

Appendix F: Analysis of risks and practical control measures

The following tables present an analysis of the key risks identified and options for possible control measures to manage the specified risks. It should be noted that the purpose of this analysis is to describe how a given risk may be managed.

Table F1: Summary of key risks for operators and options for possible control measures

Receptor	Exposure scenario	Details	Initial level of risk†	Risk mitigation options	Residual risk
Operator	Mixing and loading	<p>Exposure followed by alcohol consumption leading to cyanamide flush</p> <p>Dermal, oral and inhalation exposures during mixing and loading of hydrogen cyanamide concentrates</p>	High	<p>Label statements warning of cyanamide flush and recommendations on alcohol avoidance</p> <p>Ensure that only competent persons handle and use hydrogen cyanamide products</p> <p>Use of personal protective equipment (PPE)</p> <p><i>Use of specialised personal protective equipment, including respiratory protective equipment (RPE)</i></p> <p><i>Use of engineering controls, including closed systems for mixing and loading</i></p>	Medium

Operator	Application – airblast	<p>Exposures of concern when applied at either maximum or minimum label rates (based on 10 ha daily treatment area)</p> <p>Proposed application rate and frequency restrictions at the current maximum rates</p>	High	<p>Ensure that only competent persons handle and use hydrogen cyanamide products</p> <p>Application parameter restrictions apply:</p> <p>Maximum application rates of ≤ 25 kg ai/ha for kiwifruit and ≤ 16.9 kg ai/ha for apples</p> <p>Maximum number of applications = 1 per year</p> <p>Use of personal protective equipment</p> <p><i>Use of specialised personal protective equipment, including respiratory protective equipment</i></p> <p><i>Use of engineering controls, including closed cab technology</i></p>	Medium
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Notes:

‡ without additional mitigation measures in place

Comments:

1. Risks to operators can be reduced, but not eliminated, if the proposed risk mitigation measures are applied. These identified risks to taha hauora (human health) have also been discussed in the Māori impact assessment.
2. Applicators should know how to appropriately handle hydrogen cyanamide and know how to comply with the controls and obligations associated with its use. This can be achieved through appropriate training and supervision, which is covered by the default obligations under the Health and Safety at Work (Hazardous Substances) Regulations 2017 (HSW(HS) Regulations), regulation 4.5.
3. It is essential that hydrogen cyanamide products are handled only when a person is wearing appropriate PPE and is using that equipment appropriately. This is an obligation under the HSW(HS) Regulations.
4. Based on the quantitative assessment, full PPE is considered to be the following:
 - chemical resistant coveralls
 - chemical resistant gloves
 - chemical resistant footwear plus socks
 - protective eyewear
 - chemical resistant headgear for overhead exposures

Note: the requirements of HSW(HS) for PPE are not prescriptive, and that there may be other ways to achieve the same level (or greater) protection of workers from occupational exposure in place of use of PPE and RPE.

5. Application parameter restrictions are based on current maximum application rates. Ideally these should be set at the lowest application rates that still achieve the benefits of hydrogen cyanamide spraying. Note that application rate restrictions also arise as a consequence of environmental exposures, which would not be managed by using closed mixing and loading systems or closed cab technology.
6. *If considered necessary, requirements for engineering controls, including closed systems for mixing and loading and/or closed cab application, or for more specialised PPE, could be implemented through a WorkSafe Safe Work Instrument. Closed systems for mixing and loading would be more effective and a preferred option for further reducing operator exposure compared to use of PPE. Such measures could only be implemented by WorkSafe following their own separate consultation process and cannot be mandated as an outcome of the EPA's reassessment as they relate directly to the risks associated with use by workers in a workplace. Therefore, these measures have not been factored in when assessing the residual risk.*

Table F2: Summary of key risks for bystanders and options for possible control measures

Receptor	Exposure scenario	Details	Initial level of risk‡	Risk mitigation options	Residual risk
Bystander	Application – airblast	<p>Airblast applications for horticultural uses at rates of up to 25 kg ai/ha for kiwifruit and up to 16.9 kg ai/ha for apples present risks to bystanders associated with off-target deposition. Therefore, protective buffer zones are necessary to protect bystanders from spray drift.</p> <p>Degree of off target spray drift is influenced by wind conditions.</p>	Low to medium (dependent on application rates and crop type)	<p>Application parameter restrictions apply:</p> <p>Maximum application rates of ≤ 25 kg ai/ha for kiwifruit and ≤ 16.9 kg ai/ha for apples</p> <p>Maximum number of applications = 1 per year</p> <p>Buffer zones (downwind):</p> <p>Airblast:</p> <p>Kiwifruit: 4 m (≤ 10.4 kg ai/ha) Kiwifruit: 8 m ($> 10.4 - 25$ kg ai/ha) Apples: 28 m (≤ 10.4 kg ai/ha) Apples: 34 m ($> 10.4 - 16.9$ kg ai/ha)</p> <p>Restrict application to avoid high and low wind conditions</p>	Negligible

Comments

7. Although risks to bystanders may be manageable through the use of buffer zones, additional precautions such as the use and maintenance of shelter belts, use of specific air induction nozzles, and drift-reducing adjuvants may further reduce risks.

Table F3: Summary of key risks for the aquatic environment and options for possible control measures

Receptor	Exposure scenario	Details	Initial level of risk‡	Risk mitigation options	Residual risk
Aquatic environment	Application – airblast	<p>Single application can present exposures of concern:</p> <p>single airblast application at 10.4 to 25 kg ai/ha on kiwifruit vines requires protective buffer zones for spray drift and run off</p> <p>single airblast application at 10.4 to 16.9 g ai/ha on apple trees requires a protective buffer zones for spray drift and run off</p> <p>Degree of off target spray drift is influenced by wind conditions.</p> <p>Direct application into water will present greater risks to aquatic organisms that the proportion that may unintentionally drift into water bodies</p>	Low to medium (dependent on application rates and aquatic species)	<p>Application parameter restrictions apply:</p> <p>Maximum application rates of ≤ 25 kg ai/ha for kiwifruit and ≤ 16.9 kg ai/ha for apples</p> <p>Maximum number of applications = 1 per year</p> <p>Buffer zones (downwind):</p> <p>Airblast: Kiwifruit: 5 m ≤ 10.4 kg ai/ha Kiwifruit: 10 m ($> 10.4 - 25$ kg ai/ha) Apples: 35 m (≤ 10.4 kg ai/ha) Apples: 50 m ($> 10.4 - 25$ kg ai/ha)</p> <p>Buffer zone (run-off):</p> <p>Airblast - kiwifruit: $\leq 10\%$ slope: 15 m ≤ 10.4 kg ai/ha $> 10\%$ slope: 20 m ($> 10.4 - 25$ kg ai/ha) $\leq 10\%$ slope: 20 m (≤ 10.4 kg ai/ha) $> 10\%$ slope: 25 m ($> 10.4 - 25$ kg ai/ha)</p>	Negligible

				<p>Airblast - apples: ≤ 5% slope: 0 m ≤ 10.4 kg ai/ha > 5% slope: 10 m (> 10.4 – 16.9 kg ai/ha) ≤ 5% slope: 0 m (≤ 10.4 kg ai/ha) > 5% slope: 50 m (> 10.4 – 16.9 kg ai/ha)</p> <p>No application onto or into water</p> <p>Qualification requirements for operators recommended to ensure compliance with the proposed risk mitigation measures</p>	
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Comments:

8. Application parameter restrictions proposed, limiting use to the scenarios that were assessed.
9. Application of pesticides onto or into water is not allowed under the EPA (Hazardous Property Controls) Notice 2017.
10. Although risks to the aquatic environment may be manageable through the use of buffer zones, additional precautions such as the use and maintenance of shelter belts, use of specific air induction nozzles and drift-reducing adjuvants may further reduce risks.
11. The buffer zones detailed above are based on application rates up to 25 kg ai/ha for kiwifruit and 16.9 kg ai/ha for apples. If lower application rates are used, or if further information on the effects of air induction nozzles and drift-reducing adjuvants is taken into account, then reduced buffer zones may be appropriate.

Table F4: Summary of key risks for non-target plants and options for possible control measures

Receptor	Exposure scenario	Details	Initial level of risk‡	Risk mitigation options	Residual risk
Non-target plants	Application – airblast	single airblast application presents risks to non-target plant species, requiring a protective buffer zone of up to 30 m to protect non-threatened plant species, and a buffer zone of up to 50 m to protect threatened, non-target plant species	Low to medium (dependent on application rate)	<p>Application parameter restrictions apply:</p> <p>Maximum application rates of ≤ 25 kg ai/ha for kiwifruit and ≤ 16.9 kg ai/ha for apples</p> <p>Maximum number of applications = 1 per year</p> <p>Buffer zones (downwind):</p> <p>Airblast – non-threatened species: Kiwifruit: 0 m (≤ 10.4 kg ai/ha) Kiwifruit: 10 m ($> 10.4 - 25$ kg ai/ha) Apples: 20 m (≤ 10.4 kg ai/ha) Apples: 30 m ($> 10.4 - 16.9$ kg ai/ha)</p> <p>Airblast – threatened species: Kiwifruit: 0 m (≤ 10.4 kg ai/ha) Kiwifruit: 15 m ($> 10.4 - 25$ kg ai/ha) Apples: 40 m (≤ 10.4 kg ai/ha) Apples: 50 m ($> 10.4 - 16.9$ kg ai/ha)</p>	Negligible

Comments:

12. Application parameter restrictions proposed, limiting use to the scenarios that were assessed.

13. Although risks to the non-target plants may be manageable through the use of buffer zones, additional precautions such as the use and maintenance of shelter belts, use of specific air induction nozzles and drift-reducing adjuvants may further reduce risks.
14. The buffer zones detailed above are based on application rates up to 25 kg ai/ha for kiwifruit and 16.9 kg ai/ha for apples. If lower application rates are used, then reduced buffer zones may be appropriate, such as for application to kiwifruit at ≤ 10.4 kg ai/ha where no buffer zone for non-target plants is required.

Table F5: Summary of key risks for birds and options for possible control measures

Receptor	Exposure scenario	Details	Initial level of risk†	Risk mitigation options	Residual risk
Birds	Application – airblast	Use of hydrogen cyanamide presents significant acute risks to birds. The level of risks could be reduced with lower application rates.	Medium-high (most sensitive species)	Application parameter restrictions apply: Maximum application rates of ≤ 25 kg ai/ha for kiwifruit and ≤ 16.9 kg ai/ha for apples Maximum number of applications = 1 per year	Medium-high
Birds	Application – airblast	Use of hydrogen cyanamide presents chronic risks to birds linked to reproductive effects that occur during exposure.	High (most sensitive species)	Application timing control limiting application to winter months (when birds are less likely to be breeding): Use limited to 15 July – 1 September	Negligible

Comments:

- 15. No risk mitigation measures identified that could reduce the acute risks to birds. Complying with the proposed measures will prevent any future increase in risks, rather than reducing risks. These identified risks have also been discussed in the Māori impact assessment.
- 16. Chronic risks to birds considered manageable through the use of proposed risk mitigation measures.

Table F6: Summary of key risks for terrestrial invertebrates (pollinators and non-target arthropods) and options for possible control measures

Receptor	Exposure scenario	Details	Initial level of risk‡	Risk mitigation options	Residual risk
Pollinators	Application – airblast	All use scenarios present some risks to bees, so the only real protection is to ensure that bees are not present during or immediately after application.	Low to high (dependent on application rates)	<p>Application parameter restrictions apply:</p> <p>Maximum application rates of ≤ 25 kg ai/ha for kiwifruit and ≤ 16.9 kg ai/ha for apples</p> <p>Maximum number of applications = 1 per year</p> <p>Do not apply to flowering plants (crops or weeds) that are likely to be visited by bees, or in places where bees are foraging</p>	Negligible

Non-target arthropods	Application – airblast	Potential for risks to beneficial insects necessary for integrated pest management (IPM) – mainly in-field risks.	Low to medium	<p>Application parameter restrictions apply:</p> <p>Maximum application rates of ≤ 25 kg ai/ha for kiwifruit and ≤ 16.9 kg ai/ha for apples</p> <p>Maximum number of applications = 1 per year</p> <p>Labelling requirement warning of potential incompatibility with integrated pest management (IPM)</p> <p>Application timing control limiting application to winter months</p>	Negligible
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Comments:

17. Risk mitigation measure for pollinators is a default control in the EPA’s Hazardous Substances (Hazardous Property Controls) Notice 2017, intended to protect bees.