Australian Government

Australian Pesticides and Veterinary Medicines Authority

PUBLIC RELEASE SUMMARY

on the evaluation of the active constituent novaluron in the product Cormoran Insecticide

NOVEMBER 2016

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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.

In undertaking this task, the APVMA works in close cooperation with advisory agencies, including the Department of Health, Office of Chemical Safety (OCS), Department of Environment (DoE), and State Departments of Primary Industries.

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.

The information and technical data required by the APVMA to assess the safety 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.

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 its advisory agencies. 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 is a Public Release Summary.

It 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 section 12 of the Agvet Code, the APVMA invites any person to submit a relevant written submission as to whether the application for registration of Cormoran Insecticide 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 Tuesday 13 December 2016 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.

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
PO Box 6182
Kingston ACT 2604

Phone: +61 2 6210 4701
Fax: +61 2 6210 4721
Email: enquiries@apvma.gov.au

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

Further information

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

Further information on Public Release Summaries can be found on the APVMA website at www.apvma.gov.au.

1 INTRODUCTION

1.1 Applicant

Adama Australia Pty Limited.

1.2 Details of the product

It is proposed to register Cormoran Insecticide, containing 100 g/L novaluron and 80 g/L acetamiprid, as an emulsifiable concentrate for the control of apple dimpling bug (*campylomma leibknechti*) and plague thrips (*thrips imaginis*) in apples and longtailed mealybug (*pseudococcus longispinus*), Tuber Mealy bug (*pseudococcus viburni*), light brown apple moth (*epiphyas postvittana*) and codling moth (*cydia pomonella*) in apples and pears.

One application of Cormoran Insecticide be made to apples and two applications to pears, at a maximum concentration of 70 ml product/100 L (7 g novaluron/100 L and 5.6 g acetamiprid/100 L), or a maximum application rate of 1.4 L product/ha (140 g novaluron/ha and 112 g acetamiprid/ha).

Acetamiprid is an existing active constituent and is currently included in 9 registered products in Australia.

While there are existing approvals for the active constituent novaluron, Cormoran Insecticide is the first product containing novaluron to be introduced to the Australian market. This public release summary will focus on the evaluation of novaluron in the product Cormoran Insecticide. This publication provides a summary of the data reviewed and an outline of the regulatory considerations for the proposed registration.

The active constituent novaluron belongs to the benzoyl urea insect growth regulator chemical family (group 15 insecticides), which inhibit chitin biosynthesis. There are currently 40 other insecticides with active constituents from this chemical family registered in Australia.

Both novaluron and Cormoran Insecticide will be manufactured and formulated overseas. Cormoran Insecticide will be available in 1 L to 110 L high density polyethylene (HDPE) containers.

1.3 Overseas registrations

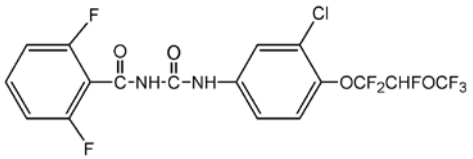
Novaluron 100 g/L as a combination emulsifiable concentrate formulation with 80 g/L acetamiprid is currently registered for use in Argentina, Chile, Colombia, Ecuador, Honduras, Indonesia, Israel, South Korea, Panama, Peru, Dominican Republic, South Africa, Turkey and Uruguay.

2 CHEMISTRY AND MANUFACTURE

2.1 Active constituent

Table 1 and 2 summarise key properties of the chemical novaluron.

Table 1: Nomenclature, chemistry and key identifiers of the active constituent novaluron

COMMON NAME (ISO):	Novaluron
IUPAC NAME:	(±)-1-[3-chloro-4-(1,1,2-trifluoro-2-trifluoromethoxyethoxy) phenyl]-3-(2,6-difluorobenzoyl)urea
CAS REGISTRY NUMBER:	(±)-*N*-[[[3-chloro-4-[1,1,2-trifluoro-2-(trifluoromethoxy) ethoxy]phenyl]amino]-carbonyl]-2,6-difluorobenzamide
MOLECULAR FORMULA:	$C_{17}H_9ClF_8N_2O_4$
MOLECULAR WEIGHT:	492.77
STRUCTURAL FORMULA:	
CHEMICAL FAMILY:	Benzoyl urea insect growth regulator

Physico-chemical properties of active constituent

Table 2: Summary of key physio-chemical properties of the active constituent Novaluron

PHYSICAL FORM:	Solid with pale pink to white colour	
ODOUR:	None detectable	
MELTING POINT:	176.5 to 178 ˚C	
RELATIVE DENSITY AT 22^{O}C:	1.56	
VAPOUR PRESSURE:	1.6×10^{-5} Pa at 25 °C	
OCTANOL-WATER PARTITION COEFFICIENT:	Log P_{OW} = 4.3	
SOLUBILITY IN WATER:	3 µg/L at 20 °C	
SOLUBILITY IN SOLVENTS:	*n*-Heptane	8.39 mg/L
	Xylene	1.88 g/L
	1,2-Dichloroethane	2.85 g/L
	Methanol	14.5 g/L
	Acetone	198 g/L
	Ethyl acetate	113 g/L
	n-Octanol	0.98 g/L
STABILITY:	Stable at 54°C for 2 weeks	

2.2 Formulated product

The product Cormoran Insecticide will be manufactured and formulated overseas and imported into Australia in HDPE containers.

Table 3: Key aspects of the identity of the product Cormoran Insecticide

[PRODUCT NAME] DISTINGUISHING NAME:	Cormoran Insecticide
FORMULATION TYPE:	Emulsifiable Concentrate (EC)
ACTIVE CONSTITUENT CONCENTRATIONS:	Novaluron at 100 g/L Acetamiprid at 80 g/L

Physical and chemical properties of product

Table 4: Summary of key physico-chemical parameters of the Cormoran Insecticide

PHYSICAL FORM:	Yellowish brown liquid
ODOUR:	Pungent odour
$_{P}$H VALUE:	2.8 at 21°C
SPECIFIC GRAVITY:	1.10 at 22°C
VISCOSITY:	73.2 cP at 21°C
FLASH POINT:	110°C
OXIDISING PROPERTIES:	Not oxidising
EXPLOSIVE PROPERTIES:	Not explosive
FLAMMABILITY:	Flammable at 110°C
CORROSIVE HAZARD:	Non corrosive to aluminium and polyethylene; Slightly corrosive to zinc and copper

2.3 Recommendations

The APVMA has previously evaluated the chemistry aspects of novaluron active constituent and found them to be acceptable. The established standard for novaluron active constituent can be viewed on the APVMA website at apvma.gov.au/node/2566.

The APVMA has reviewed the chemistry and manufacturing details provided under this current application (manufacturing process, quality control procedures, stability, batch analysis results and analytical methods) and registration of the product Cormoran Insecticide is supported.

3 TOXICOLOGICAL ASSESSMENT

3.1 Evaluation of toxicology

The product Cormoran Insecticide contains two active constituents, novaluron (100 g/L) and acetamiprid (80 g/L). The following summary focuses on the toxicity of novaluron with additional information on the toxicity of Cormoran Insecticide.

The toxicology of novaluron has been previously considered by the APVMA when the active constituent was first submitted for approval in Australia in 2000. The toxicity database for novaluron is extensive and consists primarily of toxicity studies conducted in laboratory animals.

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 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. Such dose levels as the NOEL are used to develop acceptable limits for dietary or other intakes (Acceptable Daily Intake (ADI) and Acute Reference Dose (ARfD)) at which no adverse effects in humans would be expected.

Chemical class

Novaluron is a benzoyl urea insect growth regulator and has a similar chemical structure to lufenuron, hexaflumuron and diflubenzuron. Its primary insecticidal mode of action is inhibiting chitin synthesis, thereby preventing the formation of insect cuticles.

Toxicokinetics and metabolism

Based on biliary and urinary excretion and tissue residues in rats given gavage doses (2 or 1000 mg/kg bw), absorption of radiolabelled novaluron was low (approx. 20%) and decreased as dose was increased. Maximum blood and plasma concentrations of novaluron were observed between 2 and 8 hours after dosing. Fat contained the highest concentrations of radioactive metabolites and liver, kidney, pancreas, adrenals, ovaries, epididymis and lymph nodes also contained some radioactivity 7 days after dosing. After a 500–fold increase in dose, tissue concentrations were increased by 50 to 90–fold. After repeat-doses, tissue concentrations were increased by 3 to 5-fold. A half-life for depletion of radioactivity in fat was estimated as 52–56 hours. Unchanged novaluron was the major compound present in faeces, fat, liver and kidneys. The major route of elimination of novaluron was via the faeces, with urinary and biliary excretion representing only minor routes of elimination.

Dermal absorption

An *in vitro* dermal absorption study using human epidermal membranes with a surrogate suspension concentrate (SC) formulation and a surrogate emulsifiable concentrate (EC) formulation of novaluron, was submitted for consideration under this current application.

This study demonstrated dermal absorption of 1% and 22.4% for SC formulations containing 98.4 g/L and 0.032 g/L novaluron, respectively. While dermal absorption of 0.7% for an EC formulation containing 92.8 g/L novaluron and 4.7% for 0.027 g/L novaluron was observed. For the purposes of estimating exposure during mixing/loading operations and post-application activities with the product, a dermal absorption factor of 0.7% was used, whereas for exposure during product application, a dermal absorption factor of 4.7% was used.

Toxicity of novaluron

Acute dose toxicity studies

Novaluron has low acute oral toxicity (LD_{50} >5000 mg/kg) in both rats and mice and low acute dermal (LD_{50} >2000 mg/kg) and acute inhalational (LC_{50} >5000 mg/m^3) toxicity in rats. It was not a skin or eye irritant in rabbits or a skin sensitiser in guinea-pigs.

Short-term studies

In mice fed novaluron at dietary concentrations of 0, 50, 100, 1000 or 7000 ppm (7.3/9.0, 15/19, 151/173, 1237/1279 mg/kg bw/d M/F) for 4 weeks, bodyweight gain and food consumption were higher in males at 7000 ppm. Mean Corpuscular Haemoglobin Concentration (MCHC) was decreased in females at all tested doses. The Lowest Observed Effect Level (LOEL) was 50 ppm, due to this decreased MCHC in females.

In rats treated with novaluron dermally at 0, 10, 30 or 100 mg/kg bw/d for 14 days, the only treatment-related changes observed were higher bodyweights and food conversion efficiencies in males at 100 m g/kg bw/d and in all groups of treated females.

In rats treated with novaluron dermally at 0, 75, 400 or 1000 mg/kg bw/d for 28 days. Higher methaemoglobin was observed at 400 (females only) and 1000 mg/kg bw/d (both sexes). The NOEL was 75 mg/kg bw/d due to the increased methaemoglobin levels in females at 400 mg/kg bw/d.

Subchronic Studies

In mice fed novaluron at dietary concentrations of 0, 30, 100, 1000 or 10000 ppm for 13 weeks, spleens were swollen and spleen weights were higher at 1000 and 10000 ppm and the incidence of periacinar hypertrophy in the liver was higher in males at 1000 and 10000 ppm. All parameters were similar in control and treated groups at the end of an 8–week recovery period. The NOEL was 30 ppm, equal to 4.2 mg/kg bw/d in males and 4.7 mg/kg bw/d in females.

In a 13–week repeat-dose study in rats, novaluron was administered in the diet at concentrations of 50, 100, 200 and 400 ppm (equivalent to 2.5–20 mg/kg bw/d). There were no deaths related to treatment. In females slight anaemia was observed, indicated by dose-related decreases in Red Blood Cells (RBCs) at 200–400 ppm at 7 weeks and 100–400 ppm at 14 weeks, and non-dose-related decreases in haemoglobin

and haematocrit levels. Serum glucose levels were elevated in both males and females at 200 and 400 ppm. The NOEL was 50 ppm (equivalent to 2.5 mg/kg bw/d).

In rats fed novaluron at dietary concentrations of 0, 50, 100, 10000 or 20000 ppm for 13 weeks, bodyweight gain was higher at 10000 and 20000 ppm. The incidence and severity of extramedullary erythropoiesis in the spleen was higher in all treated groups and haemosiderosis in the spleen was higher in males at 10000 and 20000 ppm and all treated groups of females. The incidence of pigmented kupffer cells in the liver was higher in females at 10000 and 20000 ppm and the incidence of extramedullary haematopoiesis in the liver was slightly higher in females at 10000 ppm. At the end of the 4–week recovery period spleen weight remained higher and haemosiderosis persisted in the spleen of females at 20000 ppm. No NOEL could be set in this study due to higher plasma bilirubin and histopathological changes in the spleen of all treated groups. The LOEL was 50 ppm (equal to 4.2 mg/kg bw/d in males and 4.7 mg/kg bw/d in females).

In dogs given novaluron in capsules at doses of 0, 100, 300 or 1000 mg/kg bw/d for 13 weeks, haemoglobin and RBC were lower in males at 1000 mg/kg bw/d and in females at 300 and 1000 mg/kg bw/d. MCHC was lower in all treated groups and Mean Corpuscular Volume (MCV) was higher at 300 and 1000 mg/kg bw/d. Methaemoglobin concentrations were higher at 300 and 1000 mg/kg bw/d and the incidence of Heinz bodies and reticulocyte counts were higher in all treated groups. Plasma bilirubin, the incidence and severity of pigmented kupffer cells in the liver and spleen weights were higher in all treated groups. All parameters were similar in control and treated groups at the end of the 4–week recovery period. The LOEL was 100 mg/kg bw/d.

Dogs were given novaluron in capsules at a dose of 10 mg/kg bw/d for 13 weeks. Based on a comparison with results from the previous study, the changes observed in organ weights, gross morphology and histopathology were not likely to be treatment-related. The only change was a higher reticulocyte count in females. A NOEL was not established.

Chronic/Oncogenicity Studies

In mice fed novaluron at dietary concentrations of 0, 30, 450 or 7000 ppm for 78 weeks, bodyweight gain was transiently higher in males at 450 and 7000 ppm and females at 450 ppm. Bodyweight gain was higher throughout the study in females at 7000 ppm. Haematocrit, haemoglobin (Hb) and RBC were lower at 450 and 7000 ppm and Mean Corpuscular Haemoglobin (MCH) was slightly higher in females at 7000 ppm. Reticulocyte counts were higher and an increased incidence and severity of Heinz bodies and “extruded bodies” and high sulphaemoglobin concentrations were observed at 450 and 7000 ppm. Liver weight was higher in females at 7000 ppm and spleen weight was higher in females at 450 and 7000 ppm. A higher incidence of swollen spleen and increased haemosiderosis, haemopoiesis and congestion in the spleen were observed at 450 and 7000 ppm. A higher incidence of extramedullary haemopoiesis in the liver was observed in females at 450 and 7000 ppm and the incidence of pigmented kupffer cells in the liver was increased at 7000 ppm. Pigmentation in the cortical tubules of the kidney was increased in incidence in females at 450 and 7000 ppm. The NOEL was 30 ppm, equal to 3.6 mg/kg bw/d in males and 4.3 mg/kg bw/d in females.

In rats fed novaluron at dietary concentrations of 0, 25, 700 or 20000 ppm for 104 weeks, bodyweight gains were transiently higher at 700 and 20000 ppm. Haematocrit, haemoglobin, RBC, MCH, MCHC and MCV were lower and reticulocyte counts were higher at 700 and 20000 ppm in females and at 20000 ppm in males. Methaemoglobin concentrations were higher in both sexes at 700 and 20000 ppm and platelet counts were slightly higher in females at 700 and 20000 ppm. An increased incidence of Heinz bodies and Howell-Jolly bodies was observed at 20000 ppm. Spleen weights were higher in males at 20 000 ppm and in females at 700 and 20000 ppm. The incidence of pigmented cortical tubules in the kidney was higher at 700 and 20000 ppm and the incidence of pigmented kupffer cells was higher in females at 20000 ppm. The incidence and/or severity of haemosiderosis in the spleen was higher at 700 and 20000 ppm. The NOEL was 25 ppm, equal to 1.1 mg/kg bw/d in males and 1.4 mg/kg bw/d in females.

In dogs given novaluron by capsule at doses of 10, 100 or 1000 mg/kg bw/d for 52 weeks the following were observed in all treatment groups. Bodyweight gain was higher at 1000 mg/kg bw/d, haemoglobin, RBC and MCHC were lower and methaemoglobin and MCV were higher at 100 and 1000 mg/kg bw/d. An increased incidence of cellular aggregates containing brown pigment in the liver was observed at 100 and 1000 mg/kg bw/d. A higher incidence of engorged sinusoids in the spleen was observed in males at 1000 mg/kg bw/d and in females at 100 and 1000 mg/kg bw/d. An increased severity of red pulp congestion in the spleen and haemosiderosis in kupffer cells in the liver was observed at 100 and 1000 mg/kg bw/d. A NOEL could not be established in this study due to histopathological and haematological effects of treatment at the lowest dose tested. The LOEL was 10 mg/kg bw/d.

Genotoxicity

Novaluron was negative for point mutation *in vitro* in the Ames test at concentrations of 10–3333 µg/plate, was not mutagenic in the mouse lymphoma TK locus assay at 50–200 µg/mL or on unscheduled DNA synthesis repair in HeLa S3 epithelioid cells at concentrations of 0.125–256 µg/mL. Novaluron was not clastogenic *in vitro* in cultured human lymphocytes at concentrations of 40–1000 µg/mL or *in vivo* in the mouse micronucleus test at doses of 1250, 2500 and 5000 mg/kg bw.

Reproductive and developmental toxicity

In rats fed novaluron at dietary concentrations of 0, 1000, 4000 or 12000 ppm for two successive generations, bodyweight gains in adults were slightly higher during gestation but pups were not affected. Higher organ weights were observed at all tested doses, however, there was no effect of treatment on fertility and reproduction. The NOEL for reproduction was 12000 ppm, equal to 1039 mg/kg bw/d in males and 1158 mg/kg bw/d in females.

In a preliminary developmental toxicity study, novaluron was administered to pregnant rats by oral gavage at doses of 0, 250, 500 or 1000 mg/kg bw/d on gestation days 6–15. There were no mortalities and no effect of treatment on bodyweight and food consumption of dams. There was no effect of treatment on foetal and placental weights and macroscopic examination did not reveal any findings related to treatment. The NOEL was 1000 mg/kg bw.

Novaluron was administered to pregnant rabbits by oral gavage at doses of 0, 100, 300 or 1000 mg/kg bw/day on gestation days 6–19. After treatment had ceased, bodyweight gain of does at 1000 mg/kg bw/d was lower than controls during days 20–28, but there was no effect of treatment on bodyweight gain during the treatment period (days 6-19) or during the overall period from day 6 to day 28. In foetuses, there were no external or visceral abnormalities related to treatment. The NOEL for both maternal and foetal toxicity was 1000 mg/kg bw/d.

Novaluron was not considered to be a developmental toxicant in these species.

Neurotoxicity

No neurotoxicity was observed in rats administered single oral (gavage) doses of novaluron up to 2000 mg/kg bw.

Toxicity of Cormoran Insecticide

Cormoran Insecticide has low acute oral (LD_{50} >300 (no deaths, no clinical signs of toxicity) < 2000 mg/kg) and dermal (LD_{50} > 2000 mg/kg (no deaths, no clinical signs of toxicity)) toxicity in rats. The product has low inhalation toxicity in rats (LC_{50} > 1610 mg/m^3, maximum achievable concentration (MAC), no deaths). It is not a skin-irritant but is a severe eye irritant and a skin sensitiser in guinea pigs.

3.2 Public health standards

Poisons scheduling of novaluron and acetamiprid

Novaluron is included in Appendix B, Part 3 of the SUSMP as an agricultural substance considered not to require control by scheduling due to its low toxicity.

Acetamiprid is in Schedule 6 of the Standard for the Uniform Scheduling of Medicines and Poisons SUSMP except in preparations containing 1% or less of acetamiprid.

Cormoran Insecticide containing 100 g/L novaluron and 80 g/L (8% (w/v)) acetamiprid is therefore included in Schedule 6.

No Observable Effect Level (NOEL)/Acceptable Daily Intake (ADI)

The ADI is that quantity of a compound which can safely be consumed on a daily basis for a lifetime and is based on the lowest NOEL obtained in the most sensitive species. This NOEL is then divided by a safety (uncertainty) factor which reflects the quality of the toxicological database and takes into account the variability in responses between species and individuals.

The ADI for novaluron was established in 2001 at 0.01 mg/kg bw/d based on a NOEL of 1.1 mg/kg bw/d in a 2–year rat study using a safety (uncertainty) factor of 100. The NOEL was selected on the basis of findings of haematological change, increased spleen weight and haemosiderosis in the spleen at the next highest dose of 700 ppm (equal to 31 mg/kg bw/d).

The ADI for acetamiprid was established in 2001 at 0.1 mg/kg bw/d based on a NOEL of 9 mg/kg bw/d in a 2–year rat dietary study using a safety (uncertainty) factor of 100. The NOEL was based on decreased bodyweight gains and food consumption and increased incidence of hepatocellular hypertrophy and vacuolation at the next highest dose of 23 mg/kg bw/d.

Acute Reference Dose (ARfD)

The ARfD is the maximum quantity of a chemical that can safely be consumed as a single, isolated, event. The ARfD is derived from the lowest single or short term dose which causes no effect in the most sensitive species of experimental animal tested, together with a safety (uncertainty) factor which reflects the quality of the toxicological database and takes into account the variability in responses between species and individuals.

Novaluron has low toxicity following single dose and short-term administration in animals, including studies on developmental toxicity. Therefore, it is considered that an ARfD is not necessary.

The ARfD for acetamiprid was established in 2001 at 0.1 mg/kg bw, based on a NOEL of 10 mg/kg bw in a single-dose (gavage) neurotoxicity study in rats with the reduction of locomotor activity at the next highest dose of 30 mg/kg bw and using a 100–fold safety (uncertainty) factor.

4 RESIDUES ASSESSMENT

4.1 Introduction

Cormoran Insecticide contains the active constituent novaluron and acetamiprid (see section 2.1) for use on apples and pears. The proposed use is described in section 1.2.

A harvest withholding period of 'Do Not Harvest for 70 days after application' is proposed for apples and 'Do Not Harvest for 35 days after application' is proposed for pears.

The following restraint is proposed:

- DO NOT graze any treated area or cut for stockfood.

4.2 Metabolism

Available studies examining the metabolism of difluorophenyl-^{14}C- or chlorophenyl-^{14}C-novaluron in apples, cabbages, potatoes and cotton following foliar application, and in goats and hens following oral ingestion, are summarised in the 2005 JMPR evaluation.

Plants

In apples, two or three applications were made to trees at a rate of 2.5–2.7 mg/tree/application. The applications were made 110 days, 90 days and 60 days (3 applications only) before harvest. TRRs were 0.03–0.04 mg/kg in fruit 60 days after the third application. Novaluron comprised >90% TRR in all fruit samples from all applications and sampling intervals.

In cabbage, two applications (either 8 or 6 weeks before harvest or 5 and 2 weeks before harvest) were made at 30–45 g a.i/ha. TRRs were 0.23–0.35 mg/kg for the 6 weeks PHI application and 0.32–0.45 mg/kg for the 2 week PHI application. An acetonitrile wash removed 81–90% of the TRR at final harvest. Acetonitrile/water extraction released an additional 9-15% TRR, the majority of which was on the outer cabbage leaves. 96–100% of the TRR on cabbage heads at final harvest was identified as novaluron.

In potatoes, two applications (43 and 29 days before harvest) were made at 91–100 g a.i/ha. Whole plant samples were taken after the last application and also at 22, 10 and 0 days before harvest. For both radiolabels, the TRR on tubers at all intervals was <0.001 mg/kg. At harvest (29 days after the second application) the TRR on plants was 9.9 mg/kg for the [difluorophenyl-^{14}C] and 5.9 mg/kg for the [chlorophenyl -^{14}C] novaluron. An acetonitrile wash removed 82% of the TRR and an acetonitrile /water extraction released an additional 17% TRR. Novaluron comprised 97% of the TRR for both labelled compounds.

In cotton, two treatment regimes were used; regime 1 consisted of two applications, 14 days apart with a 90 day PHI and regime 2 consisted of two applications 14 days apart with a 30 day PHI. Samples from plants treated according to regime 1 were taken for analysis after each application and at 60 and 30 days before normal harvest. The maximum TRR on undelinted seed (for both treatment regimes) was 0.005 mg/kg and no isolation or characterisation was attempted. The TRR on cotton gin trash at harvest were 0.27–0.29 mg/kg for the 90 day PHI treatment and 0.77–0.85 mg/kg for the 30 days PHI treatment. Acetonitrile extraction released 91–97% TRR for the various final harvest gin trashes. Novaluron constituted 88–95% TRR.

For rotational crops, one application of [chlorophenyl -^{14}C] novaluron was made to bare soil at 100 g ai/ha. Following a 30 or 120 day plant back interval, spinach, turnips and spring wheat were planted. At the 30 day plantback interval, all crops contained only very low levels of TRR (0.001-0.004 mg/kg). Novaluron in soil declined from 98–99% of the TRR on the day of application to 32–49% TRR at final harvest (127–195 days after application). Degradates identified in soil at final harvest were 1-[3-chloro-4-(1,1,2-trifluoro-2-trifluoromethoxyethoxy) phenylurea (10-14% TRR) and 3-chloro-4(1,1,2-trifluoro-2-trifluoromethoxyethoxy) analine (21–30% TRR).

Animals

In lactating goats, novaluron was administered at 11–12 ppm in the feed (12.3 & 10.6 mg/kg bw) for 5 consecutive days. The majority of the dose was eliminated within 48 hrs. Faeces accounted for 52 or 76% of administered TRR (difluorophenyl-^{14}C- and chlorophenyl-^{14}C-novaluron respectively. Parent compound accounted for ~90% of the TRR in faeces, however it was not a major component of the TRR in urine. Novaluron underwent limited metabolism to 2,6-difluorobenzoic acid and 1-[3-chloro-4-(1,1,2-trifluoro-2-trifluoro methoxyethoxy)phenyl]urea, each at <10% TRR. Parent novaluron was the only residue identified in milk at 83–96% TRR, in peritoneal fat at 99% TRR and in foreleg muscle at 98% TRR. It was also the major residue in kidney and liver at 73–83% TRR and 80–84 % TRR respectively. Of the parent in milk, 68–73% was associated with the fat soluble component and 10–28% with the aqueous component.

In laying hens, difluorophenyl-14C-novaluron was administered orally to five laying hens for fourteen consecutive days at a nominal rate of 10 ppm in the diet. Novaluron was the only TRR component detected and identified, accounting for 90–107% of the TRR.

4.3 Analytical methods

Residues of novaluron were determined in apples and pears using either a LC-MS/MS method (Australia) or a GC-ECD method (Europe). The limits of quantitation for novaluron were 0.01 and 0.05 mg/kg respectively. Residues of novaluron were determined in various animal commodities (milk, skimmed milk, cream, muscle, kidney, liver, subcutaneous and peritoneal fats) using a GC-ECD method. The limit of quantitation was 0.01 mg/kg for novaluron.

Residues of acetamiprid were determined in apples and pears in Australia and Europe using a LC-MS/MS method. In both cases the limit of quantitation for acetamiprid was 0.01 mg/kg.

4.4 Stability of the pesticide in stored analytical samples

Residue stability in stored analytical samples for novaluron was investigated for a range of representative substrates (JMPR 2005). The following minimum intervals of frozen storage stability were determined: apple 12 months, pear fruit 158 days, apple juice 99 days, potato 12 months, undelinted cotton seed 160 days, broccoli 6 months, tomato 12 months and orange processed fractions 8 months.

No storage stability data was submitted with the application. Samples in all trials were stored for less than six months.

4.5 Residue definition

A residue definition for novaluron of parent only is already established and is considered appropriate for both enforcement and dietary risk assessment for both plants and animals.

4.6 Residue trials

A number of relevant residues studies have been submitted for apples and pears. Trials were carried out in Australia at two sites (one in Victoria and one in Queensland) during the 2012 growing season to determine the residues of acetamiprid and novaluron after 80 g/L acetamiprid and 100 g/L novaluron EC formulation was applied three (21 days apart) or four (14 days apart) times to apples at 70 mL/100 L (7 g novaluron/ 100 L and 5.6 g acetamiprid/100 L) (high volume application). Other trials were carried out in Australia at four sites each (five in Victoria and three in Queensland) during the 2013 growing season to determine the residues of acetamiprid and novaluron after CMT 2010 (80 g/L acetamiprid and 100 g/L novaluron EC formulation) was applied four times to apples or pears at nominal rates of 70 mL/100L (7 g novaluron/100 L and 5.6 g acetamiprid/100 L) or 140 mL/100 L (14 g novaluron/100 L and 11.2 g acetamiprid/100 L) (high volume application).

Supportive residues data from Europe was also submitted for both novaluron (twelve apple trials, two pear trials) and acetamiprid (five apple trials).

Based on the supplied residues data (highest observed residues in acetamiprid and novaluron of 0.12 and 0.18 mg/kg respectively), MRLs of 0.3 mg/kg are recommended for both acetamiprid and novaluron on pears (FP 0230).

Based on the supplied residues data (highest observed residues in acetamiprid and novaluron of 0.11 and 0.15 mg/kg respectively), MRLs of 0.2 and 0.3 mg/kg are recommended for acetamiprid and novaluron respectively on apples (FP 0226).

Please refer to **Table 5: Proposed amendments to MRL Standard Table 1—MRLs of agricultural and veterinary chemicals and associated substances in food commodities.**

4.7 Animal feeds

Processing into apple pomace (an animal feed commodity) was not performed. Calculations were performed for acetamiprid and novaluron based on the recorded percentage juice yield which assumed that all of the active constituents partitioned into apple pomace. The best estimate processing factors for dry pomace for acetamiprid and novaluron were both estimated to be 6.5. Acetamiprid and novaluron MRLs of 1 mg/kg were considered appropriate to cover residues in dry apple pomace (AB 0226 Apple pomace, dry).

Please refer to **Table 6: Proposed amendments to MRL Standard Table 4—MRLs for pesticides in animal feed commodities.**

4.8 Animal commodity MRLs

For novaluron a dairy cattle feeding study was submitted showing the residues of novaluron in milk and tissues after oral administration for 42–44 days at concentrations in the feed of 0, 0.35, 2.6, 8.0 and 26 ppm. A beef cattle feeding study was submitted showing the residues of novaluron in tissues after oral administration for 28 days at concentrations in the feed of 5 ppm in the feed.

The estimated maximum dietary burdens of novaluron for beef and dairy cattle resulting from the proposed uses were calculated to be 0.026 and 0.013 ppm in the feed respectively (after extrapolation of observed residues in apples at 42 or 56 day harvest WHPs to expected residues at a 70 day harvest WHP).

Novaluron MRLs for MO 0105 Edible offal (Mammalian) at *0.01 mg/kg, MM 0095 Meat [mammalian] [in the fat] at 0.1 mg/kg and ML 0106 Milks at *0.01 mg/kg are required for the proposed use on apples with a 70 day harvest withholding period.

Residues are concentrated in cream, reflecting the fat solubility of novaluron. Consequently a novaluron MRL for milk fats set at 0.2 mg/kg was considered to be appropriate for the proposed use.

No poultry feeding study was submitted. Although commodities from apples and pears are not fed to poultry, novaluron poultry commodity MRLs for PE 0112 Eggs, PO 0111 Poultry, edible offal of and PM 0110 Poultry, meat [in the fat] will be established at the LOQ (*0.01 mg/kg).

The estimated maximum dietary burdens of acetamiprid for beef and dairy cattle resulting from the proposed uses and also considering currently registered uses were calculated to be 0.117 and 0.081 ppm respectively. No changes to the animal commodity MRLs for acetamiprid were considered necessary and no further consideration is necessary at this time.

4.9 Bioaccumulation potential

The octanol-water partition coefficient (log10KOW) for novaluron is 4.3, indicating a high potential for fat solubility. The novaluron dairy cattle feeding study suggests that novaluron is fat soluble as residues concentrated in subcutaneous and peritoneal fat in comparison with muscle, while residues concentrated in cream in comparison with milk. The novaluron beef cattle feeding study similarly showed that residues concentrated in fat in comparison with muscle. Animal commodity MRLs for novaluron will be established ‘in the fat’.

4.10 Spray drift

Animal commodity MRLs for novaluron have not been established by some overseas markets including Korea and Taiwan and therefore novaluron residues in animal commodities must be below the LOQ for 0.01 mg/kg for the protection of international trade.

Spray drift modelling, using the average deposition (over 300m) from APVMA spray drift standard application scenarios, shows that with respect to no-spray zones (using an application rate of 140 g ai/ha), for a ‘AgDRIFT for airblast—apples’ application, a downwind buffer zone of 30 m is required.

Animal commodity MRLs for acetamiprid have not been established by some overseas markets and therefore acetamiprid residues in animal commodities must be below the LOQ for 0.01 mg/kg for the protection of international trade.

Spray drift modelling, using the average deposition (over 300 m) from APVMA spray drift standard application scenarios, shows that with respect to no-spray zones (using an application rate of 112 g ai/ha), for a ‘composite orchard airblast scenario’ application, a downwind buffer zone is not required.

4.11 Residues in rotational crops

Apples and pears are not considered to be rotational crops. It is not necessary to consider crop rotation with respect to this application.

4.12 Estimated dietary intake

The chronic dietary exposure 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 1995 National Nutrition Survey of Australia. 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 novaluron is equivalent to <20 % of the ADI. The NEDI for acetamiprid is equivalent to <5% of the ADI. It is concluded that the chronic dietary exposure to novaluron and acetamiprid 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 1995 National Nutrition Survey of Australia. NESTI calculations are conservative estimates of short-term exposure (24 hour period) to chemical residues in food. The highest acute dietary intake for acetamiprid was estimated at <15 % of the ARfD. It is concluded that the acute dietary exposure of acetamiprid is acceptable.

There is no ARfD established for novaluron by the OCS or JMPR.

4.13 Recommendations

The following amendments (Tables 6–8) are proposed to the food commodities, residue definitions, and animal feed commodities (Tables 1, 3 and 4 respectively of the APVMA MRL Standard).

Table 5: Proposed amendments to MRL Standard Table 1–MRLs of agricultural and veterinary chemicals and associated substances in food commodities

COMPOUND		FOOD	MRL (mg/kg)
ACETAMIPRID			
DELETE:			
FP	0009	Pome fruit	T0.5
ADD:			
FP	0226	Apple	0.2
FP	0230	Pear	0.3
NOVALURON			
DELETE:			
FP	0009	Pome fruit	T1
ADD:			
FP	0226	Apple	0.3
MO	0105	Edible offal (Mammalian)	*0.01
PE	0112	Eggs	*0.01
MM	0095	Meat (mammalian) [in the fat]	0.1
FM	0183	Milk fats	0.2
ML	0106	Milks	*0.01
FP	0230	Pear	0.3
PO	0111	Poultry, edible offal of	*0.01
PM	0110	Poultry meat [in the fat]	*0.01

Table 6: Proposed amendments to MRL Standard Table 4–MRLs for pesticides in animal feed commodities

COMPOUND		ANIMAL FEED COMMODITY	MRL (mg/kg)
ACETAMIPRID			
ADD:			
AB	0226	Apple pomace, dry	1

5 ASSESSMENT OF OVERSEAS TRADE ASPECTS OF RESIDUES IN FOOD

5.1 Commodities exported

Apples and pears are considered to be major export commodities[2], as are commodities of animal origin, such as meat, offal and dairy products, which may be derived from livestock fed treated apple pomace. Residues in these commodities resulting from the use of Cormoran Insecticide may have the potential to unduly prejudice trade.

5.2 Destination and value of exports

Australian exports of apples totalled 2.1 kt (value $5.9 million) in 2014–15.[3] The Applicant indicated that the leading markets for Australian apples in 2013 were Papua New Guinea, UK, Malaysia and Thailand.

Australian exports of pears totalled 7.6 kt (value $12.5 million) in 2014–15. The Applicant indicated that the leading markets for Australian pears in 2013 were New Zealand, Indonesia and Canada.

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).

5.3 Proposed Australian use pattern

Cormoran Insecticide (100 g/L novaluron and 80 g/L acetamiprid)

CROP	PEST	RATE	CRITICAL COMMENTS
Apples	Apple Dimpling Bug (*Campylomma leibknechti*)	70 mL/ 100L (≡ 7 g novaluron/100 L and 5.6 g acetamiprid /100 L)	Apply a single application of Cormoran in apples targeting either: Apple dimpling bug, plague thrips and/or mealybugs from early post flowering; OR

[2] APVMA regulatory guidelines—data guidelines: agricultural—overseas trade (part 5B)

[3] Australian Commodity Statistics.

CROP	PEST	RATE	CRITICAL COMMENTS
	Plague Thrips (*Thrips imaginis*) Longtailed mealy bug (*Pseudococcus longispinus*) Tuber mealybug (*pseudococcus viburni*) Codling moth (*cydia pomonella*) Lightbrown apple moth (*epiphyas postvittana*)	or 1.4 L/ha (≡ 140 g novaluron/ha and 112 g acetamiprid /ha)	First generation codling moth and/or lightbrown apple moth Apply Cormoran in rotation with registered alternative mode of action insecticides. Refer to pest specific guidelines below **Apple dimpling bug and plague thrips** Apply an alternative mode of action product such as mavrik during flowering. Apply Cormoran after flowering to protect developing fruitlets from damage caused by apple dimpling bug and plague thrips. Monitor insect numbers and apply an alternative mode of action insecticide 5–7 days later if populations approach threshold numbers. under heavy plague thrips pressure, use an alternative registered insecticide such as mavrik. **Longtailed mealybug and tuber mealybug** Apply Cormoran as part of a spray program to prevent mealybugs from migrating into the calyx of the fruit where they are difficult to control. Early control of crawlers is very important. Monitor the crop and apply Cormoran as soon as crawlers are seen after petal fall. Apply a different mode of action insecticide 14 days later to maximise knockdown control. Some mealybugs sheltering in the canopy may not be adequately controlled and these survivors can multiply and infest developing fruit. Further applications of insecticides from other mode of action groups is recommended to ensure control of any surviving mealybugs. **Codling moth** Apply Cormoran as part of a season long codling moth management program including pest monitoring and targeted insecticide applications. Apply Cormoran targeting the first generation of codling moth, just prior to the generation egg hatch and before 110 degree days after codling moth are detected in traps. Apply further insecticide applications after 14 day interval using alternative mode of action insecticides. See application timing in general instructions for further detail. **Lightbrown apple moth** Monitor for lightbrown apple moth activity from late flowering using pheromone traps. Apply Cormoran after petal fall or 140 degree days after lightbrown apple moths are detected in traps. If required,

CROP	PEST	RATE	CRITICAL COMMENTS
			apply further insecticide applications after a 14 day interval using alternative mode of action insecticides. See Application timing in general instructions for further detail. **Application** Apply Cormoran as a dilute (high volume) spray ensuring thorough coverage of fruitlets and foliage. If the water volume will exceed 2000 L/ha, use the per hectare rate and adjust the dilute concentration accordingly. Concentrate spraying is not recommended when targeting mealybug as thorough coverage is critical for control. DO NOT apply more than one application of Cormoran per season in apples. DO NOT apply Cormoran at more than 1.4 L/ha.
Pears	Codling Moth (*Cydia pomonella*) Lightbrown apple moth (*Epiphyas postvittana*) Longtailed Mealy bug (*Pseudococcus longispinus*) Tuber Mealybug (*Pseudococcus viburni*)	70 mL/ 100L (≡ 7 g novaluron/100L and 5.6 g acetamiprid /100L) or 1.4 L/ha (≡ 140 g novaluron/ha and 112 g acetamiprid /ha)	Apply up to two applications of Cormoran per season in pears. Always apply Cormoran as part of a season long spray program in rotation with registered alternative mode of action insecticides. **Longtailed mealybug and tuber mealybug** Apply Cormoran as part of a spray program to prevent mealybugs from migrating into the calyx of the fruit where they are difficult to control. Early control of crawlers is very important. Monitor the crop and apply Cormoran as soon as crawlers are seen after petal fall. Apply a second spray 14 days later to maximise knockdown control. Some mealybugs sheltering in the canopy may not be adequately controlled and these survivors can multiply and infest developing fruit. Further applications of insecticides from other mode of action groups is recommended to ensure control of any surviving mealybugs. **Codling moth** Apply up to two sprays of Cormoran with a 14 day spray interval. Cormoran can be used to control the first generation or later generations of codling moth providing that pest monitoring is undertaken and the applications are timed just prior to a generation egg hatch. When targeting the first generation, the first spray should be applied just prior to the generation egg hatch and before 110 degree days after codling moth are detected in traps. See application timing

CROP	PEST	RATE	CRITICAL COMMENTS
			in general instructions for further detail. **Lightbrown apple moth** Monitor for lightbrown apple moth activity from late flowering by pheromone trapping. Apply Cormoran after petal fall or 140 degree days after lightbrown apple moth are detected in traps. If required, apply a second application after a 14 day interval. Additional treatments should be made using alternative modes of action insecticides. See application timing in general instructions for further detail. **Application** Apply Cormoran as a dilute (high volume) spray ensuring thorough coverage of fruitlets and foliage. If the water volume will exceed 2000 L/ha, use the per hectare rate and adjust the dilute concentration accordingly. Concentrate spraying is not recommended when targeting mealybug as thorough coverage is critical for control. DO NOT apply more than two applications of Cormoran per season in pears.

Restraints:
DO NOT apply Cormoran during flowering
DO NOT apply by aircraft

MANDATORY NO-SPRAY ZONES
DO NOT apply if there are livestock, pasture or any land that is producing feed for livestock downwind from the application area and within the mandatory no-spray zone shown below:

Wind speed range at time of application	Downwind mandatory no-spray zone
From 3 to 20 kilometres per hour	30 metres

Withholding periods:

Harvest:
Apples: DO NOT harvest for 70 days after application
Pears: DO NOT harvest for 35 days after application
Grazing: DO NOT graze any treated area or cut for stockfood

5.4 Overseas registration

The applicant indicated that Cormoran Insecticide is registered in Colombia, Argentina, South Korea, South Africa, Panama, Dominican Republic and Israel. Since the Australian application submission, new registrations have been completed in Chile, Ecuador, Honduras, Indonesia, Peru, Turkey and Uruguay.

5.5 Comparison of Australian MRLs with codex and international MRLs

The following relevant international MRLs have been established for novaluron:

Table 7: Current and proposed Australian and overseas MRLs/tolerances for novaluron

COMMODITY	TOLERANCE FOR RESIDUES ARISING FROM THE USE OF NOVALURON (mg/kg)						
	AUSTRALIA	EU	JAPAN	CODEX	USA	KOREA	TAIWAN
Residue definition	Novaluron	Novaluron	Novaluron	Novaluron (Residue is fat-soluble)	Novaluron including its metabolites and degradates		
Plant commodities							
Apple	0.3 (proposed)	2	3			1	2.0
Pear	0.3 (proposed)	3	3				2.0
Pome fruit	T1 (to be deleted)	*0.01 (Others)		3	2.0		
Animal commodities							
Cattle, meat byproducts, except kidney and liver					11		
Edible offal (mammalian)	*0.01 (proposed)	0.7	0.7 (various)	0.7	1.0 (kidney, liver)		
Eggs	*0.01 (proposed)	0.1	0.1	0.1	1.5		
Mammalian fats (except milk fats)	0.1 (proposed)	10	10 (various)	10 fat (other than marine mammals)	11 (cattle fat)		
Meat (mammalian)		10	0.7 (various)		0.60		

COMMODITY	TOLERANCE FOR RESIDUES ARISING FROM THE USE OF NOVALURON (mg/kg)						
	AUSTRALIA	EU	JAPAN	CODEX	USA	KOREA	TAIWAN
Milks	*0.01 (proposed)	0.4	0.4	0.4	1.0		
Milk fats	0.2 (proposed)			7	20		
Poultry, edible offal of	*0.01 (proposed)	0.1	0.1	0.1	0.80 (kidney, liver)		
Poultry, meat byproducts, except kidney and liver					7.0		
Poultry fat	*0.01 (proposed)	0.5	0.5		7.0		
Poultry meat		0.5	0.1	0.5 fat	0.40		

Table 8: Current and proposed Australian and overseas MRLs/tolerances for acetamiprid

COMMODITY	TOLERANCE FOR RESIDUES ARISING FROM THE USE OF ACETAMIPRID (mg/kg)					
	AUSTRALIA	EU	JAPAN	CODEX	USA	TAIWAN
Residue definition	Commodities of plant origin: Acetamiprid commodities of animal origin: sum of acetamiprid and N-demethyl acetamiprid ((E)-N1-[(6-chloro-3-pyridyl)methyl]-N2-cyanoacetamidine), expressed as acetamiprid	Acetamiprid	MRLs for acetamiprid are established for the sum of residues of acetamiprid and its metabolite IM-2-1(N1-[(6-chloro-3-pyridyl)methyl]-N2-cyano-acetamidine), calculated as acetamiprid on animal products, and for the sum of the residue of	For compliance with MRL for plant commodities and for estimation of dietary intake for plant and animal commodities): acetamiprid. Definition of the residue (for compliance with MRL for animal commodities and for estimation of dietary intake for plant and animal commodities): sum of acetamiprid and its desmethyl (IM-2-1) metabolite,	Acetamiprid including its metabolites and degradates	

COMMODITY	TOLERANCE FOR RESIDUES ARISING FROM THE USE OF ACETAMIPRID (mg/kg)					
	AUSTRALIA	EU	JAPAN	CODEX	USA	TAIWAN
			acetamiprid alone on other foods.	expressed as acetamiprid. The residue is not fat-soluble		
Plant commodities						
Apple	0.2 (proposed)		2			
Apple pomace, dry	1 (proposed)					
Pear	0.3 (proposed)		2			
Pome fruits	T0.5 (to be deleted)	0.8		0.8	1.0	1.0
Animal commodities						
Bovine kidney		0.2 (and sheep)				
Edible offal (mammalian)	*0.05		0.2 (various)	0.05	0.70 (Meat byproducts)	
Eggs	*0.01	*0.02	0.01	0.01	0.01	
Bovine liver		*0.1 (and sheep)				
Mammalian fats (except milk fats)		0.05 (cattle and sheep fat)	0.1	0.02	0.20	
Meat (mammalian)	*0.01	0.05 (cattle and sheep muscle)	0.1	0.02 (other than marine mammals)	0.30	
Milks	*0.01	0.05	0.1	0.02	0.30	
Poultry, edible	*0.05	*0.1	0.05	0.05	0.05 (liver)	

COMMODITY	TOLERANCE FOR RESIDUES ARISING FROM THE USE OF ACETAMIPRID (mg/kg)					
	AUSTRALIA	EU	JAPAN	CODEX	USA	TAIWAN
offal of		(liver and kidney)	(various)			
Poultry fat		*0.02			0.01	
Poultry meat	*0.01	*0.02	0.01	0.01	0.01	

5.6 Potential risk to trade

Apples and pears

Acetamiprid

The proposed MRL for acetamiprid in apples is 0.2 mg/kg and in pears is 0.3 mg/kg. It is noted that pome fruit MRLs set at higher levels are established in the EU and by Codex (both 0.8 mg/kg) and by the USA and Taiwan (both 1.0 mg/kg), while MRLs for apples and pears at 2 mg/kg are established in Japan.

Novaluron

The proposed MRLs for apples and pears are 0.3 mg/kg. It is noted that MRLs are established at higher levels in the EU (2 mg/kg for apples and 3 mg/kg for pears), Japan (3 mg/kg for both apples and pears), Codex (3 mg/kg for pome fruit), USA (2 mg/kg for pome fruit), Taiwan (2.0 mg/kg for apples and pears) and Korea (1 mg/kg for apples).

The applicant has proposed the following statements to mitigate the risk to trade in pome fruit:

CROPS FOR EXPORT

Before using Cormoran on crops destined for export it is essential to consult your exporter or Adama to ensure that an appropriate MRL is in place in the importing country.

Animal commodities

Acetamiprid

No changes to the established acetamiprid animal commodity MRLs were necessary. Therefore there is no change to the risk to trade through export of commodities of animal origin.

Novaluron

Since some export markets for Australian meat, such as Korea, Russia and Taiwan, do not have residue tolerances in place it is assumed that residues of novaluron in animal commodities exported to those markets must be non-detectable. The limit of quantitation (LOQ), assumed to be 0.01 mg/kg, is normally used as the threshold in these circumstances.

However it is noted that the proposed novaluron meat (mammalian) in the fat MRL (0.1 mg/kg) is significantly lower than established MRLs in the EU, Japan and by codex (10 mg/kg), while the USA has an MRL for cattle fat established at 11 mg/kg. Similarly the proposed novaluron MRL for milk fats (0.2 mg/kg) is lower than MRLs for codex (7 mg/kg) and the USA (20 mg/kg).

It is noted that the calculated maximum levels of residues are in all cases much lower than the proposed MRLs:

COMMODITY	HIGHEST PREDICTED RESIDUE—BEEF CATTLE FEEDING STUDY (mg/kg)	HIGHEST PREDICTED RESIDUE—DAIRY CATTLE FEEDING STUDY (mg/kg)	PROPOSED MRL
Meat (mammalian) [in the fat]	0.017	0.032 (subcutaneous fat), 0.042 (peritoneal fat)	0.1
Milk fats		0.083	0.2

It is also noted that the calculated residues of novaluron in apples, used to calculate estimated residues in apple pomace, were based on trials in which three or four applications were made at a 14 day retreatment interval, whereas the proposed use pattern allows one application only. Simple modelling of expected residues in apples at 70 days based on one application only and using mean observed residues in fats observed in the dairy cattle feeding study, rather than the highest observed residue, and highest mean residues in cream rather than the highest observation, gives the following predicted maximum residues in fats and milk fats.

COMMODITY	MEAN OBSERVED RESIDUES IN DAIRY CATTLE FEEDING STUDY (mg/kg)	HIGHEST PREDICTED RESIDUE BASED ON MEAN OBSERVED RESIDUES IN DAIRY CATTLE FEEDING STUDY (mg/kg).
Meat (mammalian) [in the fat]	0.30 (subcutaneous fat), 0.45 (peritoneal fat)	0.011 (subcutaneous fat), 0.017 (peritoneal fat)
Milk fats	0.94 (cream, 42 days)	0.035

In addition, the predicted maximum novaluron residues above are based on animal transfer data generated by continuous feeding of novaluron to beef cattle over a 28 day period or to dairy cattle over 42/44 days. Furthermore, the calculated processing factor for novaluron in apple pomace was based on the assumption that all of the novaluron in apples was transferred into the pomace.

Based on a half-life of 30 days in fat (beef and dairy cattle feeding studies) it would take one half-life for predicted residues in subcutaneous fat (0.011 mg/kg) and peritoneal fat (0.017 mg/kg), extrapolated from mean residues in fat from the dairy cattle feeding study and based on expected residues in apples after one application only to decrease to <0.01 mg/kg.

The Australian Lot Feeders' Association have confirmed that apple pomace is not known to be used in the feedlot industry and the Stock Feed Manufacturers' Council of Australia have stated that apple pomace is unlikely to be used by commercial feed manufacturers.

6 OCCUPATIONAL HEALTH AND SAFETY ASSESSMENT

6.1 Health hazards

Novaluron (CAS: 116714-46-6) is not listed in Safe Work Australia's (SWA) Hazardous Substances Information System (HSIS) database (SWA, 2015). Based on the available toxicology information, novaluron is not classified as a hazardous substance in accordance with NOHSC Approved Criteria for Classifying Hazardous Substances (NOHSC, 2004).

Based on the product toxicology information and/or concentrations of active constituents (novaluron and acetamiprid) and other constituents in the product, Cormoran Insecticide, is classified as a hazardous substance in accordance with NOHSC Approved Criteria for Classifying Hazardous Substances (NOHSC, 2004).

6.2 Formulation, packaging, transport, storage and retailing

The active constituent novaluron and the product Cormoran Insecticide will be manufactured and formulated overseas and imported into Australia and imported into Australia in HDPE containers. The product will be available in 1 L to 110 L pack sizes.

6.3 Use pattern

Cormoran Insecticide is intended to be used as a foliar treatment for pome fruit (apple and pear) for the control of various chewing and sucking insects (including apple dimpling bug, plague thrips, codling moth, light brown apple moth, long tailed mealy bug, tuber mealy bug).

The maximum amount of product to be used is 1.4 L/ha (140 g/L novaluron) on pome fruit up to a maximum treated area per day of 15 ha. Cormoran Insecticide may be applied by ground equipment, including air blast application, and may be applied by dilute or concentrate spraying techniques. The product is not to be applied by air. Excluding flowering, Cormoran Insecticide may be applied at any time through to fruit maturation depending upon pest pressure. The maximum number of applications of Cormoran Insecticide per season is limited to one application in apples and two in pears at a 14 day interval.

6.4 Exposure during use

Farmers and their employees will be the main users of the product. Workers may be exposed to the product when opening containers, diluting, mixing/loading, spraying it onto crops, and cleaning up spills, maintaining/cleaning equipment and re-entering treated areas. The main route of exposure to the product will be dermal and inhalational, with some ocular exposure considered possible.

In the absence of exposure data for the proposed mode of application, the US EPA Pesticide Handlers Exposure Database (PHED) Surrogate Exposure Guide (1998) was used to estimate potential worker exposure. The toxic endpoint of concern and identified NOEL was derived from a repeat dose study in animals, and in this instance a margin of exposure (MOE) of 100 or above is considered acceptable. The MOE takes into account potential interspecies and intra-species variation and the seriousness of the critical health effect of concern.

The MOE values associated with repeated use of Cormoran Insecticide when mixing and loading and for application by airblast are acceptable (*i.e.* ≥ 100) when wearing long pants and a long sleeved shirt (cotton overalls).

Bystander risk is possible, but is expected to be limited based on the proposed use pattern and crop targets. Potential routes of exposure for bystanders are dermal, inhalational and ocular during or immediately after a spraying event, while dermal exposure is the most likely route of exposure during re-entry situations. Adherence to good agricultural practice will minimise potential risks.

6.5 Exposure during re-entry

Occupational post application exposure is likely to occur through activities carried on sprayed areas upon re-entry. The most likely route of exposure upon re-entry is considered to be dermal. Post-application activities may include crop inspection, checking efficacy of control agent and timing for harvest.

The MOE estimate for workers re-entering treated areas to conduct all exposure activities is considered acceptable on day zero after treatment (i.e. MOE ≥ 100) for pome fruits. Therefore, it is expected that the risk associated with re-entry into areas where the product has been used according to the label instructions will be low.

As the re-entry risks associated with Cormoran Insecticide are considered to be low, a re-entry statement was not considered necessary.

6.6 Recommendations for safe use

Taking into consideration the potential toxicological hazard, use pattern and likelihood of handler exposure, the following first aid and safety directions are considered appropriate:

First Aid Instructions

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

Safety Directions

Harmful if swallowed. Will damage eyes. Repeated exposure may cause allergic disorders. Avoid contact with eyes and skin. When opening the container and preparing spray and using the prepared spray, wear cotton overalls buttoned to the neck and wrist (or equivalent clothing) and goggles. If product or spray in eyes, wash out immediately with water. Wash hands after use. After each day's use wash gloves, goggles and contaminated clothing.

6.7 Conclusion

The registration of Cormoran Insecticide, containing 100 g/L novaluron and 80 g/L acetamiprid for the control of various insect pests in apples and pears, is supported. Cormoran Insecticide can be used safely if handled in accordance with the instructions on the product label and any other control measures described above. Additional information is available on the product Safety Data Sheet (SDS).

7 ENVIRONMENTAL ASSESSMENT

7.1 Introduction

It is proposed to register Cormoran Insecticide for the control of apple dimpling bug (*campylomma leibknechti*) and plague thrips (*thrips imaginis*) in apples and longtailed mealybug (*pseudococcus longispinus*), tuber mealy bug (*pseudococcus viburni*), light brown apple moth (*epiphyas postvittana*) and codling moth (*cydia pomonella*) in apples and pears. Section 1 describes the proposed use in greater detail.

7.2 Environmental fate and behaviour

Hydrolysis

Hydrolysis is unlikely to contribute significantly to the degradation of novaluron in the environment.

Photolysis/photodegradation

Similarly, aqueous photolysis is unlikely to contribute significantly to the degradation of novaluron in the environment. Novaluron applied to the soil is relatively stable to photolysis. The DT50 corresponding to natural irradiation is 259 days. Photolytic degradation on soil is unlikely to contribute significantly to the degradation of novaluron in soil.

Fate and behaviour in soil

Novaluron is readily to slightly degradable in soil under aerobic and anaerobic laboratory conditions (DT50 4–45 days). Even where initial degradation is rapid, a proportion of the applied substance may persist. Novaluron can be classified as immobile in soil based on the strength of its adsorption (Kd 95–247; Koc 6030–11828). Column leaching studies with freshly applied and aged residues of novaluron confirm that novaluron is unlikely to leach significantly in soil. Novaluron is not expected to volatilise significantly. Field dissipation studies indicate degradation rates varying between sites, with surprisingly greater persistence than under laboratory conditions (field DT50 18–160 days). Field data confirm that little leaching of novaluron down the soil profile occurs. An Australian field study indicates that small amounts of novaluron may move in drainage water, either adsorbed to soil particles, or in trace amounts dissolved in the water.

Fate and behaviour in water

Novaluron is readily to slightly degradable in water/sediment systems. Even where initial degradation is rapid, a proportion of the applied substance may persist. Dissipation from water in water/sediment systems occurs rapidly (DT50 0.9–1.3 days) and is assisted by partitioning to sediment, but with low levels of novaluron remaining in water, presumably in equilibrium with the more persistent residues in sediment (whole system DT50 6.3–26 days). Novaluron is not expected to volatilise significantly.

Mobility

Novaluron can be classified as immobile in soil based on the strength of its adsorption (Kd 95–247; Koc 6030–11828). Column leaching studies with freshly applied and aged residues of novaluron confirm that novaluron is unlikely to leach significantly in soil.

Bioaccumulation

Novaluron is highly bio-concentrating, and while initial depuration is reasonably rapid, ultimate depuration is very slow. Residues in fish tissue remained largely as novaluron during exposure and depuration.

Atmospheric fate

Novaluron is classified as very slightly volatile. A Henry's Law constant of 2.0 Pa/mol·m^3 was derived which corresponds to a dimensionless Henry's law coefficient of 8.5×10^{-3} indicating volatilisation from aqueous systems, and diffusion in air is a possibility. There is further evidence of this in the sediment water studies where trapped volatiles represented up to 5% AR. Even though slight volatilisation of novaluron might be expected to occur, results for photochemical oxidative degradation (DT50 2.4 hours) suggest that the concentrations of novaluron in air are likely to be negligible in the upper atmosphere. As a result, novaluron is not expected to persist in air or be subject to long range transport through the atmosphere.

7.3 Environmental effects

Table 9: Toxicity of active constituent novaluron and the product Cormoran Insecticide for various organisms

ORGANISM		MEASURE OF TOXICITY OR EFFECT	PARAMETER (TEST PERIOD)	TOXICITY (UNIT)
Terrestrial species				
Mammals	Rat	Acute toxicity (oral)	LD50	> 5000 mg ac/kg bw
	Mouse	Short term dietary exposure	NOEC (90 d)	30 mg ac/kg diet
	Rat	Reproduction	NOEL	1176 mg ac/kg bw/d
Bird	Bobwhite quail	Acute toxicity (oral)	LD50	2000 mg ac/kg bw
	Bobwhite quail, mallard duck	Short term dietary exposure	NOEC (5 d)	5200 mg ac/kg bw/d
	Mallard duck	Reproduction	NOEL	10 mg ac/kg bw/d
Bees	Honeybee (Apis mellifera)	Oral and contact toxicity	LD50	> 100 µg/bee
Non-target arthropods	parasitoid (Aphidius rhopalosiphi)	Tier 1 dose/response	NOER	≥ 140 g ac/ha
	predatory mite (Typhlodromus pyri)			
	-	Semi-field/field	7 d interval LOER 2 months	2 × 225 g ac/ha
	Earthworm	Acute toxicity	LC50	> 1000 mg/kg
		Reproduction	NOEC	≥ 3 mg/kg
Plants	[common name of plant(s)]	Seedling emergence test/ vegetative vigour	NOER	≥ 225 g ac/ha
Aquatic species				

ORGANISM		MEASURE OF TOXICITY OR EFFECT	PARAMETER (TEST PERIOD)	TOXICITY (UNIT)
Fish	Rainbow trout	Acute toxicity	LD_{50} (96 h)	> 3 µg ac/L (limit of water solubility)
	Fathead minnow	Early life stage toxicity	NOEC (28 d)	> 3 µg ac/L (limit of water solubility)
Aquatic invertebrate	*Daphnia magna*	Acute toxicity	EC_{50}	0.31 µg ac/L
	Daphnia magna	Reproduction	NOEC (21 d)	0.03 µg ac/L
	Freshwater microcosm	Chronic exposure	NOEC (21 week)	0.05 µg/L
Aquatic plants	*Lemna gibba*	Growth inhibition	EC_{50}	> 3 µg ac/L (limit of water solubility)
Algae	*Pseudokirchneriella subcapitata* *Skeletonema costatum* (marine species) *Anabaena flos-aquae*	Growth inhibition	E_rC_{50}	> 3 µg ac/L (limit of water solubility)

The toxicity of novaluron and its associated product to a number of non-target organisms based on the results (Table 9) from submitted studies, can be summarised as follows:

Terrestrial organisms

To mammals

Mammalian toxicity tests revealed that novaluron is practically non-toxic to rats and exhibits only low acute toxicity to mice. Thus, studies on acute oral exposure of novaluron to rats indicated LD50 > 5000 mg ac/kg bw, whilst 90-day studies on subacute dietary exposure indicated a calculated NOEC 100 mg ac/kg diet. Dietary studies on the 90 day acute toxicity of novaluron to mice indicated NOEC 30 mg ac/kg diet. Reproductive studies showed effects on rats only at high dose levels (>1000 mg ac/kg diet) and the NOEL was determined to be 12000 ppm, which is equivalent to 1176 mg ac/kg bw per day.

To birds

Avian toxicity studies showed that novaluron was practically non-toxic to the birds tested on the basis of acute and sub-acute parameters. Studies on a single dose acute oral exposure of novaluron to bobwhite quail and mallard duck indicated a LD50 > 2000 mg ac/kg bw after 14 d for both species, whilst studies on subacute dietary exposure indicated an LC50 > 5200 mg ac/kg in diet for both species. Reproductive studies on bobwhite quail showed that novaluron has relatively little toxicity to this species. Egg production and chick survival were reduced at the nominal dietary concentration of 1000 ppm. The reproductive NOEL for this species was determined to be 300 mg ac/kg diet, but it is noted there was a small but statistically significant effects on adult body weight at this level. Mallard ducks were more sensitive in this respect, with a 22 week reproductive NOEL 10 mg ac/kg diet.

To bees

Novaluron exhibits low acute toxicity to bees with acute and contact LD50 values >100 µg ac/bee. Because novaluron is an insect growth regulator (IGR), bee brood development was considered. A semi field study in which bee hives were exposed to a sucrose solution containing 100 g novaluron/L showed no adverse effects on adult bees but indicated significant detrimental effects on brood development, with 98–100% developmental failure of exposed eggs and larvae. A higher tier brood/hive field study where honey bees were allowed to forage freely in orange groves that had been treated during flowering with a commercial EC formulation containing novaluron (2 applications of 225 g ac/ha in a 7–day interval), also indicated that the product was virtually non-toxic to adult worker bees. However, there were adverse effects on the development of eggs and larvae that were present at the time of application. These effects appeared to be transient and new eggs that were laid after the second application appeared normal. Observations at 2 and 6 weeks after the second treatment indicated no adverse effects on the general health of the hive in terms of the numbers of combs containing developing bees, egg and larval development or pollen gathering and honey production. Because there was no effect on the overall health of the hive, risk of novaluron to bees is considered to be acceptable under the proposed conditions of use (two applications of 140 g novaluron/ha in a 14–day interval).

Based on additive toxicity, acetamiprid is expected to be the major contributor to the acute toxicity of the Cormoran Insecticide. However when measured, the product was more toxic than what was predicted from the active constituents alone, with contact and oral LD50 values of 28.1 µg product/bee and 39.8 µg product/bee, respectively. Overall this is regarded as slightly toxic to bees.

Non-target arthropod (NTA) species

Standard laboratory studies using a representative EC formulation of novaluron showed no-effects but were not considered appropriate due to the specific mode of action (affects moulting), which is not taken into account during these studies and that these studies considered a route of entry likely to be different to that

encountered by NTAs from the proposed use. The standard studies lack exposure to developmental stages and do not include oral exposure which is the principal route of action. Field studies also using a representative EC formulation of novaluron at rates of up 2 × 225 g/ha, 7 days apart found adverse effects on NTAs. These effects were considered to be incompatible with integrated pest management (IPM) strategies utilising beneficial arthropods.

Earthworms

Novaluron is not toxic to earthworms (LC50 >1000 mg ac/kg dry soil) and reproductive effects were not observed up to 3 mg novaluron/kg dry soil (NOEC ≥ 3 mg ac/kg dry soil). However, Cormoran Insecticide demonstrated some acute toxicity to earthworms (LC50 32 mg product/kg dry soil). A regulatory acceptable level in soil of 3 mg novaluron/kg dry soil was determined based on the reproductive effects result (Regulatory Acceptable Concentration = NOEC ÷ 1).

Soil micro-organisms

No adverse effects on microbial respiration and nitrification mineralisation processes were observed in a standard laboratory study with novaluron up to 0.4 mg ac/kg dry soil (highest test concentration). Cormoran Insecticide had no adverse effects at the highest tested rate of 750 mg product/ha (135 g acs/ha).

Terrestrial plants

A lack of significant phytotoxic effects across a range of non-target crops from pre or post-emergence application was observed in tier 1 tests with a representative EC formulation of novaluron (225 g ac/ha). Acetamiprid, however, has some phytotoxic activity (lowest ER25 6.5 g ac/ha, USEPA 2011). Because novaluron is not phytotoxic, the product formulation is unlikely to be more phytotoxic than acetamiprid alone.

Aquatic organisms

Effects on fish

Novaluron is not toxic to fish to the limits of its water solubility (3 µg/L).

Effects on aquatic invertebrates

Novaluron exhibits very high toxicity to aquatic invertebrates, especially during the first moulting stage. This is consistent with the action of novaluron as an inhibitor of chitin synthesis and, hence, moulting. Additionally, it is evident that other aquatic organisms that synthesise chitin during their life cycle, including freshwater benthic invertebrates, marine molluscs and aquatic insects such as mayflies, are very sensitive to novaluron. The most sensitive species is Daphnia magna with a 48 h EC50 0.31 µg ac/L and a 21 day NOEC 0.03 µg ac/L. Studies on the chronic toxicity of novaluron to a freshwater microcosm community of pelagic and benthic invertebrates, algae and macrophytes determined a 21–week NOECcommunity 0.05 µg ac/L. The microcosm studies were conducted according to a replicated dose-response method, and these studies involved several species in a higher tier study. Therefore, the NOECcommunity of 0.05 µg ac/L was selected as the regulatory acceptable concentration for the protection of aquatic species.

Effects on algae and aquatic plants

As with fish, novaluron is not toxic to algae and aquatic plants up to the limit of its water solubility (3 µg/L).

7.4 Risk assessment

The risk assessment considered dietary intake of novaluron residues following two applications of 140 g novaluron/ha in a 14–day interval. Cumulative residues were estimated assuming a default DT50 of 10 days. Risks to birds and wild mammals were determined to be acceptable, and no hazard or labelling controls are required.

Risks to the aquatic environment were assessed to determine whether the predicted environmental concentration of novaluron was likely to exceed the regulatory acceptable level, for the proposed agricultural use via the routes of spray drift, run-off and resurfacing groundwater. The risk of spray drift was assessed using a modified scenario deemed to be representative of the current use pattern based on orchard airblast to apple and almond trees only. The model predicted an environmental concentration of novaluron less than the regulatory acceptable level in the aquatic environment at 200 m downwind of the treated area. Therefore, a downwind mandatory no spray zone of 200 m to aquatic areas and wetlands is required. The risk of run-off water containing novaluron was assessed based on an extension of the default model, taking into account more realistic slope, soil characteristics and stream flows, using the most conservative values for field dissipation (160 d) and its propensity to transfer (Koc = 6030 mL/g) from soil to run-off water. The model predicted concentrations in the aquatic environment below the regulatory acceptable concentration. Despite the persistence of novaluron in soil under field conditions, its high sorption to soil limits its potential to leach to groundwater and concentrations are predicted to be below what is regulatory acceptable.

Although novaluron is bioaccumulative, it dissipates rapidly from water in aquatic systems and with restrictions on use to limit its entry to the aquatic environment, bio-concentration of novaluron to unacceptable levels through the food chain is not expected.

Although Cormoran Insecticide, containing novaluron showed effects to bees, with restrictions on when the product is used, the exposure and hence the risk to bees can be managed. Similarly NTAs showed some sensitivity to Cormoran Insecticide and a precautionary statement is required on the label to notify the user of incompatibility with IPM.

The risk to soil dwelling organisms, taking into account the potential of novaluron to accumulate in soil was determined. Assuming a DT50 of 160 days (maximum field value), peak soil concentrations following two annual applications of 140 g ac/ha would plateau at 0.46 mg ac/kg soil after 4–5 seasons which is less than the regulatory acceptable concentration and hence the risk is acceptable.

Although terrestrial plants showed some sensitivity to Cormoran Insecticide, with general good practice for spray drift (already considered for the assessment of the risk to aquatic and wetland areas), the risk to these organisms is regarded as acceptable.

7.5 Conclusions

The APVMA is satisfied that the proposed use of Cormoran Insecticide containing the active constituents novaluron and acetamiprid will meet the environmental safety criteria, provided there are restrictions of use as per the label instructions, on downwind no spray zones to aquatic and wetland areas, timing of use for the protection of bees and precautionary statements for the protection of non-target arthropods.

8 EFFICACY AND SAFETY ASSESSMENT

8.1 Proposed product use pattern

The proposed use of Cormoran Insecticide is for the control of apple dimpling bug (*campylomma leibknechti*) and plague thrips (*thrips imaginis*) in apples and longtailed mealybug (*pseudococcus longispinus*), tuber mealy bug (*pseudococcus viburni*), light brown apple moth (*epiphyas postvittana*) and codling moth (*cydia pomonella*) in apples and pears.

More details on the proposed use are provided in Section 1.

8.2 Summary of evaluation of efficacy and crop safety

Efficacy

The applicant presented results from 15 replicated small plot field trials conducted in Victoria, NSW and Queensland over the 2011–12 and 2012–13 growing seasons, to evaluate the efficacy of Cormoran Insecticide and formulations containing the active ingredients acetamiprid and novaluron for control of insect pests of pome fruit. Trials were conducted in apple varieties royal gala, pink lady, red delicious, granny smith and summerdel and pear varieties william bon chretien and packham's triumph. In addition, a Queensland trial undertaken in nectarine in 2011–12 was presented support efficacy against plaque thrip and two trials, undertaken in 2005 and 2009 in wine grapes in South Australia and Victoria, were presented to support efficacy against light brown apple moth.

The trials used randomised complete block design, with 4 or 5 replicates, appropriate assessment parameters (insect counts, fruit damage and phytotoxicity assessments), industry standards and untreated controls. Results were analysed using standard statistical procedures (ANOVA, LSD). Pest pressure ranged from low to high during the trials. The rates used in the trials (30 mL/100 L to 140 mL/100 L) encompassed the proposed label rate and were conducted under conditions and management practices equivalent to label instructions and included multiple spray programs.

The trials demonstrated that Cormoran Insecticide when used according to proposed label instructions controlled apple dimpling bug and plague thrips in apples and longtailed mealybug, tuber mealy bug, light brown apple moth and codling moth in apples and pears.

Cormoran Insecticide was equally or more effective when compared to industry standards and infestation and damage to fruit at harvest was significantly reduced when compared to untreated controls.

Crop safety

Crop safety data was collected in conjunction with all efficacy trials and included 5 varieties of apples and two varieties of pears as listed above. The field data evaluated demonstrated that Cormoran Insecticide is safe at label rate (70 mL/100 L) when applied as multiple dilute sprays during flowering, early fruit formation through to fruit maturation. At twice the proposed rate (140 mL/100 L), marginal necrosis of leaves and slight burning of petals was observed when applied at flowering in gala apples, however no other symptoms of phytotoxicity were seen in any later application, or in any other trials at this higher rate, and fruit production or quality was not reduced.

Resistance management

The active constituent novaluron belongs to the benzoylurea insect growth regulator chemical subgroup which inhibit chitin biosynthesis. Novaluron is designated a group 15 insecticide for resistant management purposes. Cormoran Insecticide containing both novaluron and acetamiprid is a combination group 15/4A insecticide. Cormoran Insecticide is to be used as part of spray program in conjunction with insecticides from other modes of action. The maximum number of applications of Cormoran Insecticide per season is limited to one application in apples and two in pears at a 14 day interval.

8.3 Conclusions

The claims on the proposed label that Cormoran Insecticide, when used as directed, provides acceptable control of apple dimpling bug and plague thrips in apples and longtailed mealybug, tuber mealy bug, light brown apple moth and codling moth in apples and pears are supported by the results from the trial data.

Acceptable crop safety is expected when the product is used as directed. The directions for use are appropriate and consistent with insecticide use in commercial agriculture in Australia.

The application for the registration of Cormoran Insecticide is supported on efficacy and crop safety grounds when used according with label instructions.

9 LABELLING REQUIREMENTS

POISON

KEEP OUT OF REACH OF CHILDREN

READ SAFETY DIRECTIONS BEFORE OPENING OR USING

CORMORAN®
INSECTICIDE

ACTIVE CONSTITUENTS: **NOVALURON 100 g/L**
ACETAMIPRID 80 g/L

SOLVENT: **N-METHYL PYRROLIDONE 395 g/L**

GROUP 15 4A INSECTICIDE

Crops
Apples, pears
Controls
Apple dimpling bug, codling moth, light brown apple moth, longtailed mealybug, plague thrips and tuber mealybug

CONTENTS: 1–110 L

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DIRECTIONS FOR USE

Restraints:

DO NOT apply CORMORAN during flowering.

DO NOT apply by aircraft.

MANDATORY NO-SPRAY ZONES:

DO NOT apply if there are livestock, pasture or any land that is producing feed for livestock downwind from the application area and within the mandatory no-spray zone shown below:

Ground application:

Wind speed range at time of application	**Downwind mandatory no-spray zone**
From 3 to 20 kilometres per hour	30 metres

No-Spray Zone for Protection of the Terrestrial Environment

No-Spray Zone for Protection of the Aquatic Environment

Ground application:

Wind speed range at time of application	**Downwind mandatory no-spray zone**
From 3 to 20 kilometres per hour	200 metres

Table 1. Apples

PEST	RATE	CRITICAL COMMENTS
Apple Dimpling Bug (*Campylomma leibknechti)* **Plague Thrips** (*Thrips imaginis)* **Longtailed Mealybug** *(Pseudococcus longispinus)* **Tuber Mealybug** *(Pseudococcus viburni)* **Codling Moth** *(Cydia pomonella)*	70 mL/100 L or 1.4 L/ha	Apply a single application of CORMORAN in apples targeting either: • Apple Dimpling Bug, Plague Thrips and/or Mealybugs from early post flowering; OR • First generation Codling Moth and/or Light Brown Apple Moth Apply CORMORAN in rotation with registered alternative mode of action insecticides. Refer to pest specific guidelines below. **Apple Dimpling Bug and Plague Thrips** Apply an alternative mode of action product such as Mavrik® during flowering. Apply CORMORAN after flowering to protect developing fruitlets from damage caused by Apple Dimpling Bug and Plague Thrips. Monitor insect numbers and apply an alternative mode of action insecticide 5-7 days later if populations approach threshold numbers. Under heavy Plague Thrips pressure, use an alternative registered insecticide such as Mavrik®.

Light Brown Apple Moth *(Epiphyas postvittana)*		**Longtailed Mealybug and Tuber Mealybug** Apply CORMORAN as part of a spray program to prevent mealybugs from migrating into the calyx of the fruit where they are difficult to control. Early control of crawlers is very important. Monitor the crop and apply CORMORAN as soon as crawlers are seen after petal fall. Apply a different mode of action insecticide 14 days later to maximise knockdown control. Some mealybugs sheltering in the canopy may not be adequately controlled and these survivors can multiply and infest developing fruit. Further applications of insecticides from other mode of action groups is recommended to ensure control of any surviving mealybugs. **Codling Moth** Apply CORMORAN as part of a season long Codling Moth management program including pest monitoring and targeted insecticide applications. Apply CORMORAN targeting the first generation of Codling Moth, just prior to the generation egg hatch and before 110 Degree Days after Codling moth are detected in traps. Apply further insecticide applications after a 14 day interval using alternative mode of action insecticides. See Application Timing in GENERAL INSTRUCTIONS for further detail. **Light Brown Apple Moth** Monitor for Light brown Apple Moth activity from late flowering using pheromone traps. Apply CORMORAN after petal fall or 140 Degree Days after Light Brown Apple Moth are detected in traps. If required, apply further insecticide applications after a 14 day interval using alternative mode of action insecticides. See Application Timing in GENERAL INSTRUCTIONS for further detail. **Application** Apply CORMORAN as a dilute (high volume) spray ensuring thorough coverage of fruitlets and foliage. If the water volume will exceed 2000 L/ha, use the per hectare rate and adjust the dilute concentration accordingly. Concentrate spraying is not recommended when targeting Mealybug as thorough coverage is critical for control. DO NOT apply more than one application of CORMORAN per season in apples. DO NOT apply CORMORAN at more than 1.4 L/ha.

Table 2. Pears

PEST	RATE	CRITICAL COMMENTS
Codling Moth *(Cydia pomonella)* **Light Brown Apple Moth** *(Epiphyas postvittana)* **Longtailed Mealybug** *(Pseudococcus longispinus)* **Tuber Mealybug** *(Pseudococcus viburni)*	70 mL/100 L or 1.4 L/ha	Apply up to two applications of CORMORAN per season in pears. Always apply CORMORAN as part of a season long spray program in rotation with registered alternative mode of action insecticides. **Longtailed Mealybug and Tuber Mealybug** Apply CORMORAN as part of a spray program to prevent mealybugs from migrating into the calyx of the fruit where they are difficult to control. Early control of crawlers is very important. Monitor the crop and apply CORMORAN as soon as crawlers are seen after petal fall. Apply a second spray 14 days later to maximise knockdown control. Some mealybugs sheltering in the canopy may not be adequately controlled and these survivors can multiply and infest developing fruit. Further applications of insecticides from other mode of action groups is recommended to ensure control of any surviving mealybugs. **Codling Moth** Apply up to two sprays of CORMORAN with a 14 day spray interval. CORMORAN can be used to control the first generation or later generations of Codling Moth providing that pest monitoring is undertaken and the applications are timed just prior to a generation egg hatch. When targeting the first generation, the first spray should be applied just prior to the generation egg hatch and before 110 Degree Days after Codling Moth are detected in traps. See Application Timing in GENERAL INSTRUCTIONS for further detail. **Light Brown Apple Moth** Monitor for Light Brown Apple Moth activity from late flowering by pheromone trapping. Apply CORMORAN after petal fall or 140 Degree Days after Light brown Apple Moth are detected in traps. If required, apply a second application after a 14 day interval. Additional treatments should be made using alternative mode of action insecticides. See Application Timing in GENERAL INSTRUCTIONS for further detail. **Application** Apply CORMORAN as a dilute (high volume) spray ensuring thorough coverage of fruitlets and foliage. If the water volume will exceed 2000 L/ha, use the per hectare rate and adjust the dilute concentration accordingly. Concentrate spraying is not recommended when targeting Mealybug as thorough coverage is critical for control. DO NOT apply more than two applications of CORMORAN per season in pears.

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

WITHHOLDING PERIODS (WHP):
Harvest:

APPLES
DO NOT HARVEST FOR 70 DAYS AFTER APPLICATION
PEARS
DO NOT HARVEST FOR 35 DAYS AFTER APPLICATION
Grazing:
DO NOT GRAZE ANY TREATED AREA OR CUT FOR STOCKFOOD
CROPS FOR EXPORT
Before using CORMORAN on crops destined for export it is essential to consult your exporter or ADAMA to ensure that an appropriate MRL is in place in the importing country.

GROUP 15 4A INSECTICIDE

INSECTICIDE RESISTANCE WARNING
For insecticide resistance management, CORMORAN® Insecticide is a Group 15 and Group 4A Insecticide. Some naturally occurring insect biotypes resistant to CORMORAN and other Group 15 and Group 4A insecticides may exist through normal genetic variability in any insect population. Resistant individuals can eventually dominate the insect population if CORMORAN and other Group 15 and Group 4A insecticides are used repeatedly. The effectiveness of CORMORAN on resistant individuals could be significantly reduced. Since occurrence of resistant individuals is difficult to detect prior to use, ADAMA Australia Pty. Ltd. accepts no liability for any losses that may result from the failure of CORMORAN to control resistant insects. CORMORAN may be subject to specific resistance management strategies. For further information contact your local supplier, ADAMA representative, local agricultural department agronomist or CropLife Australia Insecticide Resistance Management Strategies.

GENERAL INSTRUCTIONS

MIXING
Two thirds fill the spray tank with clean water with the agitator operating, then add the required quantity of CORMORAN INSECTICIDE. Top up the spray tank to the required volume with clean water with the agitator running. Maintain agitation while spraying.
COMPATIBILITY
As formulations of other manufacturer's products are beyond the control of ADAMA, all mixtures should be tested prior to mixing commercial quantities. For more information on CORMORAN product compatibility, check the ADAMA website **adama.com**.

APPLICATION INFORMATION

Good insect control requires even, thorough coverage of the treated area.

Application Timing for Codling Moth and Light Brown Apple Moth

All insects have an optimum temperature range for growth and development. At temperatures above or below the maximum or minimum temperature range for the particular insect, the growth rate rapidly declines.

Insect development is measured in cumulative thermal time units called degree-days. A degree-day (°D) is each degree of temperature by which the average temperature on a day exceeds the lower developmental threshold.

Pheromone traps in conjunction with degree-day modelling can be used to predict when first generation egg lay will occur. The thermal time taken from mating to egg hatch for Codling Moth and Light Brown Apple Moth is approximately 110°D and 140°D respectively. This equates to 7-14 calendar days and 10-15 days calendar days respectively.

Dilute spraying

Use a sprayer designed to apply high spray volumes, up to the point of run-off and matched to the crop being sprayed. Set up and operate the sprayer to achieve even coverage throughout the crop canopy. Apply sufficient spray volume to cover the crop to the point of run-off. Avoid excessive run-off. The required spray volume to achieve point of run-off may be determined by applying different test volumes, using different settings on the sprayer, or from industry guidelines or other expert advice. Add the amount of product specified in the Directions for Use table for each 100 L of water. Spray to the point of run-off. The required dilute spray volume to achieve point of run-off will change and the sprayer set up and operation may also need to be changed, as the crop grows.

Concentrate Spraying

Use a sprayer designed and set up for concentrate spraying (that is a sprayer which applies water volumes less than those required to reach the point of run-off) and matched to the crop being sprayed. Set up and operate the sprayer to achieve even coverage throughout the crop canopy using your chosen water volume. Determine an appropriate dilute spray volume (See Dilute Spraying above) for the crop canopy. This is needed to calculate the concentrate mixing rate. The mixing rate for concentrate spraying can then be calculated in the following way:

EXAMPLE ONLY

1. Dilute spray volume as determined above: For example 2000 L/ha
2. Your chosen concentrate spray volume: For example 1000 L/ha
3. The concentration factor in this example is: 2 X (i.e. 2000 L/1000 L = 2)
4. As the dilute label rate is 70 mL/100 L, then the concentrate rate becomes 2 × 70, that is 140 mL/100 L of concentrate spray.

The chosen spray volume, amount of product per 100 L of water, and the sprayer set up and operation may need to be changed as the crop grows. Do not use a concentrate rate greater than 2 X. For further information on concentrate spraying, users are advised to consult relevant industry guidelines, undertake appropriate competency training and follow industry Best Practices.

PROTECTION OF WILDLIFE, FISH, CRUSTACEANS AND ENVIRONMENT
Dangerous to aquatic invertebrates. DO NOT contaminate ponds, waterways or drains with the chemical or used containers. DO NOT apply under weather conditions or from spraying equipment that may cause spray to drift from the target area onto wetlands, natural surface waters, neighbouring properties or other sensitive areas.

PROTECTION OF HONEY BEES AND OTHER NON-TARGET INSECTS
Dangerous to bees. Do not apply during flowering. Will kill bees foraging in the crop to be treated or in hives which are over-sprayed or reached by spray drift. Residues may remain toxic to bees for several days after application. Risks to non-target insects – CORMORAN may have adverse effects on some non-target beneficials, in particular where IPM is practiced, to foliage dwelling predators.

SAFETY DIRECTIONS
Harmful if swallowed. Will damage eyes. Repeated exposure may cause allergic disorders. Avoid contact with eyes and skin. When opening the container and preparing and using the prepared spray, wear cotton overalls buttoned to the neck and wrist (or equivalent clothing) and goggles. If product in eyes, wash out immediately with water. Wash hands after use. After each day's use wash gloves, goggles and contaminated clothing.

STORAGE AND DISPOSAL 1–100 L
Store in the closed, original container in a cool, well-ventilated area. DO NOT store for prolonged periods in direct sunlight. Triple or preferably pressure rinse containers before disposal. Add rinsings to the 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 bury empty containers in a local authority landfill. If no landfill is available, bury the containers below 500 mm in a disposal pit specifically marked and set up for this purpose clear of waterways, desirable vegetation and tree roots. Empty containers and product should not be burnt.

110 L Micro Matic Valve
Store in the closed, original container in a cool, well-ventilated area. DO NOT store for prolonged periods in direct sunlight. DO NOT tamper with the Micro Matic valve or the security seal. DO NOT contaminate the container with water or any foreign matter. After each use of the product, please ensure that the Micro Matic coupler delivery system and hoses are disconnected, triple rinsed with clean water and drained accordingly. When the contents of the container have been used, please return the container to the point of purchase. The container remains the property of ADAMA Australia Pty. Ltd.

FIRST AID
If poisoning occurs contact a doctor or Poisons Information Centre. Phone Australia 131 126.

SAFETY DATA SHEET
If additional hazard information is required refer to the Safety Data Sheet. A safety data sheet for CORMORAN INSECTICIDE is available from adama.com.

CONDITIONS OF SALE: The use of CORMORAN INSECTICIDE being beyond the control of the manufacturer, no warranty expressed or implied is given by ADAMA Australia Pty. Ltd., regarding its suitability, fitness or efficiency for any purposes for which it is used by the buyer, whether in accordance with the Directions for Use or not. ADAMA Australia Pty. Ltd. accepts no responsibility for any consequence whatsoever resulting from the use of this product.

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APVMA Approval Number: 70152/62630 Date

of Manufacture:

Barcode:

ABBREVIATIONS

ac	active constituent
ADI	Acceptable Daily Intake (for humans)
ai	active ingredient
ARfD	Acute Reference Dose
AUC	Area Under Curve
bw	bodyweight
^{o}C	Degrees Celsius
CAS	Chemistry Abstracts Service
Codex	Codex Alimentarius Commission
Codex CXLs	Codex Maximum Residue Limits
d	day
DNA	Deoxyribonucleic acid
DoE	Department of Environment
DT_{50}	Time taken for 50% of the concentration to dissipate
EA	Environment Australia
EC	Emulsifiable Concentrate
EC	European Commission
EC_{50}	concentration at which 50% of the test population are immobilised
EI	Export Interval
Eq	equivalent
EU	European Union
FSANZ	Food Standards Australia and New Zealand
g	gram
h	hour
ha	hectare

Hb	haemoglobin
Hg	Haemoglobin
im	intramuscular
IPM	Integrated Pest Management
IRM	Integrated Resistance Management
IUPAC	International Union of Pure and Applied Chemistry
iv	intravenous
in vitro	outside the living body and in an artificial environment
in vivo	inside the living body of a plant or animal
JMPR	Joint Meetings on Pesticide Residues
kg	kilogram
K_{oc}	Organic carbon partitioning coefficient
K_{ow}	Octanol-water partition coefficient
Kt	kilotonne
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
LOAEL	Lowest Observable Adverse Effect Level
LOD	Limit of Detection – level at which residues can be detected
LOEL	Lowest Observable Effect Level
LOQ	Limit of Quantitation – level at which residues can be quantified
mg	milligram
mL	millilitre
mN	milliNewton
MoA	Mode of Action
MoE	Margin of Exposure

mPa	milliPascal
MRL	Maximum Residue Limit
MSDS	Material Safety Data Sheet
ND	Not Detectable
NEDI	National Estimated Daily Intake
NESTI	National Estimated Short Term Intake
ng	nanogram
Nm	nanonmetre
NOEC/NOEL	No Observable Effect Concentration Level
NOER	No Observable Effect Rate
NOHSC	National Occupational Health and Safety Commission
OC	Organic Carbon
OD	Oil Dispersion (oil-based suspension concentrate)
OECD	Organisation of Economic Cooperation and Development
OM	Organic Matter
Pa	Pascals
PEC	Predicted Environmental Concentration
PHED	Pesticide Handler Exposure Database
PHI	Post-Harvest Interval
po	oral
PPE	Personal Protective Equipment
ppm	parts per million
RBC	Red Blood Cell Count
RCP	Restricted Chemical Product
RNA	Ribonucleic acid
s	second

sc	subcutaneous
SC	Suspension Concentrate
SUSDP	Standard for the Uniform Scheduling of Drugs and Poisons
SUSMP	Standard for the Uniform Scheduling of Medicines and Poisons
SWA	Safe Work Australia
µg	microgram
US EPA	United States Environmental Protection Agency
WBC	White Blood Count
WHO	World Health Organisation
WHP	Withholding Period
w/v	Weight/volume

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
Leaching	Removal of a compound by use of a solvent
Log Pow	Log to base 10 of octanol water partitioning co-efficient, synonym KOW
Metabolism	The chemical processes that maintain living organisms
Photodegradation	Breakdown of chemicals due to the action of light
Photolysis	Breakdown of chemicals due to the action of light
Subcutaneous	Under the skin
Total Radioactive Residue (TRR)	The total amount of ^{14}C-labelled active constituent and its metabolites detected in residue studies
Toxicokinetics	The study of the movement of toxins through the body
Toxicology	The study of the nature and effects of poisons

REFERENCES

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WHO (1997). *Joint FAO/WHO Codex Alimentarius Commission. Guidelines for predicting dietary intake of pesticide residues.* 1997. Available at: who.int/foodsafety/publications/pesticides/en/