988	Nufarm Limited	520 g/L
P007840	Synergy HC	05-05-2008	Agsin PTE Ltd	520 g/L
P005858	Gro-Chem HC50	29-11-2001	Agrinova New Zealand Ltd	530 g/L
P007190	Cyan	15-09-2004	Agrinova New Zealand Ltd	530 g/L
P007333	Treestart	12-07-2005	Agrinova New Zealand Ltd (trading as Grochem)	520 g/L
P007018	Hortcare Hi-break	29-07-2002	Grosafe Chemicals Ltd	540 g/L

[1] The active ingredient approval was transferred in the Hazardous Substances (Chemicals) Transfer Notice 2006.

The formulated substance approval was transferred in the Hazardous Substances (Pesticides) Transfer Notice 2004.

2.7 While all the commercial products listed above are broadly similar in terms of composition, the manufacturers' documentation provided with the products and the recommendations for use can vary.

2.8 The New Zealand registrant of Hi-Cane, Nufarm Limited (Nufarm), provides a Hi-Cane safe handling guide and good neighbour letter as part of its product stewardship obligations, in addition to a standard Safety Data Sheet, product label, and HazNote emergency information and storage guide. These additional documents provide a further level of guidance to users around the safe management and spray directions for the product.

2.9 Nufarm also supplies the Driftstop surfactant blend that includes an organosilicone surfactant and synthetic polymer drift retarding agents. The Driftstop surfactant blend is recommended for use with Hi-Cane when applied with air inclusion (AI) nozzles to kiwifruit during the dormant and pre-flowering period. The combination is designed to improve coverage and minimise off-target drift.

2.10 The EPA has no information on the Synergy HC product, and whether it is currently marketed in New Zealand is unclear.

2.11 Agrinova New Zealand Ltd (trading as Grochem) supplies the Cyan and Grochem HC50 products, while its TreeStart product is not currently being imported or sold. The products are supplied with a Safety Data Sheet, product label and product safety card.

2.12 Grosafe Chemicals Ltd (Grosafe) supplies the Hortcare Hi-break product. Grosafe provides a Safety Data Sheet, product label, product safety card, and Tech Note document on its website. This additional document provides more detailed information on how to apply the product for best results, as well as some technical data comparing its effectiveness with Hi-Cane. It includes a recommendation to apply Hortcare Hi-break in combination with the Hybrid SB surfactant/buffering agent plus Drift Break drift retardant, which are also supplied by Grosafe.

Reassessment in 2006

2.13 Hydrogen cyanamide was previously reassessed in 2006 by the Environmental Risk Management Authority (ERMA), the predecessor organisation to the EPA.[2]

2.14 Grounds for the 2006 reassessment were established on 5 August 2004. Grounds were determined to exist based on significant new information on the effects of hydrogen cyanamide becoming available, and a significant change in use of the substance.[3]

2.15 The significant new information included a steady flow of reports of adverse effects to human health and the environment.

2.16 The significant change in use related to the increased spray period for kiwifruit. The typical spray window had been extended in order to accommodate new kiwifruit varieties.

[2] Application number HRC05001

[3] Application number RES04001

2.17 The 2006 reassessment was received on 24 March 2006. Submissions on the application involved a variety of stakeholders including members of the public, Zespri, New Zealand Kiwifruit Growers Incorporated (NZKGI), a number of iwi, and Māori kiwifruit growers.

2.18 Based on the information before it, the Decision-making Committee decided that the kiwifruit industry was best placed to regulate itself, through measures required by NZKGI and Zespri. It also noted that regional councils imposed additional requirements through regional plans, including applicator qualifications, notification of neighbours, and signage. Accordingly, the only additional control imposed under the HSNO Act resulting from the reassessment was the requirement for a label statement warning against consuming alcohol before and after using hydrogen cyanamide (to prevent cyanamide flush). The application was decided on 1 August 2006.

2.19 The Decision-making Committee decided that the standard controls prescribed in the Hazardous Substances Regulations that were in place at that time, spray management provisions in regional plans, and Good Agricultural Practice (GAP), were adequate to manage the risks. The provisions in the regional plans and GAP included applicator qualification, signage, and bystander notification requirements.

3. Process

3.1 This section describes the process leading up to the lodgement of this reassessment application (APP203974).

Grounds for reassessment

3.2 Grounds for reassessment were established in September 2019 based on the availability of new information on the effects of hydrogen cyanamide.[4]

3.3 The new information included the European Food Safety Authority (EFSA) review and associated human health and environmental risk assessments, and the subsequent EU decision implementing the EFSA recommendations.

3.4 The EFSA review, other assessments published by regulatory authorities in the United States (US) and Europe, and risk assessments provided by stakeholders were considered and informed the EPA's assessment of risks posed by hydrogen cyanamide use in New Zealand.

Call for information

3.5 The call for information was open from 30 January 2020 – 29 May 2020, asking the public and other interested parties to provide the EPA with any information that they had on hydrogen cyanamide. The EPA received 12 responses from the following parties:

- Bay of Plenty Regional Council
- Arabella Ross (Individual)

[4] Application number APP203865

- Pirirakau Hapu
- John Levers (Individual)
- Benson Skaraichan (Individual)
- Summerfruit New Zealand
- New Zealand Kiwiberry
- Agrinova New Zealand
- Nufarm
- Seeka
- Apples and Pears
- NZKGI

3.6 Details on current use practices, risk analyses, economic assessments, information on alternative bud-break agents, and general concerns were provided to the EPA with these responses. The information provided has been used to inform this reassessment application.

4. Current use of hydrogen cyanamide in New Zealand

Use pattern

4.1 Hydrogen cyanamide is a plant-growth regulator that can be used to chemically stimulate bud-break and can also compress and/or bring forward the flowering period and resultant harvest. New Zealand products include label directions for use on kiwifruit and apples. Some off-label use for kiwiberries, cherries, and apricots also occurs.

Kiwifruit

4.2 Kiwifruit is New Zealand's largest single horticultural export, with export revenue totalling $1.8 billion (or 32%) of the $5.5 billion horticultural export revenue in 2018. Total sales revenue, including the local New Zealand market, was $2.1 billion (or 149 million trays) in the 2018 season.

4.3 Around 14,000 hectares of kiwifruit are in production with approximately 2800 kiwifruit growers in New Zealand. At present, the two main varieties grown are the green Hayward variety and the Gold3 (or SunGold) variety.

4.4 Over 80% of New Zealand's kiwifruit are grown in the Bay of Plenty, with other major growing areas in Northland, Auckland, Waikato, Gisborne, Hawkes Bay and Nelson/Tasman.

4.5 Approximately 2-3% of kiwifruit are grown in organic orchards which do not use chemical bud-break agents. Of the conventional orchards, an average of 86% of the planted area of kiwifruit is treated with hydrogen cyanamide, with the remainder using either no chemical bud-break agent or an alternative product. Based on these figures, around 11,000-12,000 hectares of kiwifruit vines are assumed to be treated with hydrogen cyanamide each season.

4.6 Regional differences in the use of hydrogen cyanamide exist, with the vast majority of orchards in the warmer regions of the upper North Island being treated, and very little use in the lower North Island and the Nelson/Tasman area.

4.7 Hydrogen cyanamide is applied to kiwifruit vines as a single airblast application during late July to early September, with exact timing dependent on the variety treated. Recommended use of hydrogen cyanamide is by a single application at a dilution of 4-6 L per 100 L of water and rate of 500-700 L spray volume per hectare, not exceeding 800 L spray volume per hectare as damage can occur at higher rates.

Apples

4.8 The New Zealand apple and pear industry is the third largest horticultural export industry in the country with an export value of $870 million in 2019, and a predicted value of over $1 billion by 2022. Over 10,000 hectares are planted over the key growing regions: Hawkes Bay, Nelson/Tasman, Central Otago, Gisborne, South Canterbury, and Waikato.

4.9 In apples, hydrogen cyanamide use helps to promote bud-break in warmer regions of the North Island and upper South Island where there is insufficient winter chilling. It also assists in advancing and/or synchronising bud-break which leads to earlier or more uniform harvest. This can help increase profits where growers can achieve an early harvest price premium or by decreasing harvest costs.

4.10 Use of hydrogen cyanamide tends to be more regional, with some use in warmer regions and much more limited use in cooler regions. Overall, 13-20% of the planted area is estimated to use a hydrogen cyanamide spray application, which equates to around 2000 hectares.

4.11 As for kiwifruit, hydrogen cyanamide is applied to apples as a single application using airblast equipment during the dormant period, which tends to be during August with some variability depending on region and apple variety. Growers are utilising application rates (product rate and water rate) within the ranges shown on product labels, which are a dilution of 2.5 L per 100 L of water and rate of 800-1300 L spray volume per hectare, with many growers favouring a 1000 L spray volume per hectare.

Off-label uses: cherries, apricots, kiwiberries

4.12 The Summerfruit NZ industry body represents apricot, cherry, nectarine, peach, and plum growers. It represents approximately 280 growers and a planted area of around 1840 hectares, mainly in Central Otago and Hawkes Bay, and to a lesser extent in Marlborough.

4.13 Hydrogen cyanamide is used for some cherries and apricots in warmer growing regions. About 20% of the planted area (around 200 hectares) is estimated to use a hydrogen cyanamide spray application.

4.14 Growers are utilising hydrogen cyanamide off-label and the application rates (product rate and water rate) appear to vary considerably, with lower rates the same as for apples, but maximum rates exceeding those used for either apples or kiwifruit.

4.15 While kiwiberries are, in fact, a species of kiwifruit, the kiwiberry sector is managed independently of kiwifruit in New Zealand.

4.16 This is a very small-scale industry with only about 30 hectares planted in kiwiberries. Many kiwiberry growers are also kiwifruit growers and follow the same hydrogen cyanamide application rates and spray practices for both crops.

4.17 The majority of kiwiberry orchards are assumed to rely on hydrogen cyanamide for enhancing bud-break and its associated advantages.

Summary

4.18 Table 3 presents a summary of hydrogen cyanamide use and application rates used in New Zealand. The information was compiled based on label information, supplemented with data provided in response to the call for information.

4.19 This information on application methods and rates has informed the EPA's human health and environmental risk assessments.

4.20 The calculated application rate values of active ingredient per hectare are based on use of a 520 g/L soluble concentrate (which is the active ingredient concentration present in Hi-Cane). This enables a comparison to be made between the EPA's human health and environmental risk assessments and those provided by the kiwifruit industry.

4.21 As noted above in Table 2, other products are available with concentrations of 530 g/L or 540 g/L, which would result in minor differences of active ingredient loading if used at the same product rate and spray volume rate as the 520 g/L concentrate. Should any restriction be placed on the amount of active ingredient loading per hectare, then the label rates for higher concentration products may need to be adjusted to take this difference into account.

4.22 As noted in Table 3, the application rate values that have been modelled in the human health and environmental risk assessments are shown in bold. These are generally the highest and lowest application rates, based on the label rates for kiwifruit and apples.

4.23 For kiwiberries, the modelling conducted for kiwifruit will apply equally, because the application rates are identical and crop interception will also correspond.

4.24 For summerfruit, the modelling for apples will be broadly similar as both follow the bare orchard scenarios in the risk assessment models used. While the application rates used for summerfruit encompass a broader range than for apples, the EPA has not modelled the very highest rates, since unmitigated risks at the high rates in apples have already been identified.

Table 3: Use pattern of hydrogen cyanamide

Crop	Purpose of application	Application: method / kind	Application: growth stage & season	Application rate per treatment: product rate (L) per 100L water min – max	Application rate per treatment: spray volume (L/ha) min – max	Application rate per treatment: active ingredient loading (kg ai/ha)[5] min – max
Kiwifruit	Plant growth regulator	High volume ground spraying	Dormant vines (prior to bud break)	4 – 6	500 – 800	**10.4** – 15.6 (500 L/ha) 14.6 – 21.8 (700 L/ha) 16.6 – **25.0** (800 L/ha)
Kiwiberry	Bud break enhancer	High volume ground spraying	Dormant vines (prior to bud break)	4 – 6	500 – 800	**10.4** – 15.6 (500 L/ha) 14.6 – 21.8 (700 L/ha) 16.6 – **25.0** (800 L/ha)
Pome fruit (apples)	Advanced bud-break and a compressed flowering period to advance harvest, crop uniformity, pollination, and fire blight disease management	Ground spraying. Calibrated airblast sprayer. Medium volume to give complete coverage.	Code 00: Dormancy	2.5	800 – 1300	**10.4** (800 L/ha) 13.0 (1000 L/ha) **16.9** (1300 L/ha)
Stone fruit (cherries, apricots)	To compensate for mild winters	Airblast and/or tower, large droplet	45 - 14 days before natural bud break	2.5 – 3	800 – 1800	**10.4** – 12.5 (800 L/ha) **16.9** – 20.3 (1300 L/ha) 23.4 – 28.1 (1800 L/ha)

[5] The active ingredient loading is expressed in pure active ingredient per hectare. In bold are the values that were retained for risk assessment purposes.

Current practice

4.25 A number of different legal requirements and guidelines for using hydrogen cyanamide products exist. The HSNO approval sets the baseline controls for managing risks by reference to the EPA Notice controls and any additional controls. Requirements under the Health and Safety at Work Act 2015 (HSW Act), and associated Health and Safety at Work (Hazardous Substances) Regulations 2017 (HSW(HS) Regulations) apply to manage risks in workplaces.

4.26 Additional requirements for using agrichemicals are typically set by regional councils in their regional plans under the Resource Management Act 1991 (the RMA). For example, the Bay of Plenty Regional Council (BOPRC) sets rules under the RMA around agrichemical use in the region within Plan Change 13 (Air Quality) of its Regional Natural Resources Plan. This sets the policy and rules around agrichemical spraying in the region, which include avoidance of spray drift and minimising discharge beyond property boundaries, signage, notification of neighbours, and use of spray risk management plans.

4.27 A safety programme has been developed within the kiwifruit industry to minimise risks to growers, neighbours, and their animals. This safety programme reiterates the legal requirements noted above and sets additional guidelines around safe use. The details are provided to growers through the Zespri Crop Protection Standard (CPS) and Support for Safe Spraying booklet. While these guidelines have no legal status, NZKGI runs its own checks on orchardists and may apply penalties for serious breaches of their guidelines.

4.28 These current kiwifruit industry guidelines require that all neighbours are pre-notified of the intention to spray, spraying can only take place in low wind conditions (to minimize the off-orchard drift hazard) and signboards declaring its use and the period of restricted entry must be advertised. Shelter belts are recommended, with preference given for live shelter, >3m high and 1m thick. The guidelines also mandate annual property spray plans and spray diaries for auditing purposes.

4.29 Spraying techniques used within the kiwifruit industry have been modified in recent years to reduce the level of spray drift by using AI spray nozzles, adjusting pressures and speeds, and adding drift-reducing adjuvants to increase the adherence of droplets to their target.

Public concerns and complaints

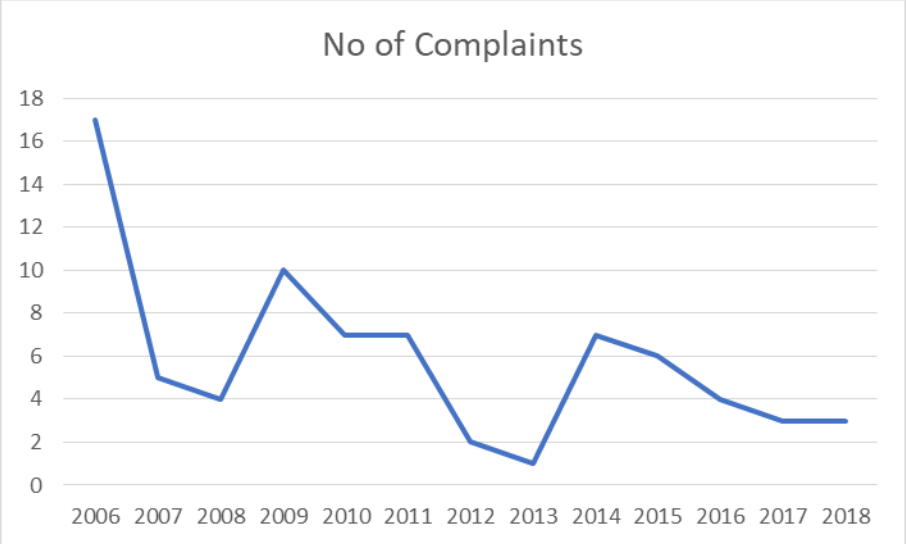
4.30 One of the factors contributing to grounds for the 2006 reassessment was an increase in public complaints and compliance issues around the use of hydrogen cyanamide. Data presented in the reassessment application showed a general increase in complaints to the Environment Bay of Plenty complaint line and to the National Poisons Centre between the late 1990s and the early 2000s.

4.31 Some responses to the call for information indicate continued concerns from members of the public around the use of hydrogen cyanamide, particularly in kiwifruit growing regions. The EPA was informed of citrus trees adjacent to a kiwifruit orchard being defoliated up to five to seven rows in from the boundary and concerns about rainwater collection tanks for household use within this area.

4.32 NZKGI set up its own phone line in 2003 to deal with public enquiries and complaints around the use of agrichemicals on kiwifruit orchards.

4.33 The graph below in Figure 1 shows the Hi-Cane complaints received on the NZKGI phone line from 2006 – 2018. The data show complaints dropping off sharply from an initial high of 17 complaints in 2006 to single digits for almost every other year.

Figure 1: Number of Hi-Cane complaints received by NZKGI from 2008 – 2018



4.34 Regional councils also receive enquiries and complaints from members of the public around agrichemical use in their area. For example, BOPRC runs its own hotline and records complaints related to agrichemicals, including hydrogen cyanamide.

4.35 Table 4 summarises the numbers and general categories of complaints received during the past two spraying seasons. The total numbers are broadly similar to the numbers received in the early 2000s as reported in the 2006 reassessment application. The majority of these relate to spray drift or notification of neighbours.

Table 4: Numbers of complaints to the BOPRC hotline by category in 2019 and 2020

Category of complaint	2019	2020
Spray drift	16	9
Signage	2	-
Notification	1	10
Odour	-	2
Unknown	3	-
Total	22	21

4.36 When considering changes to controls, factoring in the current level of compliance with existing regulations around the use of hydrogen cyanamide is useful.

4.37 WorkSafe carried out several inspections during 2019 and 2020 in areas where hydrogen cyanamide is used. Most of the site visits were kiwifruit orchards, across regions including Nelson/Tasman, Northland, Bay of Plenty, Poverty Bay, Hawkes Bay, Te Puke, and Ōpōtiki. The enforcement action data is provided in Table 5.

Table 5: Summary of WorkSafe enforcement action data from 53 site assessments in 2019 and 89 site assessments in 2020

Enforcement type	2019	2020
Inventory	25	16
SDS	14	7
Inventory and SDS	-	3
Emergency response plan	4	5
Location certificate	-	7
Signage	2	1
Storage	1	2
Labels	1	-
Secondary containment	2	1
Spray drift	1	2
Respiratory protective equipment (RPE)	3	8
Power take-off (PTO) guard*	7	9
Seatbelt*	1	4
Helmet*	-	2
Risk management*	-	4
Health monitoring*	-	5
Other – guarding and falling from heights (FFH)*	-	3
Total number of enforcement actions taken	**61**	**79**

* Not hazardous substance specific issues

4.38 As can be seen from the data, the total number of visits carried out in 2020 was much higher than in 2019. Considering the increased number of visits, a general improvement in some areas is apparent, particularly around having adequate chemical inventories and Safety Data Sheets on site. However, some improvement in compliance could still be made in certain areas.

5. International status

5.1 In Europe, the EFSA reviewed hydrogen cyanamide as part of a programme of work in which active substances were evaluated for safety concerns. A draft assessment report (DAR) was prepared by Germany, as the rapporteur member state, and submitted to EFSA in 2006. This included an initial risk assessment and proposed decision, with the use patterns evaluated including application to dormant fruit trees and kiwifruit to promote bud-break. The assessment identified unacceptable risks to operators with predicted exposures significantly exceeding acceptable levels even with full personal protective equipment (PPE).

5.2 Following publication of the EFSA DAR, the Commission of European Communities (EC) adopted the decision for non-inclusion of hydrogen cyanamide in Annex I to Council Directive 91/414/EEC, effectively banning plant protection uses of hydrogen cyanamide in Europe. An application for approval was re-submitted with additional information countering the issues identified in the DAR. This resulted in an additional report to the DAR and an EFSA focussed peer review being prepared in 2010. However, ultimately this application was declined.

5.3 Despite the non-inclusion in Annex I, hydrogen cyanamide plant-growth regulator use was granted two emergency approvals in Greece during 2020. Emergency approvals last up to 120 days, the Greek approvals being active from 14 February 2020 – 13 June 2020 and from 9 December 2020 – 15 March 2021. Nufarm has indicated that an emergency approval application is in progress in Italy, though no documentation is available to support this. Nonetheless, the emergency approval process is not as involved as the usual European approval process and does not require risk assessment – the key consideration being the lack of availability of alternatives.

5.4 Hydrogen cyanamide is currently undergoing re-registration review in the US. Human health and environmental risk assessments were published in 2014. Following this, an interim decision was published in 2016. The interim decision imposed a number of additional restrictions to protect the health of operators, which included:

- closed cab application only
- closed mixing and loading systems only
- increased PPE requirements (for use when not in a closed cab)
- maximum application rate of 17.6 lbs active ingredient (ai) per acre per year (19.73 kg ai/ha/year)
- maximum application frequency of one application per year
- restricted entry interval of 24 hours
- buffer zone for bystander protection 125 feet (38.1 m)

- buffer zone for aquatic environments 900 feet (274.32 m)
- droplet size specification – coarse droplets only
- removal of hand-gun and aerial application methods.

A final decision on the US EPA re-registration review is still awaited.

5.5 Six hydrogen cyanamide products are on Chile's register of pesticides.

5.6 Hydrogen cyanamide is approved in Brazil, as it is present on the ANVISA monografias autorizadas webpage.

5.7 Hydrogen cyanamide is on Japan's list of registered active ingredients.

5.8 Hydrogen cyanamide is approved for plant protection use in Australia. The Australian Pesticides and Veterinary Medicines Authority (APVMA) website shows four approvals for hydrogen cyanamide as an active constituent (including manufacturing concentrate), and three registered labels for products containing hydrogen cyanamide. Australia has not reviewed hydrogen cyanamide use since its initial registration and the chemical is not currently prioritised for review.

6. Hazardous properties

6.1 The hazardous properties of hydrogen cyanamide were reviewed by the EPA. Full study reports were provided for only a select number of endpoints in the call for information responses. Therefore, for the majority of hazard classes, information from overseas regulators' reviews was used to classify both the pure active ingredient, and the formulated substance. The hazard assessment is presented in its entirety in Appendix B.

6.2 Table 6 presents the current and proposed hazard classifications for the active ingredient hydrogen cyanamide.

6.3 The main changes proposed are that the active ingredient is classified as a suspected carcinogen (Category 2) and as hazardous to soil organisms, the specific target organ toxicity classification is changed (from Category 1 to 2), and that the skin and eye irritant classifications are changed to skin and eye corrosive classifications (Category 1C and 1 respectively).

6.4 These changes and additional hazard classifications are proposed based on a thorough review of the available scientific data and overseas regulators' assessments. Full justification for the changes is provided in Appendix B.

Table 6: Hazard classification for the active ingredient hydrogen cyanamide

Hazardous property	Current classification	Proposed classification
Acute oral toxicity	Category 3	Category 3
Acute dermal toxicity	Category 3	Category 3
Acute inhalation toxicity	Category 4	Category 4
Skin irritation/corrosion	Category 2	Category 1C
Eye irritation/serious eye damage	Category 2	Category 1
Skin sensitisation	Category 1	Category 1
Carcinogenicity	-	Category 2
Reproductive toxicity	Category 2	Category 2
Specific target organ toxicity (repeated exposure)	Category 1	Category 2
Aquatic ecotoxicity - chronic	Category 3	Category 3
Soil ecotoxicity	-	Hazardous to soil organisms
Terrestrial vertebrate ecotoxicity	Hazardous to terrestrial vertebrates	Hazardous to terrestrial vertebrates
Terrestrial invertebrate ecotoxicity	Hazardous to terrestrial invertebrates	Hazardous to terrestrial invertebrates

6.5 Table 7 presents the current and proposed hazard classifications for hydrogen cyanamide formulated as a 520 – 540 g/L soluble concentrate.

Table 7: Hazard classification for hydrogen cyanamide formulated as a 520 – 540 g/L soluble concentrate

Hazardous property	Current classification	Proposed classification
Acute oral toxicity	Category 3	Category 3
Acute dermal toxicity	Category 4	Category 4
Acute inhalation toxicity	Category 4	Category 4
Skin irritation/corrosion	Category 2	Category 1C
Eye irritation/serious eye damage	Category 2	Category 1
Skin sensitisation	Category 1	Category 1
Carcinogenicity	-	Category 2
Reproductive toxicity	Category 2	Category 2
Specific target organ toxicity (repeated exposure)	Category 1	Category 2
Aquatic ecotoxicity - chronic	Category 3	Category 3
Soil ecotoxicity	-	Hazardous to soil organisms
Terrestrial vertebrate ecotoxicity	Hazardous to terrestrial vertebrates	Hazardous to terrestrial vertebrates
Terrestrial invertebrate ecotoxicity	Hazardous to terrestrial invertebrates	Hazardous to terrestrial invertebrates

6.6 As for the active ingredient, the hazard classification changes include classifying the soluble concentrate as skin and eye corrosive, rather than as an irritant, including a carcinogenicity classification, changing the specific target organ toxicity classification (from Category 1 to 2), and classifying as hazardous to soil organisms. Full justification for the changes is provided in Appendix B.

6.7 The EPA recommends that the hazard classifications are amended as part of this reassessment. This would ensure that hydrogen cyanamide products are correctly identified as skin and eye corrosive, carcinogenic, and hazardous to soil organisms on their labels and safety documentation. Users could then take appropriate safety and emergency management precautions.

7. Risk assessment

7.1 Human health and environmental risk assessments were prepared by the EPA. These are presented in their entirety in Appendix B, together with a critical review of risk assessments provided in response to the call for information. Key findings and conclusions are summarised below.

Qualitative assessment of human health and environmental effects associated with importation, manufacture, transportation, and disposal

7.2 Given the hazards associated with hydrogen cyanamide and its formulations, there is potential for adverse effects to occur at any point during the lifecycle of these substances. Notably, the hazardous properties of these substances have the potential to cause moderate adverse effects.

7.3 However, during the importation, manufacture, transportation, storage, and disposal of these substances, compliance with the default HSNO controls and other legislative requirements sufficiently mitigate the overall level of risk across these different areas to negligible levels. This assessment takes into account the existing HSNO requirements around packaging, identification, and disposal of hazardous substances. In addition, the Land Transport Rule 45001, Civil Aviation Act 1990, Maritime Transport Act 1994, HSW Act and HSW(HS) Regulations all have provisions for the safe management of hazardous substances across these areas.

Human health risk assessment of hydrogen cyanamide

7.4 During the use phase of the life cycle of hydrogen cyanamide products, there is potential for significant exposure to people. Therefore, the EPA has quantitatively modelled the risks to human health, using standard risk assessment methodologies. Full methodology details are in the EPA's risk assessment methodology document.[6]

7.5 A number of key values were determined or estimated by the EPA and then used as input values for human health modelling. A summary of these input values is provided in Table 8.

Table 8: Input values for hydrogen cyanamide human health risk assessment

Acceptable operator exposure level (AOEL)	Application rate	Application method	Work rate	Dermal absorption (concentrate)	Dermal absorption (spray dilution)
0.01 mg/kg bw/day	10.4 – 25 kg ai/ha (kiwifruit) 10.4 – 16.9 kg ai/ha (apples)	Airblast	10 ha/day	14.3%	8.2%

[6] https://www.epa.govt.nz/assets/Uploads/Documents/Hazardous-Substances/Risk-Assessment-methodology/Risk-Assessment-Methodology-for-Hazardous-Substances-How-to-assess-the-risk-cost-and-benefit-of-new-hazardous-substances-for-use-in-New-Zealand-v2.docx

7.6 Full details on how the input values were derived are provided in Appendix B. As discussed in Appendix B (pages 94-101), a variety of different data sources have been analysed to arrive at this selection of input values. The selection of input values has also been compared with the various different sets of values made by the European and US regulators and in the previous 2006 reassessment.

7.7 One important finding is that the dermal absorption value, which equates to the proportion of hydrogen cyanamide absorbed through the skin is higher at higher skin loading/concentration than at lower concentrations. These findings indicate a reverse trend to what usually applies to absorption of pesticide active ingredients.

7.8 The EPA welcomes further information from submitters on the appropriateness of the values selected in the New Zealand context. The EPA also welcomes submitters to provide any additional data which is more relevant to New Zealand use of hydrogen cyanamide, particularly any dermal absorption data based on the spray dilutions currently used.

Box 1 – Feedback on selection of human health risk assessment input values

Submitters are invited to provide feedback on our selection of input values for the quantitative modelling. We also welcome any additional data relevant to input value selection.

7.9 The risks to human health from typical hydrogen cyanamide usage in New Zealand were then modelled from the perspective of operators, re-entry workers, and bystanders.

Risks to operators

7.10 The modelling conducted by the EPA calculates predicted exposures to hydrogen cyanamide from normal use and compares these with the acceptable operator exposure level (AOEL). A risk quotient (RQ) value is calculated, with a value greater than one indicating a predicted exposure above the AOEL and of potential concern. Where the RQ value is less than one, the predicted exposure is below the AOEL and risks are considered negligible.

7.11 The modelling indicates that, without further refinements, the RQ values are above the AOEL for operators whether using the maximum or minimum application rates and considering all possible levels of PPE and respiratory protection.

7.12 An abbreviated set of results is provided in Table 9. For full details, see Appendix B (Tables 29, 30 and 31 on pages 102-104).

7.13 Referring to the EPA's risk assessment methodology document, the risks without PPE are high (RQs in the range of 100-1000), and the risks with full PPE with or without a respirator are medium (RQs in the range of 10-100).

7.14 The results also demonstrate how the risks to operators increase with increasing application rates. With the use of full PPE and a respirator, the operator exposure risks at the minimum application rate have a RQ value of 12.7, which is the closest value to the low-risk category (RQs in the range of 1-10).

Table 9: Operator exposure RQ values with different levels of PPE at representative application rates

Level of PPE	RQ value: airblast at 25 kg/ha exposure scenario (maximum rate for kiwifruit)	RQ value: airblast at 16.9 kg/ha exposure scenario (maximum rate for apples)	RQ value: airblast at 10.4 kg/ha exposure scenario (minimum rate for kiwifruit / apples)
No personal protective equipment (PPE) during mixing, loading and application	466.0	315.0	193.8
Full PPE during mixing, loading and application	36.8	24.9	15.3
Full PPE during mixing, loading and application (including FP2, P2 and similar respirator achieving 90% inhalation exposure reduction)	30.4	20.6	12.7

7.15 At present, the hydrogen cyanamide application rate is not restricted in New Zealand. The EPA is proposing that an application rate is set as a result of this reassessment. This restriction would act to set an upper threshold on the risks to operators, as well as on risks to bystanders and to the environment. An application rate restriction would also prevent future possible increases in application rates, whether as label or off-label uses, thereby preventing the potential for ever-increasing operator risks.

7.16 The preference would be to set application rates at the lowest possible rate at which the benefits of hydrogen cyanamide use can still be realised, but the risks can be minimised. Further information is needed to enable the EPA to fully investigate the application rate restriction proposal and provide a range of options for consideration by the Decision-making Committee.

7.17 Current hydrogen cyanamide labels provide a range of application rates for different crops, with varying dilution rates of the product in water and spray volumes used per hectare. As such, the loading of active ingredient per hectare can vary quite substantially. As noted above, the risks have been assessed based on the absolute upper and lower label rates. Similarly, the benefits of hydrogen cyanamide use have been assessed based on current use in New Zealand, with users generally selecting application rates towards the upper end of the label ranges. What, if any, advantages are associated with the higher label rates as compared to the lower label rates, and whether a lower or an intermediate rate will provide sufficient benefits, is not clear. Submitters are encouraged to provide information on the benefits associated with use at different application rates.

7.18 The active ingredient loading used overseas also varies substantially from the New Zealand label rates. For example, European assessments are based on a much lower representative application rate of 9.36 kg ai/kg for airblast application to kiwifruit.

Similarly, the US assessment is based on an application rate of 19.7 kg ai/ha (equivalent to 17.6 lb ai/A) for a number of crops, including apples, cherries and kiwifruit, and an application rate of 4.9 – 7.4 kg ai/ha (equivalent to 4.4 – 6.6 lb ai/A) for nectarines and peaches. Information on whether these lower rates used overseas could be adopted in New Zealand would be useful.

7.19 Since we do not yet have sufficient information to recommend specific maximum application rates, the proposed maximum rates in this reassessment application are based on the current upper rates that have been assessed. Therefore, the initial proposal is to set maximum application rates of 25 kg ai/ha for kiwifruit (and kiwiberries) and 16.9 kg ai/ha for pipfruit (and stonefruit) with a maximum of one application per year.

7.20 We fully expect changes to be made to the maximum application rate proposal following submissions, and it would be useful to have a number of options open for discussion. In view of this, the EPA is asking submitters for further information on the application rates needed to achieve the desired efficacy for different fruit crops.

Box 2 – Application rate restrictions

Submitters are asked to provide information on the lowest possible application rates that can be used on the various fruit crops, while still achieving the desired efficacy. Details of any changes to the benefits assessment resulting from lower application rates would be useful. We are also asking submitters for input on whether the lower rates used overseas can be adopted in New Zealand.

7.21 The risks cannot be mitigated to a negligible level even when considering engineering controls such as enclosed mixing and loading and enclosed cab application. However, these types of engineering controls do significantly reduce the risks. For example, by applying an adjustment to the EPA's modelling based on the US EPA assessment, the calculated operator risks when applying hydrogen cyanamide at a rate of 25 kg/ha result in an RQ value of 7.75, when using a closed mixing and loading system and closed cab application.

7.22 Under the Health and Safety at Work (General Risk and Workplace Management) Regulations 2016 (HSW(GRWM) Regulations) hierarchy of controls (regulation 6), the use of engineering controls to manage risks before resorting to the use of PPE is considered preferable. Therefore, the EPA is proposing that consideration is given as to whether these types of risk reduction measures could be implemented to align with the HSW regime as that works in parallel with HSNO controls.

7.23 The EPA understands that closed cab sprayers are widely used in the kiwifruit industry, particularly for hydrogen cyanamide, but their use when treating other fruit crops, and whether closed systems for mixing and loading are available and in use in New Zealand is less clear. The EPA welcomes further information from submitters on which of these measures are achievable, and the feasibility of mandating these types of controls. The EPA also welcomes information on any other technological advances which would reduce operator risks, and whether there are alternative methods of modelling the effects of these engineering controls.

Box 3 – Information on advances in closed cab application, closed systems for mixing and loading, and other technological developments

Please provide information on the extent of use of closed systems for mixing and loading and closed cab sprayers in the New Zealand horticultural industry at present. We welcome comments on the feasibility of mandating the use of such systems.
Submitters are invited to comment on any other technological developments that can reduce operator exposure to hydrogen cyanamide, such as automated application methods.

7.24 Occupational exposure monitoring data can be useful to assess effects on human health more precisely in comparison to the modelling approach. Such data can provide actual measurements of hydrogen cyanamide in the bloodstream following normal use. The US EPA had access to some human health monitoring data for their recent human health risk assessment. If any such data could be provided in submissions, this may assist with refinement of the EPA's operator risk assessment.

Box 4 – Occupational human health data

If any occupational exposure monitoring data is available for operators that regularly use hydrogen cyanamide, please provide this monitoring data.

Worker re-entry

7.25 The risks to workers re-entering the field after application of hydrogen cyanamide are considered negligible in view of the timing of the application (late winter/early spring), when little vegetation is present in the crops.

Risks to bystanders

7.26 The modelling conducted by the EPA indicates that the risks are above the level of concern for bystanders whether using the maximum or minimum application rates for both apples and kiwifruit.

7.27 Further modelling was carried out to determine suitable buffer zones to mitigate these risks to below the level of concern. Buffer zones to protect bystanders were determined based on spraying at either the maximum or minimum application rate for kiwifruit and apples. The proposed buffer zones are shown in Table 10 below.

Table 10: Proposed bystander buffer zones

Use pattern description	Downwind buffer zone
Kiwifruit ≤ 10.4 kg ai/ha – Airblast	4 m
Kiwifruit > 10.4 – 25 kg ai/ha – Airblast	8 m
Apple ≤ 10.4 kg ai/ha – Airblast	28 m
Apple > 10.4 – 16.9 kg ai/ha – Airblast	34 m

7.28 All modelling assumes that spraying occurs in conditions that are not excessively windy or too still. Therefore, the following label statement is recommended: "**DO NOT** apply when wind speeds are less than 3 km/hr or more than 20 km/hr as measured at the application site".

7.29 The modelling uses the EPA's standard risk assessment methodology and models, with the standard "vineyard" spray curves being used for kiwifruit and the standard "sparse orchard" spray curves being used for apples. Further refinements to the modelling and proposed buffer zones could be investigated if spray drift curves specific to these crops are provided.

7.30 The modelling does not take into account use of specific nozzle types or adjuvants. Further refinements to the modelling and proposed buffer zones could be investigated if data is provided as to how particular nozzle types or adjuvants affect the risk assessment models or spray drift curves.

Box 5 – Crop-specific spray drift curve information

Submitters are encouraged to provide crop-specific spray drift curves with full supporting data. Alternatively, refined risk assessments could be submitted using crop-specific spray drift curves and the input values identified in Table 8, for the individual crops. Submitters may wish to incorporate data on the use of particular nozzle types or adjuvants into their refined risk assessments, in which case full details of those parameters should be provided.

7.31 Proposed buffer zones may also be revised if alternative lower maximum application restrictions are set, as discussed in paragraphs 7.15 to 7.20.

Environmental risk assessment of hydrogen cyanamide

7.32 During the use phase of the life cycle of hydrogen cyanamide, significant exposure to the environment is possible. Therefore, the EPA has quantitatively modelled the risks to the environment, using standard risk assessment methodologies, with further refinements where necessary. Full details of these methodologies can be found in the EPA's risk assessment methodology document.

Aquatic environment

7.33 Full details of the input parameters used in the modelling and the subsequent results for different application rates and both acute and chronic risks are provided in Tables 37-41 of Appendix B.

7.34 Predicted exposure concentrations of hydrogen cyanamide resulted in calculated RQ values above the level of concern for the aquatic environment for multiple aquatic species. To manage these risks, controls to reduce both spray-drift and runoff into the aquatic environment are proposed. Further modelling with a refinement based on a higher tier mesocosm study was conducted to calculate proposed downwind and run-off buffer zones, which are shown in Table 11 below (reproduced from Table 56 of Appendix B).

Table 11: Proposed buffer zones to protect the aquatic environment

Use pattern description	Downwind buffer zone	Run-off buffer zone
Kiwifruit ≤ 10.4 kg ai/ha – Airblast	5 m	≤ 10% slope: 15 m > 10% slope: 20 m
Kiwifruit > 10.4 – 25 kg ai/ha – Airblast	10 m	≤ 10% slope: 20 m > 10% slope: 25 m
Apple ≤ 10.4 kg ai/ha – Airblast	35 m	≤ 5% slope: 0 m > 5% slope: 15 m
Apple > 10.4 – 16.9 kg ai/ha – Airblast	50 m	≤ 5% slope: 0 m > 5% slope: 20 m

7.35 Together with prescribed controls, additional controls setting a maximum application rate and use restrictions regarding the application conditions (as detailed in the human health risk assessment summary above) can reduce the risks to below the level of concern.

7.36 If submitters provide crop-specific spray drift curves, then these proposed buffer zones could be altered to take the new data into account.

7.37 In addition, if lower maximum application rates are set, then the proposed buffer zones could also be revised.

Groundwater

7.38 The groundwater risk assessment indicates that the risks to groundwater are below the level of concern.

Sediment

7.39 The risks to sediment-dwelling organisms are considered below the level of concern, due to the substance's inherent characteristics which makes it unlikely to partition into sediment.

Soil organisms

7.40 The risks to soil organisms are considered to be low, with risks likely being limited to non-threatened species due to the low likelihood of threatened species of earthworms being present in horticultural settings.

Non-target plants

7.41 The modelling indicates that risks to non-target plants are above the level of concern for all scenarios except the lowest application rate for kiwifruit. Further modelling was conducted to calculate proposed downwind buffer zones to reduce risks to a manageable level, which are shown below (reproduced from Table 63 of Appendix B).

Table 12: Proposed downwind buffer zones to protect non-target plants

Use pattern description	Downwind buffer zone – non-threatened species	Downwind buffer zone – threatened species
Kiwifruit ≤ 10.4 kg ai/ha – Airblast	0 m	0 m
Kiwifruit > 10.4 – 25 kg ai/ha – Airblast	10 m	15 m
Apple ≤ 10.4 kg ai/ha – Airblast	20 m	40 m
Apple > 10.4 – 16.9 kg ai/ha – Airblast	30 m	50 m

7.42 Together with prescribed controls, additional controls setting a maximum application rate and use restrictions regarding the application conditions can reduce the risks to below the level of concern.

7.43 If submitters provide crop-specific spray drift curves, then these proposed buffer zones could be altered to take the new data into account.

7.44 In addition, if lower maximum application rates are set, then the proposed buffer zones could also be revised.

Birds

7.45 Screening level and higher tier risk assessments indicated that both acute and chronic risks to birds are above the level of concern for all use patterns and considered to be significant.

7.46 A higher tier refinement was performed to calculate maximum safe foraging portions (PT) for the different use patterns to evaluate the range and degree of risks. This still identified potential acute risks for both threatened and non-threatened bird species for all use patterns, with at least one species potentially being at high risk (see Tables 77 and 78 of Appendix B). Overall, being protective of threatened species and considering the higher application rates, the risks to birds are assessed as medium-high.

7.47 No modified or additional controls have been identified that can mitigate these risks to an acceptable level. However, the use of lower application rates reduced the modelled risks significantly, increasing the safe foraging time by as much as two to three times compared to the higher application rates. Therefore, if a lower application rate was set, then the residual risks to birds would be reduced.

7.48 Further information on bird foraging behaviour in New Zealand orchards during winter might assist with further refinement of the potential risks, such as the proportion of foraging time spent in orchards, and the general diet of birds typically present. Any information on the contamination level of weed seeds and insects following hydrogen cyanamide spraying would assist with the refined modelling. The EPA would also welcome any information on practical measures that can be implemented to limit bird foraging in orchards following hydrogen cyanamide application.

Box 6 – Further information on bird behaviour in New Zealand orchards

Submitters are encouraged to provide any relevant information on types of bird species present and/or bird foraging diet and behaviour in New Zealand orchards during winter months when hydrogen cyanamide is applied.
Any submissions with practical suggestions for limiting bird foraging in orchards during and after hydrogen cyanamide application are also welcomed.

7.49 Chronic risks identified in the assessment are linked to reproductive effects that occur during exposure. Provided that hydrogen cyanamide is not applied during the reproductive season, these effects could be mitigated.

7.50 An additional label control could be used to specify that hydrogen cyanamide is not applied during the reproductive season of bird species in the area. However, a specific application timing restriction and associated label statement limiting application to specific weeks of the year, is likely to be more easily understood and complied with. Therefore, an application timing restriction, together with an associated label statement, is proposed.

7.51 The following use restriction is recommended: “The use of this substance is limited to the period of 15 July to 1 September”.

Pollinators

7.52 If bees were to be exposed to hydrogen cyanamide spray, acute risks arise that are above the level of concern for all application rates and crops assessed.

7.53 Although a risk is identified, application of hydrogen cyanamide in current use scenarios occurs in winter before bud break making the crop highly unattractive to bees as there will be no nectar or pollen available. In view of this, the likelihood of exposure to bees is expected to be minimal.

7.54 Additionally, the risks to bees from surrounding flowering trees and weeds can be mitigated by ensuring the substance is not applied in a plot containing flowers that are attractive to bees. The following EPA Notice default control for the protection of bees applies to substances classified as being hazardous to terrestrial invertebrates:

58 Protection of invertebrate pollinators from substances hazardous to invertebrates

1) This clause applies if a substance hazardous to invertebrates is applied to a plant, and it is in a form that non-target invertebrate pollinators are likely to be exposed to either during, or after, its application.

2) A person who applies the substance must ensure the application plot does not include any—

(a) bees that are foraging; or

(b) plants (including trees and weeds) that—

(i) are likely to be visited by non-target invertebrate pollinators; and

(ii) are either—

(A) in flower or part flower; or

(B) likely to flower within the period specified by the Authority as an additional control for the substance.

3) Subclause (2) does not apply if the application plot is indoors, and the substance is contained within the facility.

7.55 This control prohibits application when bees or other pollinators are present, effectively reducing likelihood of bees being exposed, and reducing the risks to a negligible level.

7.56 The proposed application timing control noted in paragraph 7.51 would further reduce risks by limiting the number of flowering weeds expected to be present at that time of year.

Non-target arthropods

7.57 Risks to non-target arthropods were assessed through both a screening assessment and higher tier level of assessment. Risks were identified as being above the level of concern for a number of species, although some of these are not likely to be present during winter when crops are not foliated. However, since risks were also identified for soil-dwelling arthropod species (rove beetle and *Pardosa* sp.), a label statement is proposed to warn end-users of the potential impact on beneficial insects.

7.58 The following label statement is recommended: "**WARNING:** the substance may not be compatible with Integrated Pest Management (IPM) and can have effects on the off-field population depending on crops (for example, fruit trees)".

7.59 The proposed application timing control noted in paragraph 7.51 would further reduce risks by limiting the number of beneficial insects expected to be present at that time of year.

Other controls proposed based on the environmental risk assessment

7.60 Based on the recommendations to adhere to buffer zones, application rates and timing, and labelling requirements, users should be appropriately trained and qualified in order to handle hydrogen cyanamide substances and manage the environmental risks. Therefore, the EPA recommends that the qualification requirements in the HPC Notice should apply to hydrogen cyanamide substances as if they were classified as being hazardous to the aquatic environment acute Category 1 substances.

8. Māori impact assessment

8.1 A Māori impact assessment was prepared by Kaupapa Kura Taiao, the Māori advisory team within the EPA. This assessment takes into account sections 5(b), 6(d) and 8 of the HSNO Act and is presented in its entirety in Appendix C.

8.2 The Māori impact assessment was informed by consultation with Māori undertaken by the EPA. Hui with representatives of affected iwi were held between 31 May 2021 and 10 June 2021. A summary of perspectives discussed in the hui is incorporated into the Māori impact assessment. Background information on risks and benefits provided to participants of those hui are available on the EPA website.

8.3 The conclusions of the assessment are provided below.

Section 5(b) – Recognise and provide for economic, social, and cultural well-being

8.4 The continued use of hydrogen cyanamide is likely to support the ability and capacity of Māori to enhance their economic and social development well-being in terms of prosperity, livelihoods, and lifestyles, but is likely to adversely affect their cultural and social well-being in terms of protecting cultural values, health and welfare, and environmental quality.

8.5 Prohibiting the use of hydrogen cyanamide is likely to adversely affect the ability and capacity of Māori to maintain their economic well-being. The overall impact on Māori economic wellbeing may be significant, particularly for Māori growers and operators in regions that are highly dependent on kiwifruit production.

8.6 However, the continued use of hydrogen cyanamide is likely to adversely affect the ability and capacity of Māori to maintain their social and cultural well-being. The overall impact on Māori social wellbeing (arising from the impact on the environment and taonga) may be significant. This includes impacts on Māori ways of life and taha hauora (human health and well-being). The overall impact on Māori cultural wellbeing (arising from the impact on the environment and taonga) may be significant. This includes potential impacts Māori may experience in relation to their customary practices, traditions, beliefs, institutions, and lore.

Section 6(d) – Take into account Māori relationship to the environment

8.7 The continued use of hydrogen cyanamide is likely to adversely affect the relationship of Māori and their culture and traditions with their environment and taonga, including culturally significant species, resources, and places, and the customary values, practices and uses associated with these taonga.

8.8 The overall impact on the relationship Māori have with their environment and taonga may be significant, and may adversely affect the ability of Māori to exercise kaitiakitanga.

Section 8 – Take into account Treaty of Waitangi principles

8.9 The EPA, as a Crown Agency, must take into account the principles of the Treaty of Waitangi (Te Tiriti o Waitangi). This includes the duty to actively protect Māori interests, and ensure that EPA decision-making is informed by Māori perspectives.

8.10 The Māori impact assessment has assessed cultural risk and identified how Māori interests can be protected. The EPA considers it is acting in good faith, and is acting reasonably and fairly, in respect of this reassessment application. Mātauranga Māori and tikanga Māori are being respected. The decision makers on this reassessment application will be able to make a decision informed by a Māori perspective.

9. Benefits assessment

9.1 An economic benefits assessment was commissioned by the EPA from the economic consultants, Sapere Research Group (Sapere). Sapere's assessment is presented in its entirety in Appendix D. The assessment takes into account the responses provided to the EPA's call for information, supplemented by dialogue with key industry groups.

9.2 The content of this section summarises the general benefits of using hydrogen cyanamide as outlined in various responses to the call for information, together with key findings from the economic benefits assessment, and draws conclusions on the overall level of benefits.

Advantages of using hydrogen cyanamide

9.3 As noted above, hydrogen cyanamide is used to chemically stimulate bud-break and can also compress and/or bring forward the flowering period and resultant harvest. It is particularly useful in regions which have insufficient or unreliable winter frosts that would otherwise naturally stimulate bud-break.

9.4 Several additional advantages flow on from the use of hydrogen cyanamide and the chemical manipulation of flowering and subsequent harvest. These are summarised as follows:

- Use of hydrogen cyanamide provides bud breaking uniformity, volume, and timing – this maximises the chances of a predictable and optimal crop, including quality, timeliness, and cost.
- Hydrogen cyanamide increases the number of 'king' flowers in kiwifruit with reduced numbers of lateral flowers (which are typically removed), with more 'king' flowers correlating to higher numbers of fruit.
- The higher 'king' flower to lateral flower ratio in kiwifruit, and the synchronised flowering in apples, results in a reduced need for pruning and thinning (lower labour costs).
- Compressing the flowering period results in improved pollination, as bees only need to be in the orchard for a shorter time, crops have a more compact leaf canopy increasing ease of access for bees, and artificial pollination is more effective.
- Consistent timing of flowering and leaf canopy encourages fruit consistency (quality and uniform ripeness) and more predictable harvest time (reducing labour costs and/or managing labour and logistics during peak harvest time).
- Bringing forward harvest time helps extend the global selling window for export crops and/or meet early local market demand, which can provide an early sales premium.

- Hydrogen cyanamide use and the earlier and compressed flowering period assists in minimising the risk of fire blight infection in apples, so reducing the use of antibiotics and lowering the risk of antibiotic resistance.
- Biocidal action of hydrogen cyanamide can reduce bacteria, fungi, lichen, and scale insects.

9.5 All these advantages have been factored into the assessment of economic benefits offered by the use of hydrogen cyanamide.

Contribution to gross domestic product (GDP)

9.6 The economic benefits assessment estimated the economic value provided by hydrogen cyanamide use in kiwifruit, kiwiberry, pipfruit (apples), and summerfruit (cherries and apricots). The economic value attributable to hydrogen cyanamide use can also be interpreted as the economic impact that would result from hydrogen cyanamide becoming unavailable.

9.7 The estimated impacts on orchard gate returns (OGR) and GDP from hydrogen cyanamide being unavailable are reproduced in Table 13. This assumes that growers would switch to a less effective chemical bud-break enhancer. The additional costs of using more expensive alternatives to hydrogen cyanamide were also estimated and factored into the analysis.

9.8 Over a ten-year study period, the estimated present value impact on OGR of removing hydrogen cyanamide is between $1.9 billion and $2.5 billion, or $191 million to $253 million in year one. This equates to an impact on New Zealand's GDP in the range of $85 – 113 million per year. Of the values presented, 97% can be attributed to use of hydrogen cyanamide for kiwifruit production.

Table 13: Total combined grower cost and national GDP impacts ($ millions, present value). Reproduced from Appendix D.

	OGR (10 years)	GDP (10 years)	OGR (year 1)	GDP (1 year)
Low	$1,922	$858	$191	$85
Central	$2,190	$977	$224	$100
High	$2,494	$1,113	$253	$113

9.9 Sapere compared its findings with those reported by another economic consultancy, the New Zealand Institute of Economic Research (NZIER), which was produced on behalf of NZKGI and submitted in response to the call for information. The NZIER report was supplied to the EPA as part of a package of documents and assessments. The approach taken by the NZIER economists was broadly similar to Sapere's analysis. However, some differences were highlighted by Sapere:

- Sapere's estimation extends past kiwifruit to include kiwiberry, pipfruit, and summerfruit.
- NZIER determines the efficacy of alternatives using rainfall alone, where Sapere gives more weight to trial results.

9.10 A comparison of the results from both the Sapere and NZIER analyses is presented in Table 14. The values represent the impact on kiwifruit growers (rather than all growers as in Table 13) if hydrogen cyanamide became unavailable.

Table 14: Comparison of Sapere results with NZIER results ($ millions, present value). Reproduced from Appendix D.

Alternative effectiveness	Sapere (10 years)	NZIER (10 years)	Sapere (year 1)	NZIER (year 1)
Lower bound	$2,350	$2,811	$238	$301
Mid	$2,063	$2,187	$212	$234
Upper bound	$1,812	$1,562	$180	$167

9.11 Additionally, Sapere investigated the effect of profitability in response to decreased kiwifruit yield (price response). As New Zealand has an approximately 50% share of the global export market for kiwifruit, if kiwifruit supply was reduced (from the unavailability of hydrogen cyanamide), the price per tray of kiwifruit is expected to increase. This is based on previous events where a reduction in supply of a particular commodity led to price increases and an off-setting effect for growers (such as the crop reduction for the Hayward variety in 2017/18). The estimated lesser impact on kiwifruit returns and on GDP are demonstrated in Table 15.

Table 15: Comparison of Sapere results including price response with NZIER results ($ millions, present value). Reproduced from Appendix D.

Alternative effectiveness	Sapere (10 years)	NZIER (10 years)	Sapere (year 1)	NZIER (year 1)
Lower bound	-$366 to $1,948	$2,811	-$34 to $198	$301
Mid	-$198 to $1,728	$2,187	-$18 to $178	$234
Upper bound	-$234 to $1,509	$1,562	-$24 to $150	$167

9.12 Sapere notes that because of the inherent uncertainty in estimating price responses, the results in Table 15 are given as broad ranges and are not considered as part of their core results. However, the predicted price response may considerably offset the estimated impact if hydrogen cyanamide were to become unavailable.

9.13 Another limitation of the analysis is that potential benefits from removal of hydrogen cyanamide use have not been estimated or factored in.

Alternatives

9.14 Currently two agrichemical alternatives to hydrogen cyanamide are registered. Waiken is a plant growth regulator containing 388 g/L methyl canolate for initiating dormancy bud-break in pipfruit, stonefruit, and kiwifruit (Hayward variety), and has been commercially available since 2002. Advance Gold is a plant growth regulator

containing 123 g/L salicylic acid for improving budbreak and flowering in kiwifruit variety Gold3 and was approved for use more recently in 2015.

9.15 In addition, some products sold as fertiliser or fertiliser adjuvants, such as Erger K, are being promoted and used by some growers as bud-break enhancers. These products incorporate ingredients such as ammonium nitrate, calcium nitrate, and various surfactants. Other similar products, including Armobreak and BluPrins, have been trialled by the kiwifruit industry as alternative bud-break enhancers.

9.16 Growing fruit organically is a further alternative option where no chemical bud-break enhancer is used.

9.17 Compared with the situation at the time of the previous reassessment in 2006, the number of alternatives that are either currently available to New Zealand growers or undergoing assessment in industry trials has increased. However, adoption of newer alternatives appears not to have been widespread, presumably due to the products potentially being less effective, more difficult to use, more expensive, or due to uncertainty as to their effectiveness or reliability.

9.18 Information as to the lower effectiveness and higher costs of alternatives has been factored into the economic benefits assessment. However, with research in this area being an ongoing and evolving process, any further information from orchardists on their experience using alternatives would be appreciated. Information on the timeframes and practicalities of switching to alternative methods or products would also be useful.

Box 7 – Information on alternatives and their effectiveness

Submitters are encouraged to provide further information on alternatives, their effectiveness and relative cost, and recent developments in this area.

Conclusions on level of benefits

9.19 As shown in the economic benefits assessment, hydrogen cyanamide use currently makes a measurable and significant beneficial contribution to GDP. The consequences of reducing availability of hydrogen cyanamide would therefore lead to a reduction in GDP. Some degree of price response may act to reduce those economic impacts, but the extent of this is very difficult to predict.

9.20 The increased availability of alternatives (particularly compared to the situation 15 years ago) means that, if hydrogen cyanamide were unavailable, the economic impact would be less than when assessed during the 2006 reassessment. Possibly, the effectiveness and ease of use of alternatives would also increase as more orchardists gain experience in their use.

9.21 Given that hydrogen cyanamide is used in specific regions where kiwifruit and apples are grown, the economic benefits would be highly regionalised. Therefore, the cost of reducing availability of hydrogen cyanamide would be more profound in certain regions, and of negligible effect in other regions.

9.22 To allow a comparison between the benefits and the risks associated with use of hydrogen cyanamide substances, qualitative descriptors can be used to assign the

level of benefit into broad categories of low, medium, or high. In line with the EPA's risk assessment methodology document, these categories can be assigned by referring to a matrix combining the magnitude of the positive effects with the likelihood of those positive effects occurring.

9.23 The regional beneficial economic effects, with associated national implications and measurable impact on GDP, indicates that use of hydrogen cyanamide provides a **moderate-major** magnitude of positive effects.

9.24 Given that the substance is already in use and actual data on those benefits being realised is available, the likelihood is assessed as being **very likely (> 90%)**. Therefore, taking the magnitude and likelihood of the positive effects into account, the overall level of benefit is considered **medium-high**.

10. Use of hydrogen cyanamide in the workplace

10.1 As WorkSafe are responsible for setting requirements on hazardous substances in a workplace under the HSW Act, they have provided a report on the reassessment of hydrogen cyanamide. This is provided in full as Appendix E.

10.2 WorkSafe advises that compliance with the HSW(HS) regulations and HSW(GRWM) regulations will not adequately reduce the risks associated with the use of this substance in the workplace. This is based on concerns for the health of workers and the ability of Persons Conducting a Business or Undertaking (PCBUs) to manage the risks of using hydrogen cyanamide appropriately.

10.3 WorkSafe also notes that significant changes are proposed to the classification of hydrogen cyanamide, including adding a classification for carcinogenicity and increasing the skin and eye classifications from irritants to corrosives. Under the HSW Act and associated regulations, PCBUs using substances that are confirmed or possible carcinogens must consider substituting carcinogenic substances with alternative, less hazardous substances.

10.4 If the approvals for hydrogen cyanamide-containing substances are retained, WorkSafe is recommending that use is limited to certified handlers to ensure users are adequately trained and aware of obligations under the HSW Act.

10.5 More information is requested from the horticulture industry to determine appropriate controls, including:

- how industry is recording the use of hydrogen cyanamide
- information on recent developments relating to closed mixing and loading systems, including how effective they are and their availability in New Zealand, and developments in enclosed cab air quality systems
- measures such as automation that PCBUs could implement to reduce the worker exposure to acceptable levels
- refined or higher tier modelling for operator exposure when using enclosed cab and enclosed mixing and loading systems.

11. Proposals

Weighing up risks and benefits

11.1 To allow a comparison between the benefits and the risks associated with use of hydrogen cyanamide substances, qualitative descriptors have been used to assign the quantitatively assessed levels of risk to human health and the environment into broad categories of negligible, low, medium, or high. Similarly, qualitative descriptors have been used to assign the levels of benefits into broad categories of negligible, low, medium, or high. In line with the EPA's risk assessment methodology document, these descriptors account for the likelihood and magnitude of an adverse or positive effect.

Benefits

11.2 As discussed above in paragraph 9.24, the overall level of benefit has been qualitatively assessed as **medium-high**. The EPA has insufficient information as to how the degree of benefit presented by hydrogen cyanamide is related to the application rate. A wide range of application rates appear to be possible for both kiwifruit and apples, with the exact dilution rate of the product in water and application rate of the diluted solution per hectare left to the discretion of individual orchardists.

Risks and risk mitigation

11.3 Risks have been identified for all uses of hydrogen cyanamide and assessed at both the maximum and minimum label rates.

11.4 An analysis of the risks and options for practical control measures is provided in Appendix F.

11.5 The identified risks are anticipated to be able to be managed to negligible levels for bystanders, the aquatic environment, non-target plants, pollinators, and non-target arthropods by imposing additional controls on the use and/or labelling of hydrogen cyanamide. These additional controls include application parameter restrictions, use restrictions, buffer zones, and qualification requirements.

11.6 The identified risks to operators and to birds are non-negligible and additional controls are not able to mitigate the risks to negligible levels. For operators, the use of appropriate PPE (which is an existing requirement of the HSW(HS) Regulations) for mixing, loading, and application, together with appropriate training, reduces the risks to **medium**. For birds, no additional controls have been identified that could reduce the identified risks, which are assessed as **medium-high**.

Position on risk aversion

11.7 If hydrogen cyanamide use is to continue to be permitted and approvals retained, consideration of the degree of risk aversion to be adopted is necessary, as this will determine the tolerance of presented risks and the degree to which any material benefits may outweigh those risks.

11.8 A position of moderately high risk aversion (that is, relatively little tolerance of risk) has been adopted at this stage of the application process, given the non-negligible risks to both human health and the environment. The EPA considers this

precautionary approach is in alignment with the intent and purpose of the HSNO Act to protect the health of people and communities from the effects of hazardous substances.

11.9 While the benefits are assessed as being medium-high, the risks to operators are medium and the risks to birds are high. Coupled with this are risks that continued use would disproportionately impact on Māori ways of life and taha hauora (human health and well-being) and may adversely affect the ability of Māori to exercise kaitiakitanga. Accordingly, while finely balanced, the overall adverse effects are considered to outweigh the positive effects.

Proposals

11.10 Based on this assessment, the EPA proposes that the approvals for hydrogen cyanamide should be declined.

11.11 However, given the very high proportion of orchardists currently using hydrogen cyanamide and the relatively minimal experience of using alternatives, the EPA proposes that hydrogen cyanamide use is phased out gradually over a number of years.

11.12 A gradual phase-out would allow existing stock of products to be used, experience in use of existing alternatives to be acquired, further research and development to be carried out, and additional alternatives to be introduced to the New Zealand market. Allowing use for an interim period while a more suitable alternative bud-break regulator is found would help to protect substantial Māori investment in kiwifruit, and support the economic and social development of iwi, hapū, and whānau. Conversion of orchards to organic production, which is one of the alternatives available, typically takes place over three years.

11.13 In view of this, a phase-out period of five years from the date of the decision is proposed.

11.14 Given the relatively long time period during which hydrogen cyanamide could continue to be used, the EPA proposes that updated classifications should be implemented. The EPA considers that the classifications outlined in Table 6 and Table 7 should be conferred on the approvals immediately following the decision, and the default controls on the substance be adjusted accordingly to reflect these changes.

11.15 In view of the identified risks to human health and the environment from the use of hydrogen cyanamide, the EPA proposes that additional controls are set during the interim phase-out period to minimise those risks as far as possible. Those additional controls should apply with immediate effect, subject to a short transitional period for updating labelling and packaging for practicality purposes.

11.16 Details of the proposed controls for hydrogen cyanamide substances are provided in Appendix G.

11.17 In summary, based on the currently available information, the following proposals are recommended:

Substance	HSNO Approval number	EPA proposal	Proposed HSNO classification
Hydrogen cyanamide	HSR002949	**Revoke approval with medium-term phase-out period (up to 5 years)**	Acute oral toxicity Category 3, Acute dermal toxicity Category 3, Acute inhalation toxicity Category 4, Skin corrosion Category 1C, Serious eye damage Category 1, Skin sensitisation Category 1, Carcinogenicity Category 2, Reproductive toxicity Category 2, Specific target organ toxicity (repeated exposure) Category 2, Aquatic ecotoxicity – chronic Category 3, Hazardous to soil organisms, Hazardous to terrestrial vertebrates, Hazardous to terrestrial invertebrates
Soluble concentrate containing 520 to 540 g/L hydrogen cyanamide	HRC000001	**Revoke approval with medium-term phase-out period (up to 5 years)** - apply additional controls during phase-out period (see Appendix G)	Acute oral toxicity Category 3, Acute dermal toxicity Category 4, Acute inhalation toxicity Category 4, Skin corrosion Category 1C, Serious eye damage Category 1, Skin sensitisation Category 1, Carcinogenicity Category 2, Reproductive toxicity Category 2, Specific target organ toxicity (repeated exposure) Category 2, Aquatic ecotoxicity – chronic Category 3, Hazardous to soil organisms, Hazardous to terrestrial vertebrates, Hazardous to terrestrial invertebrates

11.18 The EPA would like to reiterate that the proposals may change if additional information can be provided to refine the risk assessments and/or demonstrate that the risks can be adequately and practically managed with alternative risk mitigation measures.

Appendix A. Current controls applying to hydrogen cyanamide approvals

Current controls applying to hydrogen cyanamide – HSR002949

Hazardous substances and new organisms (HSNO) default controls

Control code	EPA Notice	Notice / Part description
LAB	Labelling Notice 2017	Requirements for labelling of hazardous substances
PKG	Packaging Notice 2017	Requirements for packaging of hazardous substances
SDS	Safety Data Sheet Notice 2017	Requirements for safety data sheets for hazardous substances
DIS	Disposal Notice 2017	Requirements for disposing hazardous substances
HPC-1	Hazardous Property Controls Notice 2017 Part 1	Preliminary provisions
HPC-2	Hazardous Property Controls Notice 2017 Part 2	Substances restricted to workplaces
HPC-3	Hazardous Property Controls Notice 2017 Part 3	Requirements for hazardous substances in a place other than a workplace
HPC-4A	Hazardous Property Controls Notice 2017 Part 4A	Substances that are hazardous to the environment: Site and storage controls
HPC-4B	Hazardous Property Controls Notice 2017 Part 4B	Use of substances that are hazardous to the environment
HPC-4C	Hazardous Property Controls Notice 2017 Part 4C	Qualifications required for application of substances that are hazardous to the environment

HSNO additional controls and modifications to controls

Control description	Varied / Additional Control	Control
Active ingredient notification – requirements for notification of pesticide and veterinary medicine active ingredients	Additional control	Specification of pesticide and veterinary medicine actives (1) Any person who— (a) manufactures or imports into New Zealand this hazardous substance, which that person has not previously manufactured or imported on or before 1 July 2006; or (b) had previously manufactured or imported this hazardous substance on or before 1 July 2006, but that person has since modified the manufacturing process or changed the source of manufacture for that hazardous substance, must provide to the Authority in writing the information required by subclauses (3) and (4). (2) The information required by subclause (1) must be provided— (a) in the case of a substance that is manufactured in New Zealand prior to that substance being sold to another person or used in accordance with clause 1 of Schedule 3; or (b) in the case of a substance that is imported into New Zealand, prior to that substance being imported; and (c) in the case of a substance to which subclause (1)(b) applies— (i) each and every time the manufacturing process or source of manufacture is changed; and (ii) include equivalent information for the substance that was produced by the manufacturing process before it was modified, or supplied by the previous source of manufacture, if such information has not previously been provided to the Authority. (3) The information to be provided is— (a) the name and address of the manufacturer of the substance; (b) the specification of the substance including either— (i) the full name, including relevant citation, of the national and/or international standard(s) set by an international scientific or regulatory body

Control description	Varied / Additional Control	Control
		recognised by the Authority with which the substance complies, and evidence to support this; or (ii) the manufacturer's specifications including purity of the hazardous substance, isomeric ratio where applicable, maximum impurity content and evidence to support these, including details of analytical methods used. Where the substance is produced at more than one manufacturing site, this information must be provided for each site separately; (c) the identity of any impurity, its origin, and the nature of its relationship to the active component— (i) in the case of this substance, when the impurity is present at a concentration of 10 g/kg or more; (d) the identity of any impurity that is known to be of toxicological concern, its origin, and the nature of its relationship to the active component— (i) in the case of this substance, when the impurity is present at a concentration of less than 10 g/kg. (4) Information on an impurity that is required under subclause (3) must include— (a) its chemical name; (b) its Chemical Abstract Service Registry number (if available); and (c) its maximum concentration in the substance.
Use restrictions	Additional control	Prohibition on use of substances (1) No person may use this hazardous substance for any purpose other than— (a) for research and development; or (b) as an ingredient or component in the manufacture of another substance or product. (2) Despite subclause (1)(a), research and development using this substance does not include investigation or experimentation in which the substance is discharged, laid or applied in or to the outdoor environment.

Health and safety at work (HSW) requirements

Advisory Note: These requirements are not set for the substance under this approval but apply in their own right under the HSW (Hazardous Substances) Regulations 2017 according to the classification of the substance. They are listed here for information purposes only.

Control code	Regulation Part	Description
HSW1	Part 1	Application
HSW2	Part 2	Labelling, signage, safety data sheets, and packaging
HSW3	Part 3	General duties relating to risk management
HSW4	Part 4	Certified handlers and supervision and training of workers
HSW5	Part 5	Emergency management
HSW13	Part 13	Class 6 and 8 substances
HSW16	Part 16	Tank wagons and transportable containers

Current controls applying to Soluble concentrate containing 520 to 540 g/L hydrogen cyanamide – HRC000001

Hazardous substances and new organisms (HSNO) default controls

Control code	EPA Notice	Notice / Part description
LAB	Labelling Notice 2017	Requirements for labelling of hazardous substances
PKG	Packaging Notice 2017	Requirements for packaging of hazardous substances
SDS	Safety Data Sheet Notice 2017	Requirements for safety data sheets for hazardous substances
DIS	Disposal Notice 2017	Requirements for disposing hazardous substances
HPC-1	Hazardous Property Controls Notice 2017 Part 1	Preliminary provisions
HPC-2	Hazardous Property Controls Notice 2017 Part 2	Substances restricted to workplaces
HPC-3	Hazardous Property Controls Notice 2017 Part 3	Requirements for hazardous substances in a place other than a workplace
HPC-4A	Hazardous Property Controls Notice 2017 Part 4A	Substances that are hazardous to the environment: Site and storage controls
HPC-4B	Hazardous Property Controls Notice 2017 Part 4B	Use of substances that are hazardous to the environment
HPC-4C	Hazardous Property Controls Notice 2017 Part 4C	Qualifications required for application of substances that are hazardous to the environment

HSNO additional controls and modifications to controls

Control description	Varied / Additional Control	Control
Label - additional labelling requirements	Additional control	The following shall appear on hydrogen cyanamide label: Do not consume alcohol the day before or up to seven days after application. In combination with alcohol, a severe temporary reaction known as “cyanamide flush” may be produced. Symptoms of cyanamide flush include skin flushing, dizziness, headache, shortness of breath, and a rapid pulse.
Information - additional information requirements	Additional control	The following shall appear on hydrogen cyanamide documentation: Do not consume alcohol the day before or up to seven days after application. In combination with alcohol, a severe temporary reaction known as “cyanamide flush” may be produced. Symptoms of cyanamide flush include skin flushing, dizziness, headache, shortness of breath and a rapid pulse.

Health and safety at work (HSW) requirements

Advisory Note: These requirements are not set for the substance under this approval but apply in their own right under the HSW (Hazardous Substances) Regulations 2017 according to the classification of the substance. They are listed here for information purposes only.

Control code	Regulation Part	Description
HSW1	Part 1	Application
HSW2	Part 2	Labelling, signage, safety data sheets, and packaging
HSW3	Part 3	General duties relating to risk management
HSW4	Part 4	Certified handlers and supervision and training of workers
HSW5	Part 5	Emergency management
HSW13	Part 13	Class 6 and 8 substances
HSW16	Part 16	Tank wagons and transportable containers
HSW17	Part 17	Stationary container systems

Appendix B. Science memo – human health and environmental risk assessments

https://www.epa.govt.nz/assets/FileAPI/hsno-ar/APP203974/APP203974_20210920.1_Appendix_B_Science_memo.pdf

Appendix C. Māori impact assessment

https://www.epa.govt.nz/assets/FileAPI/hsno-ar/APP203974/APP203974_20210920.2_Appendix_C_Maori_impact_assessment_report.pdf

Appendix D. Economics assessment

https://www.epa.govt.nz/assets/FileAPI/hsno-ar/APP203974/APP203974_20210920.3_Appendix_D_Economics_assessment_report.pdf

Appendix E. WorkSafe report

https://www.epa.govt.nz/assets/FileAPI/hsno-ar/APP203974/APP203974_20210920.4_Appendix_E_WorkSafe_advice_report.pdf

Appendix F. Analysis of risks and practical control measures

https://www.epa.govt.nz/assets/FileAPI/hsno-ar/APP203974/APP203974_20210920.5_Appendix_F_Analysis_of_risks_and_practical_control_measures.pdf

Appendix G. Proposed controls applying to hydrogen cyanamide approvals

Proposed controls applying to hydrogen cyanamide – HSR002949

Hazardous substances and new organisms (HSNO) default controls

Control code	EPA Notice	Notice / Part description
LAB	Labelling Notice 2017	Requirements for labelling of hazardous substances
PKG	Packaging Notice 2017	Requirements for packaging of hazardous substances
SDS	Safety Data Sheet Notice 2017	Requirements for safety data sheets for hazardous substances
DIS	Disposal Notice 2017	Requirements for disposing hazardous substances
HPC-1	Hazardous Property Controls Notice 2017 Part 1	Preliminary provisions
HPC-2	Hazardous Property Controls Notice 2017 Part 2	Substances restricted to workplaces
HPC-3	Hazardous Property Controls Notice 2017 Part 3	Requirements for hazardous substances in a place other than a workplace
HPC-4A	Hazardous Property Controls Notice 2017 Part 4A	Substances that are hazardous to the environment: Site and storage controls
HPC-4B	Hazardous Property Controls Notice 2017 Part 4B	Use of substances that are hazardous to the environment
HPC-4C	Hazardous Property Controls Notice 2017 Part 4C	Qualifications required for application of substances that are hazardous to the environment

HSNO additional controls and modifications to controls

Control description	Varied / Additional Control	Control
Active ingredient notification – requirements for notification of pesticide and veterinary medicine active ingredients	Additional control	Specification of pesticide and veterinary medicine actives (1) Any person who— (a) manufactures or imports into New Zealand this hazardous substance, which that person has not previously manufactured or imported on or before 1 July 2006; or (b) had previously manufactured or imported this hazardous substance on or before 1 July 2006, but that person has since modified the manufacturing process or changed the source of manufacture for that hazardous substance, must provide to the Authority in writing the information required by subclauses (3) and (4). (2) The information required by subclause (1) must be provided— (a) in the case of a substance that is manufactured in New Zealand prior to that substance being sold to another person or used in accordance with clause 1 of Schedule 3; or (b) in the case of a substance that is imported into New Zealand, prior to that substance being imported; and (c) in the case of a substance to which subclause (1)(b) applies— (i) each and every time the manufacturing process or source of manufacture is changed; and (ii) include equivalent information for the substance that was produced by the manufacturing process before it was modified, or supplied by the previous source of manufacture, if such information has not previously been provided to the Authority. (3) The information to be provided is— (a) the name and address of the manufacturer of the substance; (b) the specification of the substance including either— (i) the full name, including relevant citation, of the national and/or international standard(s) set by an international scientific or regulatory body

Control description	Varied / Additional Control	Control
		recognised by the Authority with which the substance complies, and evidence to support this; or (ii) the manufacturer's specifications including purity of the hazardous substance, isomeric ratio where applicable, maximum impurity content and evidence to support these, including details of analytical methods used. Where the substance is produced at more than one manufacturing site, this information must be provided for each site separately; (c) the identity of any impurity, its origin, and the nature of its relationship to the active component— (i) in the case of this substance, when the impurity is present at a concentration of 10 g/kg or more; (d) the identity of any impurity that is known to be of toxicological concern, its origin, and the nature of its relationship to the active component— (i) in the case of this substance, when the impurity is present at a concentration of less than 10 g/kg. (4) Information on an impurity that is required under subclause (3) must include— (a) its chemical name; (b) its Chemical Abstract Service Registry number (if available); and (c) its maximum concentration in the substance.
Use restrictions	Additional control	Prohibition on use of substances (1) No person may use this hazardous substance for any purpose other than— (a) for research and development; or (b) as an ingredient or component in the manufacture of another substance or product. (2) Despite subclause (1)(a), research and development using this substance does not include investigation or experimentation in which the substance is discharged, laid or applied in or to the outdoor environment.

Health and safety at work (HSW) requirements

Advisory Note: These requirements are not set for the substance under this approval but apply in their own right under the HSW (Hazardous Substances) Regulations 2017 according to the classification of the substance. They are listed here for information purposes only.

Control code	Regulation Part	Description
HSW1	Part 1	Application
HSW2	Part 2	Labelling, signage, safety data sheets, and packaging
HSW3	Part 3	General duties relating to risk management
HSW4	Part 4	Certified handlers and supervision and training of workers
HSW5	Part 5	Emergency management
HSW13	Part 13	Class 6 and 8 substances
HSW16	Part 16	Tank wagons and transportable containers

Proposed controls applying to Soluble concentrate containing 520 to 540 g/L hydrogen cyanamide – HRC000001

Hazardous substances and new organisms (HSNO) default controls

Control code	EPA Notice	Notice / Part description
LAB	Labelling Notice 2017	Requirements for labelling of hazardous substances
PKG	Packaging Notice 2017	Requirements for packaging of hazardous substances
SDS	Safety Data Sheet Notice 2017	Requirements for safety data sheets for hazardous substances
DIS	Disposal Notice 2017	Requirements for disposing hazardous substances
HPC-1	Hazardous Property Controls Notice 2017 Part 1	Preliminary provisions
HPC-2	Hazardous Property Controls Notice 2017 Part 2	Substances restricted to workplaces
HPC-3	Hazardous Property Controls Notice 2017 Part 3	Requirements for hazardous substances in a place other than a workplace
HPC-4A	Hazardous Property Controls Notice 2017 Part 4A	Substances that are hazardous to the environment: Site and storage controls
HPC-4B	Hazardous Property Controls Notice 2017 Part 4B	Use of substances that are hazardous to the environment
HPC-4C	Hazardous Property Controls Notice 2017 Part 4C	Qualifications required for application of substances that are hazardous to the environment

HSNO additional controls and modifications to controls

<table>
<tr><th>Control description</th><th>Varied / Additional Control</th><th>Control</th></tr>
<tr><td>HPC-4B</td><td>Variation to Hazardous Property Controls Notice Part 4B</td><td>
For kiwifruit, the maximum application rate for this substance, as specified by the Authority in accordance with clause 50(1) of the Hazardous Property Controls Notice, is 25 kg of hydrogen cyanamide active ingredient/ha, with a maximum application frequency of one application per calendar year.

For all other crops, the maximum application rate of this substance, as specified by the Authority in accordance with clause 50(1) of the Hazardous Property Controls Notice, is 16.9 kg of hydrogen cyanamide active ingredient/ha, with a maximum of one application per calendar year.

The buffer zones for this substance, as specified by the Authority in accordance with clause 51(1) of the Hazardous Property Controls Notice, apply as following, according to the relevant application method, application rate/crop treated, and sensitive area:

Bystander buffer zones
<table>
<tr><th>Use pattern description</th><th>Downwind buffer zone</th></tr>
<tr><td>Kiwifruit ≤ 10.4 kg ai/ha - Airblast</td><td>4 m</td></tr>
<tr><td>Kiwifruit > 10.4 – 25 kg ai/ha - Airblast</td><td>8 m</td></tr>
<tr><td>Apple ≤ 10.4 kg ai/ha - Airblast</td><td>28 m</td></tr>
<tr><td>Apple > 10.4 – 16.9 kg ai/ha - Airblast</td><td>34 m</td></tr>
</table>
Aquatic environment buffer zones
<table>
<tr><th>Use pattern description</th><th>Waterbody downwind buffer zone</th><th>Waterbody run-off buffer zone</th></tr>
<tr><td>Kiwifruit ≤ 10.4 kg ai/ha - Airblast</td><td>5 m</td><td>≤ 10% slope: 15 m
> 10% slope: 20 m</td></tr>
<tr><td>Kiwifruit > 10.4 – 25 kg ai/ha - Airblast</td><td>10 m</td><td>≤ 10% slope: 20 m
> 10% slope: 25 m</td></tr>
<tr><td>Apple ≤ 10.4 kg ai/ha - Airblast</td><td>35 m</td><td>≤ 5% slope: 0 m
> 5% slope: 15 m</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Control description</th><th>Varied / Additional Control</th><th>Control</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td>Apple > 10.4 – 16.9 kg ai/ha - Airblast</td><td>50 m</td><td>≤ 5% slope: 0 m
> 5% slope: 20 m</td></tr>
</table>
Non-target plant downwind buffer zones
<table>
<tr><th>Use pattern description</th><th>Downwind buffer zone – non-threatened species</th><th>Downwind buffer zone – threatened species</th></tr>
<tr><td>Kiwifruit ≤ 10.4 kg ai/ha - Airblast</td><td>0 m</td><td>0 m</td></tr>
<tr><td>Kiwifruit > 10.4 – 25 kg ai/ha - Airblast</td><td>10 m</td><td>15 m</td></tr>
<tr><td>Apple ≤ 10.4 kg ai/ha - Airblast</td><td>20 m</td><td>40 m</td></tr>
<tr><td>Apple > 10.4 – 16.9 kg ai/ha - Airblast</td><td>30 m</td><td>50 m</td></tr>
</table>
Note: these downwind buffer zones are designed to protect non-target seeds, seedlings and established vegetation from effects on yield parameters (eg weight, height) and not from phytotoxic effects (eg chlorosis)
</td></tr>
<tr><td>HPC-4C</td><td>Variation to Hazardous Property Controls Notice Part 4C</td><td>Clauses 60, 63, and 64 of the Hazardous Property Controls Notice apply as if this substance has a hazard classification of hazardous to the aquatic environment acute Category 1.</td></tr>
<tr><td>Application method restrictions</td><td>Additional control</td><td>This substance must be applied using ground-based methods only.
This substance must not be applied when wind speeds are less than 3 km/h or more than 20 km/h as measured at the application site.</td></tr>
<tr><td>Use restrictions</td><td>Additional control</td><td>The use of this substance is limited to the period from 15 July to 1 September.</td></tr>
</table>

Control description	Varied / Additional Control	Control
Label - additional labelling requirements	Additional control	The information about the application method restrictions and use restrictions must be included on the label. The following shall appear on the label: Do not consume alcohol the day before or up to seven days after application. In combination with alcohol, a severe temporary reaction known as “cyanamide flush” may be produced. Symptoms of cyanamide flush include skin flushing, dizziness, headache, shortness of breath and a rapid pulse. The following statements, or wording to the same effect, shall appear on the label: WARNING: the substance may not be compatible with Integrated Pest Management (IPM) and can have effects on the off-field population depending on crops (eg fruit trees). WARNING, very toxic to some plant species. Certain plants may be damaged or killed from contact with this product. The substance should not be applied within a specified distance of a downwind area containing any non-target plants, the distance varies per use pattern. Before application users should check with the regional authority to establish if there are wetlands, indigenous vegetation habitat areas or reserves which may contain threatened plants adjacent to the application area, in which case it is recommended to increase the buffer zone, the distance varies per use pattern. See buffer zone information.
Information - additional information requirements	Additional control	The following shall appear on hydrogen cyanamide documentation: Do not consume alcohol the day before or up to seven days after application. In combination with alcohol, a severe temporary reaction known as “cyanamide flush” may be produced. Symptoms of cyanamide flush include skin flushing, dizziness, headache, shortness of breath and a rapid pulse.

Health and safety at work (HSW) requirements

Advisory Note: These requirements are not set for the substance under this approval but apply in their own right under the HSW (Hazardous Substances) Regulations 2017 according to the classification of the substance. They are listed here for information purposes only.

Control code	Regulation Part	Description
HSW1	Part 1	Application
HSW2	Part 2	Labelling, signage, safety data sheets, and packaging
HSW3	Part 3	General duties relating to risk management
HSW4	Part 4	Certified handlers and supervision and training of workers
HSW5	Part 5	Emergency management
HSW13	Part 13	Class 6 and 8 substances
HSW16	Part 16	Tank wagons and transportable containers
HSW17	Part 17	Stationary container systems

Further information

More detailed information is available on our website at **www.epa.govt.nz** or by contacting us directly.

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