Australian Government

Australian Pesticides and
Veterinary Medicines Authority

Public release summary

On the evaluation of the new active cinmethylin
in the product LUXIMAX HERBICIDE
APVMA product number 86413
OCTOBER 2019

© Australian Pesticides and Veterinary Medicines Authority 2019

ISSN1443-1335 (electronic)

Ownership of intellectual property rights in this publication

Unless otherwise noted, copyright (and any other intellectual property rights, if any) in this publication is owned by the Australian Pesticides and Veterinary Medicines Authority (APVMA).

Creative Commons licence

With the exception of the Coat of Arms and other elements specifically identified, this publication is licensed under a Creative Commons Attribution 4.0 Australia Licence. This is a standard form agreement that allows you to copy, distribute, transmit and adapt this publication provided that you attribute the work.

A summary of the licence terms is available from www.creativecommons.org/licenses/by/3.0/au/deed.en. The full licence terms are available from www.creativecommons.org/licenses/by/3.0/au/legalcode.

The APVMA's preference is that you attribute this publication (and any approved material sourced from it) using the following wording:

Source: Licensed from the Australian Pesticides and Veterinary Medicines Authority (APVMA) under a Creative Commons Attribution 4.0 Australia Licence.

In referencing this document the Australian Pesticides and Veterinary Medicines Authority should be cited as the author, publisher and copyright owner.

Use of the Coat of Arms

The terms under which the Coat of Arms can be used are set out on the Department of the Prime Minister and Cabinet website (see www.dpmc.gov.au/pmc/publication/commonwealth-coat-arms-information-and-guidelines).

Disclaimer

The material in or linking from this report may contain the views or recommendations of third parties. Third party material does not necessarily reflect the views of the APVMA, or indicate a commitment to a particular course of action. There may be links in this document that will transfer you to external websites. The APVMA does not have responsibility for these websites, nor does linking to or from this document constitute any form of endorsement. The APVMA is not responsible for any errors, omissions or matters of interpretation in any third-party information contained within this document.

Comments and enquiries regarding copyright:

Assistant Director, Communications
Australian Pesticides and Veterinary Medicines Authority
GPO Box 3262
SYDNEY NSW 2001
Australia

Telephone: +61 2 6770 2300

Email: communications@apvma.gov.au.

This publication is available from the APVMA website.

CONTENTS

LIST OF TABLES

PREFACE

The Australian Pesticides and Veterinary Medicines Authority (APVMA) is the Australian Government regulator responsible for assessing and approving agricultural and veterinary chemical products prior to their sale and use in Australia. Before approving an active constituent and/or registering a product, the APVMA must be satisfied that the statutory criteria, including the safety, efficacy, trade and labelling criteria, have been met. The information and technical data required by the APVMA to assess the statutory criteria of new chemical products, and the methods of assessment, must be consistent with accepted scientific principles and processes. Details are outlined on the APVMA website.

The APVMA has a policy of encouraging transparency in its activities and seeking community involvement in decision making. Part of that process is the publication of public release summaries for products containing new active constituents. This public release summary is intended as a brief overview of the assessment that has been conducted by the APVMA and of the specialist advice received from advisory agencies, including other Australian Government agencies and State departments of primary industries. It has been deliberately presented in a manner that is likely to be informative to the widest possible audience to encourage public comment.

About this document

This public release summary indicates that the APVMA is considering an application for registration of an agricultural or veterinary chemical. It provides a summary of the APVMA's assessment, which may include details of:

- the toxicology of both the active constituent and product
- the residues and trade assessment
- occupational exposure aspects
- environmental fate, toxicity, potential exposure and hazard
- efficacy and target crop or animal safety.

Comment is sought from interested stakeholders on the information contained within this document.

Making a submission

In accordance with sections 12 and 13 of the Agvet Code, the APVMA invites any person to submit a relevant written submission as to whether the application for approval of the new active constituent, cinmethylin and registration of Luximax Herbicide should be granted. Submissions should relate only to matters that the APVMA is required, by legislation, to take into account in deciding whether to grant the application. These matters include aspects of public health, occupational health and safety, chemistry and manufacture, residues in food, environmental safety, trade, and efficacy and target crop or animal safety. Submissions should state the grounds on which they are based. Comments received that address issues outside the relevant matters cannot be considered by the APVMA.

Submissions must be received by the APVMA by close of business on **5 November 2019** and be directed to the contact listed below. All submissions to the APVMA will be acknowledged in writing via email or by post.

Relevant comments will be taken into account by the APVMA in deciding whether the product should be registered and in determining appropriate conditions of registration and product labelling.

When making a submission please include:

- contact name
- company or group name (if relevant)
- email or postal address (if available)
- the date you made the submission.

All personal information, and confidential information judged by the APVMA to be confidential commercial information (CCI)[1] contained in submissions will be treated confidentially. Unless requested by the submitter, the APVMA may release a submission, with any CCI redacted, to the applicant for comment.

Written submissions on the APVMA's proposal to grant the application for registration that relate to the grounds for registration should be addressed in writing to:

Case Management and Administration Unit
Australian Pesticides and Veterinary Medicines Authority
GPO Box 3262
SYDNEY NSW 2001 Australia

Phone: +61 2 6770 2300
Email: enquiries@apvma.gov.au.

Further information

Further information can be obtained via the contact details provided above.

Copies of technical evaluation reports covering chemistry, efficacy and safety, toxicology, occupational health and safety aspects, residues in food and environmental aspects are available from the APVMA on request.

Further information on public release summaries can be found on the APVMA website.

---

[1] A full definition of "confidential commercial information" is contained in the Agvet Code.

1 INTRODUCTION

This publication provides a summary of the data reviewed and an outline of the regulatory considerations for the proposed registration of Luximax Herbicide, and approval of the new active constituent of cinmethylin.

1.1 Applicant

BASF AUSTRALIA LTD.

1.2 Purpose of application

BASF AUSTRALIA LTD has applied to the APVMA for registration of the new product Luximax Herbicide, an emulsifiable concentrate formulation containing 750 g/L of the new active constituent, cinmethylin.

This publication provides a summary of the data reviewed and an outline of the regulatory considerations for the proposed registration of the product Luximax Herbicide, and approval of the new active constituent cinmethylin.

1.3 Proposed claims and use pattern

The proposed product Luximax Herbicide is intended for use in wheat for the control of various weeds.

1.4 Mode of action

Cinmethylin is a selective inhibitor of acyl-ACP (acyl carrier protein) thioesterase enzyme, resulting in inhibition of fatty acid biosynthesis and disruption of cell membranes. The uptake of cinmethylin is mainly through the shoots and roots of germinating weeds. It disrupts meristematic development in growing points of roots and shoots.

1.5 Overseas registrations

The product Luximax Herbicide is not currently registered in any other country.

2 CHEMISTRY AND MANUFACTURE

2.1 Active constituent

The active constituent cinmethylin is manufactured overseas. Details of the chemical name, structure, and physicochemical properties of cinmethylin are listed below (Tables 1–2).

Cinmethylin is a colourless liquid with a faint fruity smell in the case of the technical active. It has a low solubility in water (0.062 g/L), while being miscible in all proportions with most organic solvents (> 500 g/L). It is lipophilic. Both the purified active ingredient and the technical grade active ingredient are not surface-active. There are no flammability, explosive, and/or oxidizing properties of concern with cinmethylin.

Table 1: Nomenclature and structural formula of the active constituent cinmethylin

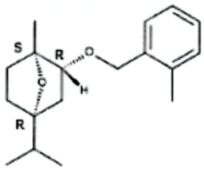
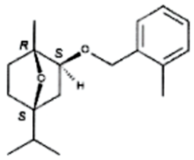
Common name (ISO):	Cinmethylin
IUPAC name:	(1*RS*,2*SR*,4*SR*)-1-methyl-2-[(2-methylphenyl)methoxy]-4-(propan-2-yl)-7-oxabicyclo[2.2.1]heptane
CAS registry number:	87818-31-3
Molecular formula:	$C_{18}H_{26}O_2$
Molecular weight:	274.4 g/mol
Structural formula:	 *Cis*-isomer  *Trans*-isomer

Table 2: Key physicochemical properties of the active constituent cinmethylin

Physical form:	Technical grade—liquid, purified active—liquid
Colour:	Colourless
Odour:	Faint fruity smell
Melting point:	Liquid at room temperature
Boiling point:	The test substance thermally decomposes at 332°C before reaching the intrinsic boiling point under both atmospheric and reduced pressure
Relative density	1.002 g/cm3 at 20 °C
Stability:	In an inert atmosphere, cinmethylin is stable to high temperature, though in air, oxidation occurs at temperature above 100 °C to give the same product as by photodecay. No adverse reaction to metal or metal ions has been observed after 24 hours interaction.
Safety properties:	Not considered flammable. Not explosive. Auto-flammability is 375 °C. Except a slight reaction with water, the cinmethylin technical does not show any chemical incompatibility with oxidising, reducing and fire extinguishing agents and is essentially non-hazardous.
Solubility in water:	0.069 g/L (pH 8.9) 0.063 g/L (pH 4.1) 0.058 g/L (pH 7.0) 0.062 g/L (pH 9.0) at 25 ºC
Organic solvent solubility:	n-heptane> 500 g/L p-xylene> 500 g/L 1,2-dichloroethane > 500 g/L Methanol > 500 g/L Acetone > 500 g/L Ethyl acetate > 500 g/L at 25 °C
PH:	pH 5.8 and pH 6.5 at a 1% dilution in pure water and CIPAC water D respectively at 23–26 ºC
Octanol/water partition coefficient (Log Kow/KOW):	Active constituent (purity of test substance 99%) log Pow = 4.5 at 20 oC, pH 7
Vapour pressure:	8.1 x 10-3 Pa at 20 ºC 1.5 x 10-3 Pa at 25 ºC.
Henry's law constant:	3.2 x 10-2 Pa m3/mol

UV/VIS absorption spectra:	pH 6.8 (Methanol) = λmax209 nm pH 6.0 (Deionised water) = λmax209 nm pH 1.4 (Acidic) = λmax209 nm pH 12.1 (Basic) = λmax209 nm

2.2 Formulated product

The product, Luximax Herbicide, will be manufactured overseas. Tables 3 and 4 outline some key aspects and physicochemical properties of the product.

Luximax Herbicide will be available in 10 L, 20 L, 110 L and 1000 L PA/PE (polyethylene)—coextruded bottles and fluorinated high-density polyethylene (FHDPE) containers.

Table 3: Key aspects of the formulation of the product Luximax Herbicide

Distinguishing name:	Luximax Herbicide
Formulation type:	Emulsifiable concentrate (EC)
Active constituent concentration:	750 g/L cinmethylin

Table 4: Physicochemical properties of the product Luximax Herbicide

Physical form:	Light yellow coloured liquid
PH:	5.8–6.5 (1% aqueous dilution)
Density:	0.986 g/cm3 at 20 ºC
Kinematic viscosity:	70 mPa-s at 20 ºC
Persistent foaming:	10–22 mL foam
Corrosion of metal:	No corrosion, seal intact and no peculiarities
Miscibility of formulated product:	Miscible and compatible with the other plant protection products
Safety properties:	No flash point up to 142 °C. Auto-ignition temperature is 350 °C. Heat decomposition is -270 J/g. Not classified as a flammable liquid or an explosive and/or as an oxidising substance.
Storage stability:	There was sufficient data to conclude that the product is expected to remain within specifications for at least two (2) years when stored under normal conditions

2.3 Recommendations

The APVMA has evaluated the chemistry of the active constituent cinmethylin and associated product Luximax Herbicide—including the manufacturing process, quality control procedures, stability, batch analysis results and analytical methods—and found them to be acceptable. The available storage stability data indicate that Luximax Herbicide is expected to remain stable for at least two years when stored under normal conditions.

Based on a review of the chemistry and manufacturing details, the registration of Luximax Herbicide, and approval of the active constituent cinmethylin, are supported from a chemistry perspective.

3 TOXICOLOGICAL ASSESSMENT

The APVMA has considered the toxicological aspects of both the active constituent cinmethylin and associated product Luximax Herbicide. Based on this review, the APVMA has concluded that there are no toxicological concerns regarding the approval of the active constituent, and registration of the product Luximax Herbicide.

A revised Acceptable Daily Intake (ADI) has been established and the previously established Acute Reference Dose (ARfD) has been confirmed.

Cinmethylin is a 2-benzyl ether substitute analogue of the monoterpene 1,4-cineole, a derivative of the natural monoterpene 1,8-cineole. In June 2003, cinmethylin was listed in Schedule 5 of the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) on the basis of its moderate skin irritancy. Following examination of the toxicological data provided the APVMA considers that the listing of cinmethylin in Schedule 5 of the SUSMP remains appropriate.

The APVMA is satisfied that the proposed importation and use of cinmethylin would not be an undue hazard to the safety of people exposed to it during its handling and use.

3.1 Evaluation of toxicology

The toxicological database for cinmethylin is considered sufficient to determine its toxicology profile and to characterise the risk to humans. The data package provided included metabolism studies, acute toxicity studies (active constituent and formulated product), short-term toxicity studies (oral and dermal), long-term oral toxicity studies (including carcinogenicity), reproductive and developmental toxicity studies, genotoxicity studies, and other information to address the human safety criteria.

In interpreting the data, it should be noted that toxicity tests generally use doses that are high compared with likely human exposures. The use of high doses increases the likelihood that potentially significant toxic effects will be identified. Findings of adverse effects in any one species do not necessarily indicate that such effects might be generated in humans. From a conservative risk assessment perspective however, adverse findings in animal species are assumed to represent potential effects in humans unless convincing evidence of species specificity is available. Where possible, considerations of the species-specific mechanisms of adverse reactions weigh heavily in the extrapolation of animal data to likely human hazard. Equally, consideration of the risks to human health must take into account the likely human exposure levels compared with those, usually many times higher, which produce effects in animal studies. Toxicity tests should also indicate dose levels at which the specific toxic effects are unlikely to occur.

Chemical class

Cinmethylin is a 1,4-cineole herbicide.

Pharmacokinetics

Rats were administered cinmethylin radiolabelled (^{14}C) either on its phenyl or cyclohexane moiety. Cinmethylin was rapidly and extensively absorbed (78–99 per cent of the dose) after administration of a single oral dose in male and female rats. Peak plasma concentrations were reached one hour after low dose (15 mg/kg bw) administration and four or eight hours after single high dose (350 mg/kg bw) administration of the phenyl or cyclohexane label, respectively. Cinmethylin was widely distributed across tissues, with the highest proportions found in the gastro-intestinal tract. Concentrations above those seen in plasma were also observed in the liver, kidney, pancreas, adipose, adrenal glands, thyroid, ovaries, and uterus.

Cinmethylin was rapidly and extensively metabolised in rats, initially involving hydroxylation, oxidation and/or cleavage of the ether bridge. Subsequent metabolism involved conjugation with glucuronic acid, glycine, sulphuric acid, or glutathione, before further cleavage. In males and females, the unchanged parent product accounted for ≤5 per cent of the dose recovered in faeces, <1 per cent of the dose recovered in bile excretions, and <0.1 per cent of the dose recovered in urine.

Excretion was rapid following all rat oral dosing regimens. Approximately 70 to 90 per cent of the dose was excreted 48 hours after dosing and total excretion reached 88 to 99 per cent of the dose seven days after administration. There was no evidence of potential for bio-accumulation. In all groups, excretion was higher in urine (52–61 per cent of the dose) than in faeces (33–43 per cent of the dose). Calculated cinmethylin half-lives were 7.7–16 hours in females and ~22–23 hours in males following oral dosing.

In additional studies, in vitro degradation of cinmethylin incubated with human, rat, rabbit, and dog hepatocytes resulted in similar metabolic patterns, and no human-specific metabolite was identified.

Acute toxicity of the active constituent cinmethylin

The active constituent was considered to have low acute oral (LD_{50} >2000 mg/kg bw), dermal (LD_{50} >5000 mg/kg bw), and inhalation toxicity (LC_{50} > 5268 mg/m^3, 4h nose only) in rats. The TGAC was considered to be a slight eye irritant and a moderate skin irritant in rabbit, and sensitising to the skin (Buehler).

Acute toxicity of the formulated product Luximax Herbicide

Luximax Herbicide is of low toxicity via the oral, dermal, and inhalation routes of administration. It is moderately irritating to the skin and eyes of rabbits and has skin sensitising potential.

Repeat-dose toxicity

The main target organs for cinmethylin were the liver, thyroid gland, kidney, nasal cavity, and male reproductive organs. The observed kidney findings are not relevant to human toxicology because exposure to cinmethylin increased the occurrence of α2-u globulin, which is a male rat-specific protein. Although adverse in rodents, the significance of nasal cavity findings for human toxicology is uncertain. The effects observed in thyroid glands were considered to be a result of increased thyroid gland activity secondary to treatment-related liver effects.

Mouse

In mice fed cinmethylin in the diet, liver effects observed at high doses included increased liver weight and related clinical chemistry changes in 28 and 90 day studies, and histopathologic findings in an 18 month study. Adverse effects in the nasal cavity were also observed in the 18 month study. These effects consisted mainly of increased incidence of degeneration and regeneration of the olfactory epithelium, and respiratory metaplasia (localised replacement of the olfactory epithelium by respiratory epithelium). In addition, decreased feed consumption and decreased bodyweight and/or decreased bodyweight gain were observed at high doses in studies of 28 day, 90 day, and 18 month duration. In mice, the lowest NOAEL for systemic toxicity was 43 mg/kg bw/d in the 90 day study, based on adverse effects on the liver.

Rat

Dietary administration of cinmethylin resulted in adverse effects on the liver. Increased liver weight with related clinical chemistry changes and histopathologic findings were observed in 28 day, 90 day, and 24 month studies. Follicular hypertrophy/hyperplasia was observed in the thyroid glands of high dose males and females in 28 day, 90 day, and 24 month studies; these findings were associated with an increased incidence of altered colloid in 90 day, and 24 month studies. Thyroid observations were considered to be secondary to liver toxicity.

Effects in the kidneys of male rats were observed in 28 day, 90 day and 24 month studies. A dose related increase in storage of eosinophilic droplets, immunohistochemically identified as α2u globulin was associated with dose related chronic nephropathy and increased kidney relative weight. These observations are specific to male rats and not relevant to human pathology.

Adverse effects on the nasal cavity were observed in 90 day and 24 month studies. These effects consisted mainly of increased incidence of degeneration of the olfactory epithelium in the 90 day study. Degeneration/regeneration of the olfactory epithelium was observed in the 24 month study, as well as respiratory metaplasia.

In the 24 month study, treatment with cinmethylin resulted in increased incidence of reduced size epididymides, prostate, coagulating glands, and seminal vesicles correlated with increased incidence of aspermia/oligospermia and diffuse tubular degeneration in the testes.

The lowest No Observed Adverse Effect Levels (NOAEL) for systemic toxicity were obtained in the 24 month study. In males, the NOAEL was 9 mg/kg bw/d, based on adverse effects on bodyweight, liver, nasal cavity, and thyroid glands, at 45 mg/kg bw/d. In females, the NOAEL was 59 mg/kg bw/d based on adverse effects on bodyweight, liver, nasal cavity, and thyroid glands at 317 mg/kg bw/d.

Dog

Treatment with cinmethylin resulted in reduced feed consumption and body weight at high doses. Increased absolute and/or relative liver weight was observed in five week, 13 week, and 12 month studies. Associated changes in clinical chemistry parameters and adverse histopathologic findings were noted at the highest doses tested.

Increased incidence in reactive lymphoid hyperplasia of the stomach was determined in ≥3000 ppm animals in a 13 week study and in a 12 month study, but not in another 12 month study. Increased incidence of reduced prostate glandular development was noted in a 13 week study and in a 12 month study (with oligospermia also noted in one high dose animal), but not in another 12 month study. Therefore, the significance of these findings is unclear. However, since they were observed at higher doses than those producing other signs of toxicity, and not seen consistently across the studies, there is sufficient conservatism in the risk assessment to account for these variabilities.

The overall NOAEL from the studies conducted in dogs is 8 mg/kg bw/d.

Chronic toxicity and carcinogenicity

The potential for cinmethylin to induce tumours was investigated in rats and mice. The results of the 18 month mouse oncogenicity study and the 24 month rat chronic toxicity and oncogenity study demonstrated that cinmethylin had no effect on mortality rate, nor on the nature or rate of neoplastic lesions at any of the doses tested in both species. Therefore, the NOAEL for carcinogenicity was 242 and 317 mg/kg bw/d in male and female rats, respectively and 904 and 940 mg/kg bw/d in male and female mice, respectively.

Reproductive and developmental toxicity

Cinmethyin had no adverse effects on reproductive parameters in a two generation reproductive toxicity study in rats. In rat and rabbit developmental toxicity studies, reduced foetal weight was noted in the presence of maternal toxicity.

Genotoxicity

Cinmethylin was not genotoxic in a series of tests, which included: *in vitro* bacterial reverse mutation, mammalian cell forward mutation, a micronucleus test in human lymphocytes and an *in vivo* mouse micronucleus test.

Neurotoxicity

In an acute oral neurotoxicity study conducted in rats, transient effects were observed shortly after dosing. The NOAEL in that study was 300 mg/kg bw in males and females, based on salivation and reduced motor activity observed at 1000 mg/kg bw. The ARfD for cinmethylin is based on similar effects (ie excessive salivation) observed shortly after gavage in a rat developmental study.

Toxicity of metabolites and/or impurities

Investigation of the specific toxicity of cinmethylin metabolites and of impurities present in cinmethylin was not considered to be required. This is because cinmethylin’s metabolic pathway, and the resulting metabolic pattern, are believed to be similar in humans and in the animal species used to establish cinmethylin’s toxicological profile.

Therefore, the toxicological profile established for cinmethylin covers its metabolites and for the impurities.

Reports related to human toxicity

As products containing cinmethylin have not yet been commercialised, human exposure to cinmethylin is limited. Recent searches in the scientific literature provided no reference relevant for adverse effects arising from occupational exposure to cinmethylin. No reports of adverse effects were identified during routine monitoring of production plant workers nor among personnel involved in the experimental biological testing or field trials with cinmethylin, or products containing cinmethylin.

3.2 Health-based guidance values and poisons scheduling

Poisons standard

In June 2003, cinmethylin was listed in Schedule 5 of the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) on the basis of its moderate skin irritancy. Following examination of the toxicological data provided for approval of the active constituent cinmethylin, the APVMA considers that listing of cinmethylin in Schedule 5 of the SUSMP remains appropriate.

Health-based guidance values

Acceptable Daily Intake (ADI)

An ADI of 0.01 mg/kg bw/d was established in 2003 based on increased incidence of parenchymal hepatocellular vacuolation in the liver at the lowest dose tested of 11 mg/kg bw/d in a rat reproduction study, and applying an uncertainty factor of 1000 to take into account the use of a LOAEL. Considering all toxicological data now available for cinmethylin, a revised ADI has been proposed.

The new ADI for cinmethylin is 0.08 mg/kg bw/d, using an overall NOAEL of 8 mg/kg bw/d from dog studies of up to one year duration, based on adverse effects in the liver, and incorporating an uncertainty factor of 100.

Acute Reference Dose (ARfD)

An ARfD of 0.3 mg/kg bw was established in 2003, using a NOAEL of 30 mg/kg bw/d in a rat developmental study based on clinical signs of toxicity (excess salivation and urine stained abdominal fur) and an uncertainty factor of 100. The APVMA considers that the ARfD of 0.3 mg/kg bw remains appropriate for cinmethylin.

3.3 Recommendations

There are no objections on human health grounds to the approval of the new active constituent cinmethylin.

There are no objections on human health grounds to the registration of the product Luximax Herbicide, containing 750 g/L of cinmethylin.

4 RESIDUES ASSESSMENT

Metabolism, analytical methodology, residue trial data, fate in storage, and trade aspects have been considered for cinmethylin.

4.1 Metabolism

The applicant has provided details of cinmethylin metabolism studies conducted on plants (wheat, oilseed rape, and carrots) and target animals (lactating goats, laying hens, and rainbow trout). A confined rotational crop study was conducted on spinach, radish, and wheat.

In plants, the metabolic pathway is largely based on:

- hydroxylation of the parent compound at various positions
- subsequent conjugation of these hydroxyl groups with glycoside and malonyl glycoside.

No cleavage of parent cinmethylin was observed through metabolism in primary crops. The only major compounds found in food items were parent cinmethylin (up to 14 per cent TRR in oilseed rape seed) and carbohydrates (up to 78 per cent TRR in carrot roots). In wheat forage, wheat straw and oilseed rape straw, major metabolites were the sugar conjugates M684H005 (up to 22 per cent TRR in oilseed rape straw) and M684H006 (up to 30 per cent TRR in wheat forage). In oilseed rape hulls and wheat grain, no major compounds were identified.

In livestock, the metabolic pathway for cinmethylin is largely based on:

- hydroxylation of the parent compound at various positions
- subsequent conjugation of these hydroxyl groups with glucuronide
- cleavage at the ether bridge.

The major compounds found in animal food items were parent cinmethylin (up to 36 per cent TRR in fish skin), M684H001 and M684H012 (A-branch), M684H021, M684H022 and M684H039 (B-branch) and cleavage products M684H026 (D-branch), M684H009, M684H010 and M684H059 (E-branch). Metabolite M684H029 was exclusively found in goat urine and faeces, but not in any edible livestock matrix.

The plant metabolism studies showed only low amounts of the parent cinmethylin in wheat and canola forage and straw, but main portions of metabolites M684H005 and M684H006. Hence, livestock animals, being fed with plant material obtained after application of cinmethylin, are more likely exposed to metabolites M684H005 and M684H006.

For both metabolites, M684H005 and M684H006, a complete degradation was observed in native and acetonitrile samples collected after incubation in rumen fluid for 4 h indicating that both metabolites were rapidly cleaved to M684H002. Similar results were obtained from an experiment conducted with hen intestine. Noting that M684H002 would be an expected intermediate in the formation of other metabolites which were observed in edible tissues in the goat and hen metabolism studies involving dosing with parent, the metabolism of M684H005 and M684H006 in livestock would therefore be expected to proceed along a similar path as parent cinmethylin.

4.2 Analytical methods and storage stability

Analytical methods for commodities of plant origin

In the Australian wheat and barley residue trials, cinmethylin residues were extracted from blended homogeneous samples with acetonitrile (forage) or water/acetonitrile (grain/straw). After addition of $MgSO_4$, NaCl, and buffering citrate salts, the mixture was shaken and centrifuged for phase separation. An aliquot of the acetonitrile layer was taken and diluted with acetonitrile/water prior to analysis by LC-MS/MS. Quantitation was via matrix external standards. The LOQ was 0.01 mg/kg for forage, grain and straw, the LOD was 0.003 mg/kg.

For the metabolites M684H005 and M684H006, samples were extracted with acetonitrile and water and a subsequent cleavage performed by heating the samples in aqueous sodium hydroxide (cleavage of M684H006 to M684H005). After addition of the QuEChERs extraction salts ($MgSO_4$, NaCl, and buffering citrate salts) the mixture was shaken and centrifuged for phase separation. The organic extract was further cleaned up by dispersive SPE using $MgSO_4$, PSA and C18 (for wheat and barley straw, the organic extract was first stored for at least 6 hours in a freezer). An aliquot of the extract was diluted with water/acetonitrile prior to analysis by LC-MS/MS. Quantitation was via external standards, with total M684H005 and M684H006 determined as M684H005. The LOQ was 0.01 mg/kg for M684H005 in forage and grain and 0.1 mg/kg in straw. The LOD was 0.003 mg/kg in forage and grain and 0.03 mg/kg in straw.

Average recoveries of cinmethylin and M684H005 from fortified samples were within acceptable limits.

Analytical methods for commodities of animal origin

BASF method L0385/01 was developed for the determination of cinmethylin in animal matrices by LC-MS/MS with a limit of quantification (LOQ) of 0.01 mg/kg. Specimens were extracted with pure acetonitrile. After addition of QuEChERS extraction salt kit ($MgSO_4$, NaCl and buffering citrate salts), the mixture was shaken intensively and centrifuged for phase separation. The organic extract was cleaned up by dispersive SPE (d-SPE) using QuEChERS clean-up kit containing $MgSO_4$, PSA, C18EC and GCB (graphitized carbon black). For bovine meat, d-SPE was performed using QuEChERS clean-up kit containing $MgSO_4$, PSA and C18. For hen's egg, d-SPE was performed using QuEChERS clean-up kit containing $MgSO_4$ and PSA. For fat d-SPE was performed using the QuEChERS d-SPE EMR-Lipid kit and the QuEChERS Final Polish EMR-Lipid kit. The final determination is achieved by liquid chromatography coupled to tandem mass spectrometric detection (LC-MS/MS). The method proved to be suitable to determine cinmethylin in animal matrices. Samples were fortified with the analyte at LOQ and 10x LOQ with recoveries being within acceptable limits.

Storage stability

The freezer storage stability of cinmethylin in plant matrices (barley, whole plant no roots; bean, pods with seeds; grapes (table), fruit; rape, winter (solid seeded), seed; bean, dried, seed; wheat, grain and wheat, straw) over a period of 730 days was investigated. The specimens were fortified with the test item at a concentration level of 0.10 mg/kg. The spiked specimens were stored under the usual storage conditions for field specimens (≤ -18°C in the dark) and analysed after different intervals.

Cinmethylin remained stable over the whole storage period of about 24 months (730 days) in every matrix examined. Mean procedural recoveries (freshly spiked samples at 0.01 mg/kg and 0.1 mg/kg) were in a range of 70 and 110 per cent, except for samples of the matrix oilseed rape seed at nine months of storage with 68.5 per cent.

An interim report on the freezer storage stability of metabolite M684H005 has been provided which gives the results after about six months. M684H005 remained stable over the interim storage period of about six months (179–184 days) in every matrix examined.

In the residue trials submitted, all samples were maintained under freezer conditions, (ie -18 °C) prior to analysis and tested within 8–17 months of collection for parent cinmethylin and 9–29 months of collection for M684H005 / M684H006. The sample storage period for M684H005 / M684H006 analysis was greater than that tested so far in the storage stability study. However, as no decomposition was observed during the period tested so far in the stability study and given these metabolites will not be included in the residue definition, this is considered to be acceptable for the purposes of the current application.

4.3 Residue definition

Commodities of plant origin

The only major commodities found in plant food commodities were parent cinmethylin (0.014 mg/kg 14 per cent TRR) in oilseed rape seed and carbohydrates (up to 78 per cent TRR in carrot roots). In animal feeds, the sugar conjugates of hydroxylated parent, M684H005 (up to 22 per cent TRR in oilseed rape straw) and M684H006 (up to 30 per cent TRR in wheat forage) were also observed. There were no additional metabolites from the rotational crop or processing studies requiring consideration.

M684H005 and M684H006 only require consideration with respect to animal feed commodities. The available residue trials relevant to the proposed use pattern found that a low finite level of M684H005 and M684H006 may occur in forage (but not straw) following the proposed use, however the expected level of these metabolites in forage should not result in detectable residues in animal commodities, as discussed below. The inclusion of these metabolites in the residues definition for plant commodities is not considered necessary for the proposed use on wheat.

A residue definition of parent cinmethylin only is recommended for commodities of plant origin. This definition is suitable for both risk assessment and enforcement.

Commodities of animal origin

Cinmethylin was extensively metabolised in lactating goats and laying hens. Parent cinmethylin was a predominant component in goat fat (15–22 per cent TRR), goat liver (7–14 per cent TRR) and hen fat (13–18 per cent TRR). M684H005 and M684H006 were not observed in the goat or hen metabolism studies. Other metabolites were not consistently present at higher proportions than parent.

Considering M684H005 and M684H006, the highest residue of these metabolites in the available Australian residue trials was 0.26 mg/kg at 48 days after an IBS application at approximately 1× the proposed rate, which is equivalent to 0.16 mg/kg expressed as parent cinmethylin. Studies were provided to indicate that these metabolites follow a similar metabolic pathway in livestock to parent.

In the goat metabolism study, dosing with parent at 12 ppm gave a maximum radioactive residue of 0.690 mg/kg in liver. The estimated total residue from dosing at 0.16 ppm (the HR of M684H005 and M684H006 in forage from the proposed use pattern) is 0.0092 mg/kg. Given this is a total residue, it is not expected that feeding on wheat forage or fodder containing the metabolites M684H005 and M684H006 will result in detectable residues in animal commodities. It is not necessary to consider metabolites of cinmethylin in the residue definition for animal commodities at this time.

A residue definition of parent cinmethylin only is recommended for commodities of animal origin. This definition is suitable for both risk assessment and enforcement.

4.4 Residues in food and animal feeds

Australian residue trials conducted on wheat (10 trials) and barley (four trials) are supported by 24 trials conducted on wheat in Europe. The residue trials conducted on barley are considered relevant to the proposed use on wheat as the use pattern is prior to emergence.

Residues of cinmethylin (parent) in wheat and barley grain from Australian trials at 127–203 days after an IBS application at 350–373 g ai/ha (approximately 1× proposed) were <0.01 (n = 13) mg/kg. After application at approximately 2× proposed residues in grain were also <0.01 mg/kg (n = 13).

European trials involved a higher application rate (1.3×) and later application timing than proposed. However, residues of cinmethylin (parent) in wheat grain at harvest 47–126 days after treatment at 500 g ai/ha were <0.01 (n = 24 mg/kg).

An MRL of *0.01 mg/kg is recommended for cinmethylin on GC 0654 Wheat. The proposed harvest withholding period of “Not Required when used as directed” is supported for this use that is pre-sowing only.

Residues of cinmethylin (parent) in wheat and barley forage from Australian trials at 46–52 days after an IBS application at 350–373 g ai/ha (approximately 1× proposed) were <0.01 (n = 6) mg/kg (as received). An MRL of *0.01 mg/kg is recommended for cinmethylin on wheat forage [fresh weight] in conjunction with a seven week grazing withholding period.

Residues of cinmethylin (parent) in wheat and barley straw from Australian trials at 127–203 days after an IBS application at 350–373 g ai/ha (approximately 1× proposed) were <0.01 (n = 13) mg/kg. An MRL of *0.01 mg/kg is recommended for cinmethylin on AS 0654 Wheat straw and fodder, dry.

4.5 Crop rotation

The confined crop rotation study involving application at 500 g ai/ha (1.3× proposed) did not show any significant residues in the rotated crops. Plant back intervals from a residues perspective or MRLs for rotational crops are not required for the proposed use of cinmethylin on wheat.

4.6 Residues in animal commodities

Animal transfer studies for lactating cattle or laying hens have not been provided. Due to the low feeding burden associated with the proposed use, the metabolism studies for lactating goat and laying will be considered. Validated analytical methods for animal commodities have been provided.

Quantifiable residues of parent cinmethylin are not expected to occur in wheat forage or straw from the proposed use (noting also the discussion on the metabolites M684H005 and M684H006 in section 4.3). Mammalian livestock are not expected to be exposed to significant residues of cinmethylin from the proposed use and finite levels of residues are not expected in milk or tissues of livestock as a result of the proposed use. It is appropriate to establish animal commodity MRLs for cinmethylin at the LOQ for the analytical method.

The following mammalian commodity MRLs are recommended:

- MO 0105 Edible offal (mammalian)*0.01 mg/kg
- MM 0095 Meat (mammalian)*0.01 mg/kg
- ML 0106 Milks*0.01 mg/kg

Detectable residues of cinmethylin are not expected to occur in wheat grain from the proposed use. Poultry should therefore not be exposed to residues of cinmethylin in their feed and finite levels of residues are not expected in eggs or tissues of poultry as a result of the proposed use. It is appropriate to establish poultry commodity MRLs for cinmethylin at the LOQ of the analytical method.

The following poultry commodity MRLs are recommended:

- PE 0112 Eggs*0.01 mg/kg
- PO 0111 Poultry, edible offal of*0.01 mg/kg
- PM 0110 Poultry meat*0.01 mg/kg

4.7 Spray drift

The product will be applied by ground application only with a droplet size no smaller than medium.

In the goat metabolism study, dosing with parent at 12 ppm gave a maximum parent residue in liver of 0.097 mg/kg. The estimated feeding level for parent residues in liver to be at the LOQ of 0.01 mg/kg is 1.24 ppm.

If a Regulatory Acceptable Level of 1.24 ppm is used in the APVMA spray drift risk assessment tool, the following label statements are recommended for protection of international trade:

DO NOT apply by a boom sprayer unless the following requirements are met:

- spray droplets not smaller than a MEDIUM spray droplet size category

- minimum distances between the application site and downwind sensitive areas (see ‘Mandatory buffer zones’ section of the following table titled ‘Buffer zones for boom sprayers’) are observed.

Table 5: Physicochemical properties of the product Luximax Herbicide

Application rate	Boom height above the target canopy	Livestock areas
Up to maximum label rate	0.5 m or lower	5 metres
	1.0 m or lower	45 metres

4.8 Dietary risk assessment

The chronic dietary exposure to cinmethylin is estimated by the National Estimated Daily Intake (NEDI) calculation encompassing all registered/temporary uses of the chemical and the mean daily dietary consumption data derived primarily from the 2011–12 National Nutritional and Physical Activity Survey. The NEDI calculation is made in accordance with WHO Guidelines and is a conservative estimate of dietary exposure to chemical residues in food. The NEDI for cinmethylin is equivalent to <1 per cent of the ADI. It is concluded that the chronic dietary exposure to cinmethylin is acceptable.

The acute dietary exposure is estimated by the National Estimated Short Term Intake (NESTI) calculation. The NESTI calculations are made in accordance with the deterministic method used by the JMPR with 97.5th percentile food consumption data derived primarily from the 2011–12 National Nutritional and Physical Activity Survey. NESTI calculations are conservative estimates of short-term exposure (24 hour period) to chemical residues in food. The highest acute dietary intake was estimated at <1 per cent of the ARfD. It is concluded that the acute dietary exposure is acceptable.

4.9 Recommendations

The following amendments are required to be made to the APVMA MRL Standard (Table 5).

Table 6: Amendments to the APVMA MRL Standard

Amendments to Table 1		
Compound	Food	MRL (mg/kg)
ADD:		
Cinmethylin		
MO0105	Edible offal (mammalian)	*0.01
PE0112	Eggs	*0.01
MM0095	Meat (mammalian)	*0.01
ML0106	Milks	*0.01

Amendments to Table 1		
Compound	**Food**	**MRL (mg/kg)**
PO0111	Poultry, edible offal of	*0.01
PM0110	Poultry meat	*0.01
GC0654	Wheat	*0.01

Amendments to Table 3	
Compound	**Residue**
ADD:	
Cinmethylin	Cinmethylin

Amendments to Table 4		
Compound	**Animal feed commodity**	**MRL (mg/kg)**
ADD:		
Cinmethylin		
	Wheat forage [fresh weight]	*0.01
AS0654	Wheat straw and fodder, dry	*0.01

5 ASSESSMENT OF OVERSEAS TRADE ASPECTS OF RESIDUES IN FOOD

5.1 Commodities exported and main destinations

Wheat is considered to be a major export commodity, as are commodities of animal origin, such as meat, offal and dairy products, which may be derived from livestock fed feeds produced from treated wheat. Residues in these commodities resulting from the use of Luximax Herbicide may have the potential to unduly prejudice trade.

Total exports of wheat (including flour) were 15,492 kilotonnes in 2017/18, valued at $4.7 billion (ABARES). Major export destinations are summarised below:

Table 7: Total exports of wheat and destinations

COMMODITY	MAJOR DESTINATIONS
Wheat	Indonesia, India, Korea, China, Japan, Thailand, Malaysia, Philippines, Vietnam, Egypt, Nigeria, Yemen, Kuwait, New Zealand

The significant export markets for Australian beef, sheep, pig meat, and offals are listed in the APVMA Regulatory Guidelines–Data Guidelines: Agricultural–Overseas trade (Part 5B).

5.2 Overseas registrations and approved label instructions

The applicant indicated that cinmethylin products are not currently registered in any overseas countries (as at October 2019). However, an application has been submitted in the UK/EU for use on wheat at higher rates than proposed for Australia.

5.3 Comparison of Australian MRLs with Codex and international MRLs

The Codex Alimentarius Commission (Codex) is responsible for establishing Codex Maximum Residue Limits (CXLs) for pesticides. CXLs are primarily intended to facilitate international trade, and accommodate differences in Good Agricultural Practice (GAP) employed by various countries. Some countries may accept Codex CXLs when importing foods. Cinmethylin has not been considered by Codex. No relevant international MRLs have been established for cinmethylin.

5.4 Potential risk to trade

Export of treated produce containing finite (measurable) residues of cinmethylin may pose a risk to Australian trade in situations where (i) no residue tolerance (import tolerance) is established in the importing country or (ii) where residues in Australian produce are likely to exceed a residue tolerance (import tolerance) established in the importing country.

Detectable residues of cinmethylin are not expected to occur in wheat or animal commodities from the proposed use. The risk to trade is considered to be low.

6 WORK HEALTH AND SAFETY ASSESSMENT

Based on the product use pattern, exposure is expected to occur mainly through the dermal and inhalation routes. Exposure is expected to occur over short periods of time during wheat sowing season when environmental factors are favourable to application of the spray and subsequent wheat sowing.

6.1 Health hazards

The acute risks associated with use of the product are moderate eye and skin irritation and skin sensitisation.

All available repeat dose studies of adequate duration were considered to assess the risk of systemic exposure during use of the product. A short-term dermal toxicity study is available for cinmethylin, with a NOAEL of 1000 mg/kg bw/d. However, due to findings indicative of maternal neurotoxicity in a developmental study, use of the short-term dermal toxicity study for occupational risk assessment was not considered appropriate. Hence, it was considered preferable to use the NOAEL (30 mg/kg bw/d) from the developmental study, on which the ARfD was derived, to conduct route-to-route extrapolation with an appropriate dermal absorption factor in the occupational risk assessment.

6.2 Occupational exposure

Exposure during use

In the absence of exposure data for the proposed application, the Pesticide Handler Exposure Database (PHED) Surrogate Exposure Guide (US EPA 2018) was used to estimate dermal and inhalational exposure. Since the NOAEL selected for this risk assessment was derived from animal toxicity testing, margins of exposure (MOEs) of 100 or above were considered to be acceptable. MOEs take into account both interspecies extrapolation and intraspecies variability. MOEs for users of the product were calculated by dividing the selected NOAEL by the corresponding estimated exposure. The risk assessment determined acceptable MOEs (> 100) for operators wearing no additional protective equipment (above those required to mitigate the acute hazard) while using the product.

Exposure during re-entry or rehandling

Although no post-application activity with a potential for significant exposure is expected to occur, workers entering the treated areas (for example for monitoring, or maintenance purposes) before the spray has dried may be exposed to the acute hazards associated with the product.

To mitigate this risk, a re-entry statement is recommended to be included on the product label.

6.3 Public exposure

Luximax Herbicide is not intended for use by the general public or in areas accessible by the general public.

6.4 Spray drift – Bystander exposure

Based on the overall toxicity of the product, and assessed risks during mixing, loading and application, as well as considerations for re-entry into treated areas, no buffer zones are required for the protection of bystanders.

6.5 Recommendations

The following first aid instructions, safety directions and precautionary (warning) statements are recommended for the product label.

First aid instructions

“If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 131126; New Zealand 0800 764 766.”

Safety directions

“Will irritate the eyes and skin. Avoid contact with eyes and skin. Repeated exposure may cause allergic disorders. When opening the container, and preparing the product for use, wear cotton overalls buttoned to the neck and wrist (or equivalent clothing) and a washable hat and PVC or rubber apron and elbow-length chemical resistant gloves and face shield or goggles. If product on skin, immediately wash area with soap and water. If product in eyes, wash it out immediately with water. Wash hands after use. After each day’s use, wash gloves, face shield or goggles and contaminated clothing.”

Re-entry statement

“Do not enter treated areas until the spray has dried, unless wearing cotton overalls buttoned to the neck and wrist (or equivalent clothing) and chemical resistant gloves. Gloves and clothing must be laundered after each day's use.”

7 ENVIRONMENTAL ASSESSMENT

7.1 Fate and behaviour in the environment

Soil

Cinmethylin absorbs light in the UV area (absorption bands around 209 and 262 nm); however, the investigation of photolysis on soil surfaces did not show an influence of light on the degradation behaviour and metabolite formation in soil. The half-life of cinmethylin in irradiated samples was 24 days, compared to 26 days in the dark control.

Under aerobic conditions in four laboratory soils, modelling DT_{50} values ranged 19 to 193 days (geomean 59 days). Biphasic degradation best described parent degradation in two soils under aerobic conditions while in the other two soils, degradation followed a single first-order (SFO) pattern of decline.

Under anaerobic conditions in four laboratory soils, modelling DT_{50} values ranged 241 to >1000 days, all of which followed the ‘hockey stick’ model of decline.

The degradation pathway of cinmethylin in soil was found to be similar under aerobic and anaerobic conditions and is characterized by a medium to high mineralization rate and the formation of medium to high amounts of non-extractable residues. No metabolites exceeded five per cent of applied radioactivity in these studies.

Cinmethylin is a mixture of two enantiomers. A shift of the enantiomeric ratio was observed in some instances, from initially 50:50 ((-)-enantiomer : (+)-enantiomer) to maximum 23:77. The change in the enantiomeric ratio was found to be caused by different degradation rates of the two enantiomers and not by enantiomeric conversion, ie there was no formation of one enantiomer from the other.

Standard batch equilibrium test results were available for eight soils from an adsorption/desorption study. The soils tested had a range of 0.66 to 4.34 per cent organic carbon. In all cases, the Freundlich exponent (1/n) approximated a value of 1 with an average of 0.97 across all soils. This indicated that sorption was not dependent on environmental concentrations, and the choice of K_f from the range of results can be applied as a surrogate for Kd in the risk assessment. The K_f values ranged from 1.9 to 14 L/kg and corresponding K_{foc} values ranged from 266 to 645 L/kg. Based on these results, it can be determined that cinmethylin may be moderately mobile in soil. The data showed a reasonable correlation between soil sorption and organic carbon. The relationship from the regression equation indicates a K_d of 3.2 L/kg for a soil with one per cent organic carbon, which is considered a screening level value for the runoff risk assessment.

Cinmethylin was tested in field dissipation studies in Europe (n = 6) and the United States (n = 6). The trials undertaken in the Europe were designed to minimise dissipation processes, particularly soil surface influences such as volatilisation and photolysis by incorporating the test item into the soil. The US trials did not incorporate the test item. An analysis of the field half-lives obtained from Europe and US indicate the results were not statistically different. Modelling DT_{50} values for the 12 sites ranged 5.3 to 84 days (geomean 30 days). Residues were retained in the top 15 cm soil layer.

A comparison of the US terrestrial field dissipation trial site conditions to those in Australia was provided (APVMA data number 165945). In terms of temperature, the APVMA supports the conclusion that many areas in Australia's cropping regions are possibly more conducive for degradation than some of the US trial sites and accepts the US field dissipation results as applicable to Australian conditions.

Water and sediment

Cinmethylin is almost insoluble in water (0.058 g/L). Due to the lack of acidic protons, cinmethylin does not dissociate. Cinmethylin was shown to be stable to hydrolysis at environmentally relevant pH values. In an aqueous photolysis study in buffered water, the DT_{50} was determined to be 48 days under constant irradiation. No major degradates were observed. In natural water, the DT_{50} was estimated to be 33 days; M684H003 was a major degradate reaching 11 per cent of applied radioactivity at the end of the 15 day study.

A ready biodegradability study was undertaken at 22°C using activated sludge. Biodegradation was not observed in the test period; therefore, cinmethylin is not considered to be readily biodegradable.

The aerobic mineralisation of cinmethylin in stream water containing suspended sediment was also tested. There was no significant degradation of cinmethylin in a microbially active water system incubated in the dark over 63 days for both test concentration (10 µg/L and 50 µg/L). Kinetic analysis could not be undertaken in the high concentration system due to lack of degradation. In the low concentration system, the DT_{50} was calculated to be 144 days.

The behaviour of cinmethylin in two water/sediment systems was also investigated under laboratory conditions in the dark. Cinmethylin was observed to dissipate from the water phase, mostly partitioning to sediment. The degradation half-lives (single first order) in water ranged 4.7 to 5.1 days (geomean 4.9 days). By the end of the study period, <5 per cent cinmethylin was detected in the water phase with 16 to 30 per cent in the sediment phase. Peak levels in the sediment of parent compound ranged from 49 to 53 per cent were observed after two weeks and declined over the remainder of the study. No major metabolites were formed.

Air

Using standard modelling methodology, cinmethylin is predicted to have an atmospheric half-life of 0.18 days based on 12 hours of sunlight per day. Because of this, and its low vapour pressure, cinmethylin is unlikely to be transported long and short distances in air.

The volatilization potential from soil and plant surfaces as well as short-range transport and deposition in a wind tunnel test system were further investigated. Volatilization of cinmethylin from either plant or soil surfaces may be significant with maximum volatilization rates after 24 hours of 73 per cent and 89 per cent of the applied amount from soil and plant surfaces, respectively.

The experiment in the wind tunnel showed that deposition after volatilization of cinmethylin took place on a relatively low level. Maximum deposition values were observed 48 hours after application and were found to decrease with the increasing distance from the applied area: from 0.82 per cent of the applied amount at 1 m distance from the applied area to 0.17 per cent at 20 m distance. Air concentration was also a clear function of time after application and distance from the treated area. At a distance of 20 m, the maximum cinmethylin concentration was 0.47 µg ac/m^3 and decreased to 0.01 µg ac/m^3 after 96 hours.

Considering the fast degradation in air together with the low level of deposition, it can be concluded that there is low risk of off-site movement of cinmethylin to non-target areas. Due to the short half-life in air, local and global effects are not expected.

7.2 Effects and associated risks to non-target species

Terrestrial vertebrates

Following gavage administration, cinmethylin had low toxicity to mammals (LD_{50} 4550 mg ac/kg bw, *Rattus norvegicus*) and birds (LD_{50} >2510 mg ac/kg bw, *Colinus virginianus*). Cinmethylin was similarly not toxic to birds following short-term dietary exposure (LC_{50} >5620 mg ac/kg diet, two species tested). Following long-term dietary administration in reproduction studies, no adverse effects were observed in birds at the highest dosage tested (lowest NOEL 99 mg ac/kg bw/d, *Colinus virginianus*), while reduced food consumption and body weight in parental mammals were observed at doses as low as 395 mg ac/kg bw/d (NOEL 81 mg ac/kg bw/d, *Rattus norvegicus*).

The major potential routes of exposure to terrestrial vertebrates are considered to be feeding on food items (eg vegetation and invertebrates) directly contaminated from spray application of the product. The screening level assessment assumed that terrestrial vertebrates feed exclusively on oversprayed food items within the treatment area. Risks were determined to be acceptable at the screening level. Therefore, risks to terrestrial vertebrates were considered to be acceptable and no specific protection statements are required.

Although the log K_{ow} of 4.5 indicates potential for bioaccumulation of cinmethylin, a food chain assessment indicated that any accumulated residues in earthworms or fish are not expected to reach levels harmful to predators under the proposed conditions of use. In addition, based on toxicokinetic studies, biomagnification is not expected along the food chain.

Aquatic species

Cinmethylin is moderately toxic to fish (lowest LC_{50} 4.4 mg ac/L, *Cyprinus carpio*), aquatic invertebrates (lowest EC_{50} 6.6 mg ac/L), sediment dwellers (lowest LC_{50} 2.5 mg ac/L, *Chironomus lugubris*), and algae (lowest E_rC_{50} 20 mg ac/L, *Pseudokirchneriella subcapitata*), and highly toxic to aquatic plants (lowest E_rC_{50} 0.089 mg ac/L, *Lemna gibba*). Available data indicate that the representative EC formulation does not enhance the toxicity of cinmethylin to aquatic species. Following long-term exposure, cinmethylin inhibited growth in the early life stages of fish in a dose-dependent manner (EC_{10} 0.91 mg ac/L, *Pimephales promelas*), and inhibited population growth of aquatic invertebrates at concentrations as low as 1.2 mg ac/l (NOEC 0.59 mg ac/L, *Daphnia magna*). Available data indicate that the major metabolites M684H001 and M684H003 are significantly less toxic to aquatic species than parent cinmethylin.

The major potential routes of exposure of aquatic species are considered to be spray drift or runoff from the treatment area. Although the product is not applied to water, a screening level risk assessment assumed the worst-case scenario of a direct overspray of shallow aquatic habitat in order to determine which aquatic species are not at risk. Acceptable risks could be concluded at the screening level for all aquatic species except aquatic plants.

The aquatic plant endpoint was based on a seven day static test. The results are provided in terms of a mean measured concentration and it was shown that the concentrations at the end of the study were significantly lower than those at the start of the study. Given the use of mean measured concentrations, a time weighted average factor can be applied to account for the dissipation rate of cinmethylin from the water body (water DT_{50} 4.9 days). For the seven day period corresponding to the time period of the study, the time weighted average factor was calculated to be 0.64 (ie, the average exposure concentration over the seven day exposure period will be 64 per cent of the initial concentration). The adjusted RAC was therefore 0.014 mg ac/L for use in the spray drift and runoff assessments.

The spray drift assessment determined that a buffer zone is not required if the boom height is 0.5 metres or lower above the target canopy; however, higher boom heights require a buffer zone of 25 metres for the protection of natural aquatic areas. Runoff risks were determined to be acceptable at the screening level, assuming an 8 per cent slope (considered protective of 95 per cent of agricultural activities in Australia), eight mm of rainfall and a small receiving water body of 1500 m^3 within a 10 hectare catchment.

Bees and other non-target arthropods

Cinmethylin is not considered to be toxic to adult bees by contact exposure (LD_{50} >200 µg ac/bee, two species tested) or oral exposure (LD_{50} >194 µg ac/bee, two species tested). Formulation toxicity data did not show any enhanced toxicity. Following long-term dietary exposure to cinmethylin, significant mortality was observed in adult bees at doses as low as 99 µg ac/bee (NOEL 49 µg ac/bee, *Apis mellifera*) and reduced emergence of larvae was observed at 133 µg ac/bee (NOEL 100 µg ac/bee, *Apis mellifera*).

A screening level risk assessment assumed the worst-case scenario of a direct overspray of blooming plants that are frequented by bees. Risks to bee were determined to be acceptable at the screening level, and therefore no specific protection statements (including downwind buffer zones for Pollinator areas) are required on the label.

For other non-target arthropods, data were provided on contact toxicity of fresh dried residues of a representative EC formulation of cinmethylin to the indicator species—predatory mite (*Typhlodromus pyri*) and parasitic wasp (*Aphidius rhopalosiphi*). The respective Tier 1 (glass plate) studies resulted in LR_{50} values of 573 g ac/ha and 102 g ac/ha. To further address the toxicity to *Aphidius rhopalosiphi*, an extended laboratory test on natural substrate (barley plants) was performed, which resulted in 13 per cent mortality at the highest tested rate (LR_{50} >525 g ac/ha) with no effects on reproduction (ER_{50} >525 g ac/ha). Similarly, no adverse effects on the reproduction of the parasitic rove beetle were observed at the highest rate tested (ER_{50} >1050 g ac/ha, *Aleochara bilineata*).

Beneficial (predatory and parasitic) arthropods could be directly exposed to the active constituent within the crop during treatment or as a result of spray drift. A screening level risk assessment utilises Tier 1 toxicity data and assumes the non-target arthropods are exposed to fresh-dried residues within the treatment area immediately after application. Risks were determined to be acceptable for predatory arthropods at tier 1 (considering glass plate tests) and for parasitic arthropods at tier 2 (considering natural substrates). Therefore, the proposed use of the product is considered compatible with integrated pest management programs (IPM) utilising beneficial arthropods, and no specific protection statements are required on the label.

Soil organisms

Cinmethylin is considered to be moderately toxic to soil macro-organisms such as earthworms (lowest LC_{50corr} 233 mg ac/kg dry soil, *Eisenia andrei*). Following long-term exposure in soil, cinmethylin inhibited reproduction of three species of soil macro-organisms in a dose-dependent manner (lowest EC_{10corr} 42 mg ac/kg dry soil, *Eisenia andrei*). No adverse effects were observed on soil processes such as nitrogen and carbon mineralisation at exaggerated soil concentrations (NOEC 1.0 to 10 mg ac/kg dry soil). There was no enhanced toxicity from the representative EC formulation to soil organisms.

A screening level risk assessment assumes the worst-case scenario of a direct overspray of soil without interception. Risks to soil organisms were determined to be acceptable at the screening level, and therefore no specific protection statements are required.

Non-target terrestrial plants

Data were provided addressing the toxicity of a representative EC formulation of cinmethylin to non-target terrestrial plants following pre- and post-emergent exposure. These studies examined the effects on seedling emergence and vegetative vigour in ten crop species, with growth inhibition (dry weight) being the most significant response. The most sensitive species following pre-emergent exposure was ryegrass (ER_{25} 19 g ac/ha, ER_{50} 32 g ac/ha, *Lolium muliflorum*). The most sensitive species following post-emergent exposure were barley (ER_{25} 189 g ac/ha, *Hordeum vulgare*) and ryegrass (ER_{50} 532 g ac/ha, *Lolium muliflorum*). A spray drift assessment determined buffer zones of 35 metres (boom heights up to 0.5 metres) and 90 metres (boom heights up to 1.0 metre) are required for the protection of vegetation areas.

7.3 Recommendations

The following restraints and protection statements are advised from the viewpoint of environmental safety.

General restraints

- DO NOT apply by aircraft.
- DO NOT apply by vertical sprayer.
- DO NOT apply if heavy rains or storms are forecast within 3 days.
- DO NOT irrigate to the point of runoff for at least 3 days after application.
- DO NOT apply to waterlogged soil.
- DO NOT apply unless incorporation by sowing (IBS) can occur within 3 days.
- DO NOT apply more than 1 application per season.

Spray drift restraints

DO NOT apply by a boom sprayer unless the following requirements are met:

- spray droplets not smaller than a MEDIUM spray droplet size category
- minimum distances between the application site and downwind sensitive areas (see ‘Mandatory buffer zones’ section of the following table titled ‘Buffer zones for boom sprayers’) are observed.

Table 8: Spray drift restraints

Application rate	Boom height above the target canopy	Mandatory buffer zones		
		Natural aquatic areas	Vegetation areas	Pollinators
Up to maximum label rate	0.5 m or lower	Not required	35 metres	Not required
	1.0 m or lower	25 metres	90 metres	Not required

Protection statements

Very toxic to aquatic life. DO NOT contaminate wetlands or watercourses with this product or used containers.

8 EFFICACY AND SAFETY ASSESSMENT

8.1 Proposed product use pattern

The proposed product, Luximax Herbicide, is a pre-emergent herbicide for control of annual ryegrass and suppression of wild oats and brome grass in wheat. Luximax Herbicide is applied at a rate of 500 mL/ha prior to sowing using a knifepoint and press wheel system (IBS pre-sowing and incorporated by sowing).

8.2 Efficacy and target crop safety

Trial data—consisting of 85 small plot replicated field trials in NSW, Victoria, South Australia, Western Australia and Queensland during 2014–18 were provided to assess crop safety on wheat and to establish efficacy for the three grass weeds, annual ryegrass (*Lolium rigidum)*, wild oats(*Avena spp*.) and brome grass (*Bromus spp*.).

Efficacy

Efficacy (percentage control) was assessed on annual ryegrass, wild oats and brome grass. Trial data consistently demonstrated significant control of annual ryegrass and suppression of wild oats and brome grass when applied at the proposed label rate with Luximax Herbicide providing commercial control or suppression, equivalent or better than the industry standards.

Luximax Herbicide when applied to wheat cv Chara for the control of annual ryegrass, resulted in 82.0 per cent whole plot control when applied at the proposed label rate. Due to the precise placement of Luximax Herbicide to maximise selectivity, within furrow control was 82.5 per cent compared to 90.0 per cent between furrows. Mean whole plot control of annual ryegrass in 35 trials was 82.3 per cent with up to 98.25 per cent recorded in one trial.

Luximax Herbicide when applied to wheat cv Suntop for the control of wild oats, resulted in 65.0 per cent whole plot control when applied at the proposed label rate. Within furrow control was 55.0 per cent compared to 72.5 per cent between furrows. Mean whole plot control of wild oats in nine trials was 77.0 per cent with up to 77.5 per cent recorded in one trial.

Luximax Herbicide applied to wheat cv Lancer resulted in 68.8 per cent control (suppression) of brome grass.

Crop safety

Selectivity of Luximax Herbicide is dependent on separation of the seed from the herbicide treated band. Seed should be sown at a minimum of 2.5 cm below the surface, with minimal soil movement in the furrow which could concentrate herbicide near the germinating seed. Waterlogging and heavy rains after sowing may also lead to crop damage due to the proximity of herbicide to the seed.

Crop safety (selectivity) was assessed on multiple wheat cultivars by crop establishment, crop phytotoxicity, crop biomass and crop yield and plantback safety and re-cropping times on wheat, barley, durum, canola, chickpea, field pea, faba bean, lentil, cotton, sorghum, maze, sunflower, and mung beans.

In 60 trials on multiple wheat cultivars, early (13 to 56 DAT) crop phytotoxicity of Luximax Herbicide, when applied at the proposed label rate, ranged from 0 per cent to 1.25 per cent, which was bioequivalent or superior to the industry standards. In most trials, no phytotoxicity was recorded.

Impact on crop establishment and crop biomass was minimal. Luximax Herbicide applied to the wheat cv Condo at the proposed label rate, resulted in 25.1 plants/m^2 compared to 22.6 plants/m^2 for the untreated control and 22.0 plants/m^2 for the industry standard. In the same trial, crop biomass for the Luximax treatment was 96.3 per cent of the untreated control, compared to 97.5 per cent for the industry standard.

In 18 trials on multiple wheat cultivars where crop yield was measured, Luximax Herbicide resulted in 108 per cent yield compared to the untreated control when applied at the proposed label rate, compared to 109 per cent for the industry standard. At double the proposed label rate Luximax Herbicide resulted in 99 per cent yield compared to the untreated control.

The soil half-life of cinmethylin has been estimated to be 43.7 days, which has significance for re-cropping of cereal crops and other rotationals crops. This timeframe is significantly shorter than industry standards. In all trials, emergence of cereal and other rotation crops was not adversely affected using Luximax Herbicide applied at label and double label rates. Applied to wheat cv Suntop prior to sowing at double the proposed label rate, Luximax resulted in 28.7 plants/m of row at 28 days after treatment, compared to 27.4 and 29.1 plants/m of row for the industry standard and untreated control respectively. Similarly, Luximax had little impact on the emergence of barley and durum applied IBS and assessed by seedling emergence.

With minimal impact on following crops, the re-cropping interval was set at nine months, which equated to the interval between the latest application one season and the earliest application the following season. Similarly, replanting of summer rotation crops including cotton, sorghum, maize, sunflower and mung bean in northern Australia may occur in November the same year and so a three month re-cropping time was set for these crops.

8.3 Resistance management

Luximax Herbicide is a member of the diverse site of action group of herbicides. Luximax Herbicide acts by inhibiting fatty acid biosynthesis. For weed resistance management Luximax Herbicide is a Group Z herbicide. Strategies to minimize the risk of herbicide resistance are included on the label.

8.4 Recommendations

The APVMA is satisfied that trial data demonstrated Luximax Herbicide will provide acceptable control of annual ryegrass and suppression of wild oats and brome grass in wheat when used according to label instructions. The product is also expected to provide acceptable levels of crop safety in wheat when used as directed.

9 LABELLING REQUIREMENTS

CAUTION
KEEP OUT OF REACH OF CHILDREN
READ SAFETY DIRECTIONS BEFORE OPENING OR USING

LUXIMAX® HERBICIDE

ACTIVE CONSTITUENT: 750 g/L CINMETHYLIN

GROUP	■	HERBICIDE

For the pre-emergence control of annual ryegrass (*Lolium rigidum*) and suppression of certain grass weeds in wheat (not durum wheat) as indicated in the Directions for Use table.

IMPORTANT: READ THE ATTACHED LEAFLET BEFORE USING THIS PRODUCT

CONTENTS: 10L, 20L, 110L, 1000L

BASF Australia Ltd ABN 62 008 437 867
Level 12, 28 Freshwater Place Southbank VICTORIA 3006
Website: www.crop-solutions.basf.com.au

® Registered trademark of BASF

DIRECTIONS FOR USE

RESTRAINTS

DO NOT apply by aircraft.
DO NOT apply by vertical sprayer.
DO NOT apply if heavy rains or storms are forecast within 3 days.
DO NOT irrigate to the point of runoff for at least 3 days after application.
DO NOT apply to waterlogged soil.
DO NOT apply unless incorporation by sowing (IBS) can occur within 3 days.
DO NOT apply more than 1 application per season.

SPRAY DRIFT RESTRAINTS

Specific definitions for terms used in this section of the label can be found at apvma.gov.au/spraydrift.

DO NOT allow bystanders to come into contact with the spray cloud.

DO NOT apply in a manner that may cause an unacceptable impact to native vegetation, agricultural crops, landscaped gardens and aquaculture production, or cause contamination of plant or livestock commodities, outside the application site from spray drift. The buffer zones in the buffer zone table below provide guidance but may not be sufficient in all situations. Wherever possible, correctly use application equipment designed to reduce spray drift and apply when the wind direction is away from these sensitive areas.

DO NOT apply unless the wind speed is between 3 and 20 kilometres per hour at the application site during the time of application.

DO NOT apply if there are hazardous surface temperature inversion conditions present at the application site during the time of application. Surface temperature inversion conditions exist most evenings one to two hours before sunset and persist until one to two hours after sunrise.

DO NOT apply by a boom sprayer unless the following requirements are met:

- spray droplets not smaller than a MEDIUM spray droplet size category
- minimum distances between the application site and downwind sensitive areas (see ‘Mandatory buffer zones’ section of the following table titled ‘Buffer zones for boom sprayers’) are observed.

Application rate	**Boom height above the target canopy**	**Mandatory downwind buffer zones**				
		Livestock areas	**Natural aquatic areas**	**Vegetation areas**	**Bystander areas**	**Pollinator areas**
Up to maximum label rate	0.5 m or lower	5 metres	Not required	35 metres	Not required	Not required
	1.0 m or lower	45 metres	25 metres	90 metres	Not required	Not required

CROP	WEED	RATE	CRITICAL COMMENTS
Wheat (not Durum wheat)	Annual ryegrass (*Lolium rigidum*) Suppression of; Wild oats (*Avena* spp.) Brome grass (*Bromus* spp.)	500mL/ha	Apply pre-sowing and incorporate by sowing (IBS) using knife point and press-wheels. For best results, apply just prior to sowing (refer to **Interval between Application and Sowing** in **GENERAL INSTRUCTIONS**). Planting equipment should be set up to ensure seed is planted well below the treated band (**minimum 3 cm sowing depth**). Avoid throwing treated soil into adjacent crop rows when sowing with knife point and press wheels. To reduce the risk of adverse crop effects, refer to **Crop Safety** in **GENERAL INSTRUCTIONS.** To optimise weed control apply directly to uncultivated soil. Weed control may be greatly reduced where weed seeds have been buried by cultivation prior to sowing. Weed control may be adversely affected by; • uneven application, • application to ridged or cloddy soil, • stubble, plant residue or other ground cover particularly where this exceeds 50%, • germinated and emerged weeds that are not controlled by a knockdown herbicide, • insufficient rainfall within 7-10 days after application, • in soil prone to leaching where rainfall which is sufficiently heavy to cause movement of the herbicide out of the weed seed zone. These factors when combined may substantially reduce weed control.

NOT TO BE USED FOR ANY PURPOSE, OR IN ANY MANNER, CONTRARY TO THIS LABEL UNLESS AUTHORISED UNDER APPROPRIATE LEGISLATION.

WITHHOLDING PERIOD
HARVEST: NOT REQUIRED WHEN USED AS DIRECTED
GRAZING: DO NOT GRAZE OR CUT FOR STOCK FOOD FOR 7 WEEKS AFTER APPLICATION.

GENERAL INSTRUCTIONS

Luximax® Herbicide is a pre-emergent residual herbicide and will not control weeds which have already germinated or emerged prior to application. A knockdown herbicide should be used to control emerged weeds. Luximax® Herbicide is primarily absorbed by roots of germinating weeds. Optimum weed control is achieved when Luximax® Herbicide is applied evenly to uncultivated moist soil, free of clods and heavy trash residues just prior to incorporation and incorporated by sowing as soon as practical and within three days. Weeds germinating in the seed row may not be controlled. Weeds germinating from depth, weeds just about to emerge, or weeds that have emerged which are not controlled by a knockdown herbicide at sowing may not be controlled. Adequate rainfall or irrigation should occur within 7 days of application to ensure activation and uptake of the herbicide by germinating weeds.

To ensure thorough soil coverage, Luximax® Herbicide should be applied in a minimum of 70L/ha water.

Crop Safety

Crop selectivity is achieved through separation of the seed from the herbicide treated band. Planting equipment should be set up to ensure seed is planted well below the treated band (minimum 3 cm sowing depth). Use knife points and press wheels to provide good separation of herbicide and closure of the planting row.

When applying Luximax® Herbicide consider the following:

- Ensure treated soil from one sowing furrow is not thrown into an adjacent furrow when sowing
- Avoid situations which could result in concentration of the herbicide in the planting row.
- Avoid shallow planting, particularly in lighter soils.
- Avoid application to soils which are water repellent or crusted or prone to waterlogging, as this will increase movement of the herbicide into the planting row and increase damage.
- Avoid conditions which result in poor crop root development such as waterlogging, which may lead to an increase in crop damage.
- Heavy rainfall following sowing may increase the likelihood of crop damage.
- DO NOT apply in combinations with Sakura or Boxer Gold as increased crop damage may occur.
- DO NOT undersow with pasture species (legumes or grasses) following the application of Luximax® Herbicide.

MIXING

Half fill the spray tank with clean water. Commence agitation and add the required amount of product to the tank. Maintain agitation whilst filling the tank and throughout the spraying operation.

Luximax® Herbicide is an emulsifiable concentrate formulation. When using in a tank mix with other herbicides the following mix order should be observed;

- half fill the spray tank;

- add any granule (WG) formulated products first and allow dispersion, followed by any suspension concentrates (SC/flowable);

- add any water-soluble salts (eg glyphosate);

- add Luximax® Herbicide and any other EC formulations

As water quality can influence compatibility, it is recommended that mixtures should be bottle-tested in the water intended for spraying, prior to mixing commercial quantities.

APPLICATION

Ground application: Apply with flat fan nozzles in a spray volume of 70-150L of water per hectare using standard boom spraying equipment. Application as a MEDIUM spray quality (defined by ASAE S572 Standard) using air induction nozzles is recommended. Ensure complete and even spray coverage of the soil is achieved.

SPRAYER CLEANUP

Following use, the sprayer should be cleaned before being used for application of other products. Empty the tank completely and drain the whole system. Quarter fill the tank with clean water directing stream into the tank. Circulate through the pump, the hoses and nozzles then drain. Repeat if necessary. Finally remove and clean all filters (tank, in-line and nozzle) separately. This will provide an effective cleaning technique for Luximax® Herbicide. A boom cleaner may be used as part of the procedure.

CROP PLANT BACK & ROTATION RECOMMENDATIONS

Luximax® Herbicide does not provide long-term residual activity; however, certain crops show sensitivity to soil residues. Refer to the following table for application-to-sow intervals.

Rotation crop	Time from Luximax® application to replant
Winter Wheat	9 months
Durum	9 months
Barley	9 months
Oats (Tame)	9 months
Canola	9 months
Field Pea	9 months
Faba Bean	9 months
Chickpea	9 months
Lentil	9 months
Cotton	3 months
Sorghum	3 months
Maize	3 months
Mungbean	3 months
Sunflower	3 months

Check the label of any product mixed with Luximax® Herbicide, to determine any plant back periods or restrictions on use.

COMPATIBILITY

Luximax® Herbicide is compatible with the following herbicides: Avadex (triallate), Arcade (prosulfocarb), carfentrazone, glyphosate, metsulfuron, oxyfluorfen, paraquat, Sharpen® WG Herbicide, Stomp® Xtra Herbicide and trifluralin.

HERBICIDE RESISTANCE WARNING

GROUP Z HERBICIDE

Luximax® Herbicide is a member of the diverse site of action group of herbicides. Luximax® Herbicide acts by inhibiting fatty acid (FA) biosynthesis. For weed resistance management Luximax® Herbicide is a Group Z herbicide. Some naturally occurring weed biotypes resistant to this product and other Group Z herbicides may exist through normal genetic variability in any weed population. The resistant individuals can eventually dominate the weed population if these herbicides are used repeatedly. These resistant weeds will not be controlled by this product or other Group Z herbicides. Since the occurrence of resistant weeds is difficult to detect prior to use, BASF Australia Limited accepts no liability for any losses that may result from the failure of this product to control resistant weeds.

Resistance Management

Luximax® Herbicide will control weeds which have developed resistance to other mode of action herbicides. Where possible, Luximax® Herbicide should be used as a part of an integrated weed management program which includes herbicides from other modes of action and non-chemical methods. CropLife resistance management strategies are available from BASF sales representatives and from CropLife at www.croplife.com.au.

RE-ENTRY PERIOD

Do not enter treated areas until the spray has dried, unless wearing cotton overalls buttoned to the neck and wrist (or equivalent clothing) and chemical resistant gloves. Gloves and clothing must be laundered after each day's use.

PROTECTION OF WILDLIFE, FISH, CRUSTACEA AND ENVIRONMENT

Very toxic to aquatic life. DO NOT contaminate wetlands or watercourses with this product or used containers.

STORAGE

Store in the closed, original container in a cool, well-ventilated area. DO NOT store for prolonged periods in direct sunlight.

DISPOSAL

10L, 20L: Triple-rinse containers before disposal. Add rinsings to spray tank. Do not dispose of undiluted chemicals on site. If recycling, replace cap and return clean containers to recycler or designated collection point. If not recycling, break, crush or puncture and deliver empty packaging to an approved waste management facility. If an approved waste management facility is not available, bury the empty packaging 500 mm below the surface in a disposal pit specifically marked and set up for this purpose, clear of waterways, desirable vegetation and tree roots, in compliance with relevant local, state or territory government regulations. Do not burn empty containers or product.

110L: Empty container by pumping through the drybreak Micro Matic connection system. Ensure that the Micro Matic coupler, pump, meter and hoses are disconnected, triple rinsed with clean water and drained after each use. Add rinsings to spray tank. Do not dispose of undiluted chemicals on site. When empty, or contents no longer required, return the container to the point of purchase.

Bulk packs: Empty contents fully into application equipment. DO NOT dispose of undiluted chemicals on site. Close all valves and return to point of supply for refill or storage.

SAFETY DIRECTIONS

Will irritate the eyes and skin. Repeated exposure may cause allergic disorders. Avoid contact with eyes and skin. When opening the container and preparing the product for use, wear cotton overalls buttoned to the neck and wrist (or equivalent clothing) and a washable hat, PVC or rubber apron and elbow-length chemical resistant gloves and face shield or goggles. If product on skin, immediately wash area with soap and water. If product in eyes, wash it out immediately with water. Wash hands after use. After each day's use, wash gloves, face shield or goggles and contaminated clothing.

FIRST AID

If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 131126; New Zealand 0800 764 766.

SAFETY DATA SHEET

For further information refer to the Safety Data Sheet (SDS).

APVMA Approval No:

Batch No:
Date of Manufacture:

® = Registered trademark of BASF

* Other registered trademarks

BASF Australia Ltd
ABN 62 008 437 867
Level 12, 28 Freshwater Place
Southbank VICTORIA 3006

FOR SPECIALIST ADVICE IN AN EMERGENCY ONLY PHONE 1800 803 440 TOLL FREE-ALL HOURS-AUSTRALIA WIDE

ABBREVIATIONS

ac	active constituent
ADI	Acceptable Daily Intake (for humans)
ai	active ingredient
ARfD	Acute Reference Dose
bw	bodyweight
d	day
DAT	Days After Treatment
DT_{50}	Time taken for 50% of the concentration to dissipate
EA	Environment Australia
EC_{50}	concentration at which 50% of the test population are immobilised
E_rC_{50}	concentration at which the rate of growth of 50% of the test population is impacted
EI	Export Interval
EGI	Export Grazing Interval
ESI	Export Slaughter Interval
g	gram
GAP	Good Agricultural Practice
h	hour
ha	hectare
IPM	Integrated Pest Management
in vitro	outside the living body and in an artificial environment
in vivo	inside the living body of a plant or animal
kg	kilogram
L	Litre
LC_{50}	concentration that kills 50% of the test population of organisms
LD_{50}	dosage of chemical that kills 50% of the test population of organisms
LOD	Limit of Detection—level at which residues can be detected

Log K_{OW}	Log to base 10 of octanol water partitioning co-efficient, synonym P_{OW}
LOQ	Limit of Quantitation—level at which residues can be quantified
mg	milligram
mL	millilitre
MRL	Maximum Residue Limit
MSDS	Material Safety Data Sheet
NEDI	National Estimated Daily Intake
NESTI	National Estimated Short Term Intake
ng	nanogram
NOEC/NOEL	No Observable Effect Concentration Level
NOAEL	No Observed Adverse Effect Level
ppb	parts per billion
PPE	Personal Protective Equipment
ppm	parts per million
Q-value	Quotient-value
REI	Re-Entry Interval
s	second
SC	Suspension Concentrate
SUSMP	Standard for the Uniform Scheduling of Medicines and Poisons
TGA	Therapeutic Goods Administration
TGAC	Technical grade active constituent
µg	microgram
WHP	Withholding Period

GLOSSARY

Active constituent	The substance that is primarily responsible for the effect produced by a chemical product
Acute	Having rapid onset and of short duration
Carcinogenicity	The ability to cause cancer
Chronic	Of long duration
Codex MRL	Internationally published standard maximum residue limit
Desorption	Removal of a material from or through a surface
Efficacy	Production of the desired effect
Formulation	A combination of both active and inactive constituents to form the end use product
Genotoxicity	The ability to damage genetic material
Hydrophobic	Repels water
Metabolism	The chemical processes that maintain living organisms
Photolysis	Breakdown of chemicals due to the action of light
Toxicology	The study of the nature and effects of poisons

REFERENCES

APVMA 2019, *Spray drift risk assessment tool*, Australian Pesticides and Veterinary Medicines Authority, Canberra, available at apvma.gov.au/node/39701.

APVMA 2015, *Data Guidelines,* Australian Pesticides and Veterinary Medicines Authority, Canberra, available at apvma.gov.au/registrations-and-permits/data-guidelines.

WHO 1997, *Guidelines for predicting dietary intake of pesticide residues*, World Health Organization, Geneva, available at: who.int/foodsafety/publications/pesticides/en/.