Australian Government

Australian Pesticides and Veterinary Medicines Authority

DIURON REVIEW

Volume 1 of 4

Supplemental Environmental Assessment Report

Overview

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Department of Sustainability, Environment, Water, Population and Communities

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Glossary

ac .... Active constituent
APVMA .... Australian Pesticides and Veterinary Medicines Authority
BCF .... Bioconcentration Factor
DAT .... Days after treatment
DSEWPaC.......... Department of Sustainability, Environment, Water, Populations and Communities
DT50 .... Time for 50% of the substance to dissipate
E_bC50 .... The concentration of a test substance resulting in a 50% inhibition of biomass in an algal test
E_rC50................. The concentration of a test substance resulting in a 50% inhibition of growth rate in an algal test
EC25.................. The concentration of a test substance resulting in an effect on 25% of the test species.
EC50.................. The concentration of a test substance resulting in an effect on 50% of the test species.
GLP .... Good Laboratory Practice
HPLC .... High pressure liquid chromatography
ISO .... International Organization for Standardization
IUPAC................ International Union of Pure & Applied Chemistry
Kd....................... Soil sorption constant
Koc .... Soil sorption/desorption coefficient, normalised to organic carbon content
LC50.................. Concentration (for example, in water, food or soil) resulting in a 50% mortality of the test organism.
LD50 .... Dose (oral) resulting in a 50% mortality of the test organism.
LOEC .... Lowest Observed Effect Concentration ie the test concentration at which some effect occurs
LOEL .... Lowest Observable Effect Limit
LOD .... Limit of detection
LOQ .... Limit of quantification
LSC .... Liquid scintillation counter
MATC .... Maximum acceptable toxicant concentration
NOEC .... No Observed Effect Concentration ie the test concentration at which no effect is observed
NOEL .... No Observed Effect Level
OECD................. Organisation for Economic Co-operation and Development
PICT .... Pollution Induced Community Tolerance
SSD .... Species Sensitivity Distribution
TLC .... Thin layer chromatography

Conclusions and Recommendations

This assessment has focussed on the issues and data raised in submissions in response to the diuron environmental risk assessment report published as APVMA (2011). The main issue in the submissions received related to the results of the runoff risk assessment. The other major issue concerned the findings on the chronic risk to birds.

Runoff risk assessment: A comprehensive assessment of risks to algae and aquatic plants has been undertaken based on information and argument provided in submissions, and through the development of modelling and intensive use of Australian specific climatic data to assess different cropping situations and regions. The outcomes of this assessment are summarised in Tables V1.5 and V1.6 on pages 11-12 and need to be read in consultation with Volume 2 of this report (Run Off Risk Assessment) for context and rationale.

While literature data have been obtained or provided with submissions addressing higher tier aquatic plant toxicity data, these have not allowed a refinement of the aquatic plant toxicity end-point used in the assessment (95% protection level of 1.56 µg/L). While many results demonstrate increased tolerance following initial diuron exposure, the final results from these higher tier studies are still of a similar level to the end-point established in APVMA (2011). As discussed in section V1.5, the runoff risk assessment approach is based on the premise that exposed algae/aquatic plants can recover and the combined rainfall probability approach adopted therefore takes more account of the potential for repeat exposures.

The runoff model used in this assessment has been considerably enhanced to allow for a much greater use of region specific data. Despite this, there will be a very wide range of geographic and climatic conditions even within the same general cropping region, and it is therefore necessary to adopt input parameters that are at the more conservative end of the range that may exist to account for this variability.

There are several types of cropping systems that are more land-intensive than others so that their overall contribution to a particular catchment in terms of runoff will differ. This, however, is unsuitable as a means for mitigating risk particularly where several such cropping types may occur within a catchment, or where use for a more broadacre cropping system in the same catchment is being regulated due to a runoff concern.

While there have been several cases where risk has been assessed using an in-stream analysis, this approach is not always possible due to either the very large range (covering many States/Territories) for a particular situation, or for localised agricultural industries meaning there are no streams with monitoring gauge stations to obtain flow data for that area. In these cases, it is necessary to consider mitigation options by argument alone.

Previous concerns in APVMA (2011) relating to exposure to algae and aquatic plants through exposure to sediment pore water have been reassessed based on new data. Our assessment, based on new data and argument submitted, indicates that the risk is acceptable, although it is noted that there is a paucity of monitoring data of diuron and its metabolites in sediment pore water generally.

Chronic risk to Birds: The finding in APVMA (2011) of an unacceptable chronic risk to birds at an application rate higher than 370 g ac/ha has been reassessed following a revised approach which focussed on refining exposure estimates to better reflect diuron use situations, for example, not including contaminated plant material in birds' diets if applied pre-emergent to bare soil. Also the mean predicted rather than 90th percentile residues are now used for chronic exposure. The assessment now concludes that the chronic risk to birds is acceptable up to an application rate of 1800 g ac/ha when applied as a pre-emergent spray (bare ground), or post-emergent as a directed spray to the base of plants. However, when applied as a post-emergent broadcast or over-the-top spray (for example, cereals), the maximum rate at which the chronic risk to birds is considered to be acceptable is 880 g ac/ha.

Spray Drift Buffer Zones: APVMA (2011) only considered spray drift buffer zones for cotton defoliation use where application was at much lower rates (24 g ac/ha), as only these continued to be supported. Downwind spray drift buffer zones for diuron use in different cropping situations have now been assessed in the report for ground application only. In order to properly assess for aerial spray drift, product specific details are required and these should be assessed on a case-by-case basis for identified products.

Based on the maximum application rate of 1800 g ac/ha, a downwind buffer zone of 100 m to aquatic or wetland areas and 200 m to non-target vegetation is required using ground application techniques and coarse droplets.

Summary Findings

The following table summarises the final supported uses and application rates based on acceptability of runoff risk and chronic avian risk. The downwind buffer zones identified for each use are based on the highest rate using a high boom (post-emergent spray) with the exception of lupins and pulses with application within an Incorporation-By-Sowing (IBS) system. Buffer zones have been rounded based on APVMA increments. In practice, the label downwind buffer zones will be based on the highest rates present on the label, and not on the use specific rates as identified in the table below:

Table V1.1: Summary of Findings from Risk Assessment – Final Acceptable Uses, Cropping situations.

Situation	Rate (g ac/ha)	Downwind buffer zone (m)	
		Aquatic	Terrestrial
Broadacre Crops/Situations			
Winter Cereals			
Wheat, barley, triticale, cereal rye and oats, WA only	250-500	30	60
Wheat, barley, triticale and oats, WA only	180-250	15	30
Wheat, barley and oats, NSW, Vic, ACT and SA only	450	25	50
Wheat and barley, SA only	640-880	50	100
Wheat and barley, NSW, Vic, ACT and SA only	250	15	30
Summer Fallow, SA only	250	15	30
Cotton Irrigated cotton, capacity to retain runoff	900 to 1800	100	200
Lupins, WA Only	990	30	80
Pulses Incorporated by Sowing (see (1) below)	750 to 990	30	80
Post sowing pre-emergent	495 to 750	50	100
Tree and Vine Crops – Apples and Pears, Goulburn Valley only	900 to 1800	100	200
Tropical/Sub-Tropical Crops – Sugarcane; Bananas	250 to 450	25	50
Miscellaneous - Asparagus	1800	100	200
Bore drains (Qld only)	32000	N/R	N/R

(1) Information in DSEWPaC data holdings show herbicide is often a separate boom spray application which normally takes place 5-6 h before IBS, but can be up to 48 h previously.

Lucerne seed production

The lucerne label rate is currently 900-1710 g ac/ha. However, the post-emergence rate is expected to be an over the top spray, and consequently an avian chronic risk is identified. In their submission to the APVMA, Lucerne Australia stressed that use of diuron in the lucerne production system is one which has evolved over several decades. As part of this, the rates of use have been tested at both high and low rates. This long term use has seen the rates reduced significantly from the high label rates down to 750 g ac/ha.

An over the top pre-emergence spray rate of 750 g ac/ha has been shown to result in both an acceptable risk to birds and algae/aquatic plants in the runoff risk assessment for the lucerne seed production area. An aquatic downwind bufferzone of 50 m and a terrestrial downwind bufferzone of 100 m would be supported in these situations.

The downwind buffer zones for both the aquatic and terrestrial compartments could be reduced if maximum label rates were able to be reduced; particularly for cereals, it appears that lower rates are often used.

In addition to the above cropping uses, labels indicate application to bore drains in Queensland at 32000 g ac/ha . This rate is much higher than agricultural uses, but has been supported as the use pattern is highly unlikely to expose natural waterways.

For more detailed tables on both supported and non-supported uses, please refer to Section V1.7.2.

Supplemental Environmental Assessment Report - Diuron

V1.1 Introduction

In July 2011 the APVMA published the environmental risk assessment for diuron (APVMA, 2011). That report represented the second revision of the environmental risk assessment of diuron since release of the Preliminary Review Findings (PRF) in 2005, and consideration of submissions received at that time that included new environmental fate and ecotoxicity data, along with a detailed modelling study to address potential changes to sugar cane application and management to reduce runoff of diuron in this crop.

While the revision of the PRF had largely been completed by 2009, the required process meant significant time was spent in consultation with the sole data provider, Du Pont Australia, and during that period, no additional data were considered in the assessment unless submitted by the data provider.

While the supplemental environmental risk assessment (APVMA, 2011) was a detailed report with consideration of a large volume of environmental fate and effects data, conclusions with respect to runoff in particular remained largely generic by necessity. The APVMA had been provided no data on contemporary cropping practices for the large range of diuron registered uses, with the exception of sugar cane. Labels contained old and out-of-date instructions with respect to application rates and techniques.

Further, at the start of revising the PRF report (2008 to 2009), there was no Australian runoff model used as a standard in national regulatory assessments. This resulted in a heavy reliance on monitoring data, most of which was available for the sugar growing regions with some earlier data from the irrigation region of south western NSW. The Department of Sustainability, Environment, Water, Populations and Communities (DSEWPaC) developed a screening model for national risk assessments in 2009, and this was applied initially to the APVMA (2011) report. However, it was considered a screening model only (for example, fixed slope, fixed ratio of rainfall to runoff) and monitoring data were still relied upon as the primary information source.

One of the main concerns with diuron is the likely exposure to smaller watercourses from runoff. The most recent and voluminous monitoring data are available from application to sugar cane, but these data do not represent smaller streams that may be found in sugar cane growing regions or streams/rivers from other agricultural industries. Consequently, the irrigation region data were used to represent these regions. However, with monitoring data there were no available information on important aspects such as application rates in the catchments and times between application and rainfall events that may have contributed to the monitoring results. The assessment hence relied on an assumption of the likely application rate in the catchment and extrapolation from this to lower rates to predict risk outcomes.

Submissions received for APVMA (2011) questioned the assumptions used and it was necessary to improve the versatility of the runoff model. It is important to note that APVMA (2011) assessed diuron use in cropping situations only where information has been received through submissions. The submissions contained important information on current use rates and application methods, along with more detailed information on regions of application in many cases that allow significant refinement of the runoff assessment.

There remain, however, inherent limitations in providing crop specific advice at a continental scale. Site by site analysis is not feasible and some growing situations occur over a very wide range of geographic and climatic conditions, often within the same state. The assessment in such cases has to consider the worst case that may be encountered in such situations. In other cases it may be possible to assess risk based on region specific parameters where crops are only grown in these areas.

V1.2 Findings of unacceptable risk, APVMA (2011)

Conclusions of unacceptable risk summarised from APVMA (2011) that have been considered further in this assessment are:

Birds: Chronic risk was **unacceptable** at all modelled rates of 0.37 kg ac/ha or higher.

Aquatic organisms (based on runoff risk):

- for registered agricultural uses, the risk to organisms in secondary streams and rivers from use rates above 0.9 kg ac/ha was **unacceptable** unless tailwaters could be retained on-farm;
- for registered agricultural uses, the risk to organisms inhabiting primary streams and creeks was **unacceptable** for all modelled rates of 0.16 kg ac/ha or higher unless tailwaters could be retained on-farm;
- risk from high application rate use patterns (rights of way; commercial industrial, irrigation ditches/drainage channels) was **unacceptable**.

Risk to aquatic organisms resulting from spray drift exposure could be **managed** by appropriate spray drift buffer zones and restrictions on spray quality.

In addition, APVMA (2011) concluded that there remained insufficient data to adequately assess risk to aquatic systems where exposure was through the sediment. There was a concern that the soil metabolite, dichlorophenyl methyl urea (DCMPU), which has been found at levels similar to diuron in Australian stream sediments, is not able to be considered sufficiently. Where exposure to rooted aquatic macrophytes, or other sediment flora, occurred through sediments and associated pore water, there was insufficient data to determine risk. Modelling indicated this could be at **unacceptable** levels, and this outcome was applicable to all registered agricultural uses of diuron.

Terrestrial Fauna:

- The risk to bees from higher use application rates was **unacceptable** (≥10 kg ac/ha);
- The in-field risk to non-target terrestrial arthropods was **unacceptable** for higher use application rates (≥10 kg ac/ha).

Terrestrial plants: The risk to non-target terrestrial plants resulting from spray drift exposure could be **managed** by appropriate spray drift buffer zones and restrictions on spray quality.

V1.3 Structure of this report

This report is comprised of four volumes. Volume 1 is the overview and addresses the findings from assessment of submitted data and argument to address the areas of unacceptable risk identified in APVMA (2011). The additional environmental fate and ecotoxicity data that were supplied, and considered relevant to providing further input into the assessment are summarised here, and discussed in more technical detail in Volume 3 (Additional Data).

The bulk of argument and data in the submissions related to the findings for aquatic organisms, which in turn were a result of assessment of risk from runoff of diuron. Volume 2 reassesses the runoff risk associated with diuron use. To this end, a runoff risk assessment framework that can be applied equally to all use patterns was developed.

V1.4 Environmental Fate – discussion of additional data

Many papers published since APVMA (2011) were provided addressing the issue of diuron mobility. Mainly, these arguments related to increased sorption of diuron with increasing time after application. These papers (see Volume 3) and associated arguments were considered with a view as to how they may be used to refine the Kd value (soil/water partition coefficient) used in the runoff modelling.

The runoff model uses an adsorption Kd. The model equations were developed and promoted as part of an OECD exercise (OECD, 2000) and were calibrated based on, among other inputs, the adsorption soil/water partition coefficient.

The geometric mean adsorption Kd of 9.74 L/kg used in APVMA (2011) received criticism as being too low and adding an unnecessary layer of conservatism. The data provided in literature papers for this assessment to support use of a higher Kd over time, however, did not provide a measure of adsorption Kd. They tended to be a reflection of a desorption Kd, which is somewhat different and would be expected to be higher than the adsorption Kd. While such a property could theoretically be used in model development, it would result in a different set of runoff equations to those in the OECD model and are therefore not considered applicable to use in the current model. Specific conclusions relating to the mobility findings in the individual papers are discussed in Volume 2. The findings of Saison et al (2010) concerning the reversibility of adsorption over time and the higher levels of diuron runoff three weeks after application are noted.

On the issue of adsorption Kd, using the results from the regulatory studies, it is quite apparent that the use of the geometric mean adsorption Kd of 9.74 L/kg was not too low. Diuron sorption is strongly correlated with soil organic carbon. This relationship holds even when additional literature adsorption Kd values are incorporated in the data set (see Appendix 3). In the refinement of runoff modelling Kd has been modified for different cropping scenarios depending on their general geographic region and associated top soil organic carbon levels. Further, given the short time frame between application and the assumption of a runoff event, it is likely the Kd results obtained from the standard batch equilibrium experiments will more likely over-estimate the short term sorption (but under-estimate longer term sorption). Wauchope et al (2002) point out that, rather than being instantaneous, there are at least three time scales describing sorption-desorption responses to solution concentration changes. Initially, there is a rapid, reversible diffusion of the solute up to, and then adhering to, ‘accessible’ sites of soil surfaces at or near the soil/water interface. Measurements on a time scale of minutes clearly show a time-dependent concentration that requires minutes to approach equilibrium for either sorption or desorption. Second, there is a slower exchange of pesticide between hours and a day or two to approach equilibrium. This exchange appears to be fully reversible, based on the many column experiments in which ‘kinetic’ sorption effects have been observed. Third, a very slow reaction, which is generally referred to as ‘aging’, irreversibly removes pesticide from solution. This process has a time frame of weeks to years and will not be observed in a batch equilibrium/slurry experiment that ends in one or two days. Aging is characterised by the storage of intact pesticide molecules that may be freed by subsequent processes. It is not the same as degradation, but may be difficult to distinguish from it or formation of bound residues. Consequently, Wauchope et al (2002) conclude that the batch method will inherently tend to overestimate short term sorption but under estimate longer term sorption. Their overall conclusion was that the batch experiment will probably vary from the true **average** Kd value in a field of the same soil by up to a factor of two.

Over time, it is expected there will be less diuron available for runoff. Apart from just increased sorption over time, this may also be likely due to several other fate processes that include removal in earlier runoff events, vertical movement through the soil profile or degradation processes. The runoff calculations however, are performed on the premise that the runoff event occurs three days after application. The argument that the majority of the mobile fraction of diuron will be removed during the initial runoff events is acceptable, however, it cannot be readily applied in the assessment. On a wider spatial scale than individual farms, it is unlikely that all use areas within a catchment will be treated at the same time. This means exposure can continue over an extended period of time and is supported in both monitoring and other additional information provided for review here (see Rohde et al, 2011 in Volume 3 with respect to multi farm scale monitoring).

With the assumption of runoff occurring three days after application, the field half-life used in the model is not as influential as if a longer time were used between application and runoff. Nonetheless, the half-life of 79 days used in the model is still not considered unreasonable. It is expected that in different agricultural systems a wide range of field half-lives will be available. Because there are often a wide range of geographical and climatic conditions experienced even within single cropping systems, such variation in field half-lives could be encountered for single cropping systems. Therefore, the use of a representative, but conservative value is necessary.

Additional monitoring data have become available since APVMA (2011). These data (all generated post the Reef Rescue initiative) consist primarily of values associated with sugar cane growing areas and are available for a range of river systems, and inshore reef areas. In addition, results based on paddock to reef field experiments have provided further valuable data on expected diuron levels in runoff from sugar cane farming. The results have been used to help validate the DSEWPaC model. River monitoring results demonstrated the general decline in residue levels as the wet season progressed. Assuming the bulk of application occurred early in the wet season (or just before it), this would be expected. Despite this, some data in smaller systems showed the potential for elevated levels (>1 µg/L) for extended periods of time. Meanwhile, passive samplers in inshore reef areas showed much lower levels of diuron (generally <0.02 µg/L). However, these values were average exposure concentrations over a 1 month (wet season) or 2 month (dry season) period and there is no way of knowing what peak concentrations were or how long they may have persisted. Paddock to reef field experiments demonstrated that, while differences in management practices may influence runoff, detection of high levels in run off for diuron were evident. Initial runoff concentrations were very high and significantly underestimated by the DSEWPaC model. Further, the potential for pulse exposure at levels of concern was demonstrated at farm scale level due to multiple application times within a catchment.

V1.5 Environmental Toxicity – discussion of additional data

Several literature papers describing higher tier aquatic toxicity testing were provided to address the issues surrounding recovery and pulse exposure effects on aquatic plants and communities. It is acknowledged that the standard toxicity studies for algae and aquatic plants demonstrate recovery can occur, but the main concern relates to effects following continued or pulsed exposure at levels considered to exceed the toxicity threshold established through the use of a species sensitivity distribution.

The assessment of the new literature considered here is described in Volume 3. Results tended to show that pre-exposed algae communities were not more susceptible (and were often less susceptible) to short term toxicity following a second pulse exposure to diuron. LOEC values from one such study ranged from 1.25 to 5 µg/L to algae communities from an untreated control pond that were not previously exposed (4 X 1.25 µg/L and 1 X 5 µg/L LOECs), while communities previously exposed for around 35 days at ~5 µg/L, and then re-exposed showed LOECs of 1.25 µg/L (1 result), 2.5 µg/L (1 result), 5 µg/L (2 results) and 10 µg/L (1 result). The concern remains though, that these are short term LOEC values showing many results still below the 95th percentile protection value determined from the SSD approach. The results do not allow a determination of a community or population NOAEC that could help refine the toxicity end-point.

One recent study did allow determination of a $LOEC_{community}$ for benthic algal communities from around Townsville. This study identified pollution induced community tolerance in the tropical estuarine periphyton tested in response to chronic diuron exposures. However, microscopy and pigment analysis revealed that this decrease in sensitivity was accompanied by a shift in species composition towards communities dominated by diatoms. Community composition changed compared to controls at 1.6 µg/L, which is in very close agreement with the current 95th percentile SSD endpoint of 1.56 µg/L used in the assessment.

In a study with submerged rooted macrophytes, a time weighted concentration of 4.9 µg/L over 34 days did not have any effect on growth rate and only showed a transitory effect on photosynthetic efficiency based on PAM measurements.

In a complex study considering pulse exposure on periphyton communities measuring a number of end-points and exposure scenarios, the results tend to indicate an increased tolerance to pulse exposures to diuron (7 and 14 µg/L) from chronically (1 µg/L) exposed periphyton communities. However, where periphyton communities were not continually exposed to low level diuron concentrations, there were adverse impacts with, for example, significantly lower biomasses and significant inhibition of *in vivo* fluorescence.

A further complex study was considered assessing the sub lethal and long-term effects of successive pulses with the same pesticide mixture on periphytic communities, mimicking different flood-event exposure scenarios. This is discussed in detail in Volume 3.

Additional data were assessed for effects on non-standard test species (foraminifera) using non-standard test systems. While the methodology is now becoming well developed, in line with APVMA (2011) these data have not been used as part of end-point determination. However, the results show the ecotoxicity end-point used in the risk assessment should remain protective to foraminifera.

Overall, it is considered that algae/aquatic plants will demonstrate recovery following an exposure to diuron. The results now considered for pulse exposure tend to support a view that a degree of pollution induced community tolerance could be observed, that is, pre-exposed aquatic plant communities may be less susceptible to further exposures of diuron. However, while data from higher tier studies are available, their results do not provide a compelling reason to further refine the ecotoxicity end-point. In many of the higher tier studies there did not appear to be a clear path of investigation in the mesocosm data. It is generally not possible, for example, to categorise the results of micro/mesocosms experiments in line with guidance from sources such as EU (2002) or Brock et al (2010) which could allow refinement of the toxicity end-point.

One study did provide a benthic microalgae $LOEC_{community}$ result. As described in EU (2002), the data from microcosm and mesocosm studies should be used to determine a number of endpoints which can then be used further in the risk assessment (for example, to derive an ecologically acceptable concentration (EAC) – see below). For the relevant taxonomic groups in the study, a no observed effect concentration at the community level ($NOEC_{community}$) should be derived using appropriate statistical techniques such as Principal Response Curves. In addition, NOECs for populations of relevant organisms should be reported ($NOEC_{population}$). Where there are effects at the community or population level, the time taken for recovery to occur should also be reported.

The $NOEC_{community}$, the $NOEC_{population}$ and the time taken for recovery should then be used to determine a no observed ecologically adverse effect concentration (NOEAEC). The NOEAEC is defined as being the concentration at or below which no long-lasting adverse effects were observed in a particular higher-tier study (e.g. mesocosm). No long-lasting effects are defined as those effects on individuals that have no or only transient effects on populations and communities and are considered of minor ecological relevance (e.g., effects that are not shown to have long-term effects on population growth, taking into account the life-history characteristics of the organisms concerned). Different recovery rates may therefore be acceptable for different types of organisms. The NOEAEC can therefore be higher than the $NOEC_{community}$ or $NOEC_{population}$. Thus, if at a single test concentration effects were determined but recovery occurs and the effect is considered of no concern for the ecosystem sustainability, that concentration should be used as NOEAEC. Different NOEAECs may be derived from a study depending on the protection aim (such as in-crop versus off-crop area).

EU (2002) offers further guidance in this regard. The actual assessment of the effects found in the mesocosm/microcosm studies can be grouped into 5 classes where class 1 is the lowest level (no treatment related effects demonstrated) and class 5 is the most severe (clear response of sensitive endpoints and recovery time of these being >8 weeks after the last application; effects observed at various subsequent samplings".

A further refinement of these effects classes is provided in Brock et al (2010) where effect class 3 is separated as 3A being pronounced short term effects (<8 weeks) followed by recovery while 3B is considered pronounced effects and recovery within 8 weeks after the last application. Additionally, class 5 is also separated to 5A being pronounced long term effects followed by recovery while 5B is pronounced long-term effects without recovery.

In the study where a $LOEC_{community}$ was derived, recovery was considered over a 2 week period and in this timeframe, recovery was demonstrated at the lower concentrations tested. However, community composition changed compared to controls at 1.6 µg/L, which is indicative of a study LOEC, not a NOEC. This value can probably be taken to represent a lower limit ecologically adverse effect concentration. It is very close to the currently used 95th percentile SSD endpoint of 1.56 µg/L so does not justify a change in the end-point used in the risk assessment.

Additional new data provided address the impact of diuron on sediment microbial communities. These findings help alleviate previous concerns regarding long term exposure of aquatic flora when exposed through sediment pore water as the results from this study demonstrated that diuron contamination via runoff and erosion may stimulate the diuron mineralisation capacities of the sediments (see Section V1.7.3).

V1.6 Risk to Birds

For spray applications, DSEWPaC estimates pesticide concentrations in animal food items with the focus on quantifying possible dietary ingestion of residues on vegetative matter and insects. Residue estimates are based on the updated Kenaga nomogram (Pfleeger *et al*, 1996) that relates food item residues to pesticide application rate. Residues are compared directly with dietary toxicity data or converted to an oral dose. In the previous assessment, this approach demonstrated an acceptable acute risk to birds based on application rates up to 1800 g ac/ha.

V1.6.1 Exposure estimates

A long term exposure assessment was undertaken based on European guidance (EFSA, 2008). This reference has since been updated (EFSA, 2009). In the past, the EU approach was to also use the Kenaga methodology. However, in their latest guidance a slightly different approach is taken based on several new studies:

- The database of Fletcher et al (1994) was updated by examining the validity of extrapolating residue unit dose values (RUD) across application rates, and to improve the categorisation of crops using crop morphology and cultivation methods;
- Several studies were carried out to provide information on RUD values on insects; and
- Industry provided databases for residues on cereals and grass and on non-grass weeds.

While this updated information could arguably be more appropriate than the Kenaga methodology, the EU approach assumes that birds and mammals will not eat large leaves or eat at all from the crop. It remains DSEWPaCs position to maintain calculation of exposure estimates based on the Kenaga approach.

For this refined assessment, though, DSEWPaC considers it appropriate to refine the avian exposure assessment where possible. The EFSA methodology uses 90th percentile residue levels for acute exposure and mean residue levels for chronic exposure assessment. The Kenaga residues that DSEWPaC had used previously were the 90th percentile values and for this refinement, these will be amended to the mean residues through the US EPA T-REX model. This relaxation from 90th percentile to mean residues is based on EFSA (2009), where it is reasoned that over the longer periods that are relevant for some reproductive endpoints, animals may feed on several fields and thus tend to average out variation in residues, although it is also possible that an individual may continue to feed in a single field with high (or low) residues over multiple days. EFSA (2009) considers it reasonable to use the 90th percentile residue levels for the acute assessment and the mean residues for the reproductive assessment.

The Kenaga residues approach used by DSEWPaC as described in Section 5.4.1 of the Risk Assessment Manual (EPHC, 2009) is the same as that employed with the T-REX model. This model is publicly available at:
www.epa.gov/oppefed1/models/terrestrial/index.htm.

The three main situations considered based on cropping scenarios described above are use in pre-emergent situations, and use as a post-emergent. Post-emergent application can either be as an over the top spray (cereals), or as a directed spray (for example, tree and vine crops). In the case of tree and vine crops, application will be to the base of trees such that no more than 50% of the area will be sprayed, and foliage above the base of trees should not be exposed.

V1.6.2 Ecotoxicity end-point for use in the assessment

In the previous assessment, a study on chronic toxicity of diuron to mallard duck was provided demonstrating reproductive effects to this species primarily related to egg laying. At the study test concentrations of 10, 33, 100 and 160 ppm, the reduction in egg laying compared to control birds appeared to follow a dose/response relationship with reduction of 13%, 28%, 34% and 67% respectively. Statistical analysis suggested only reductions at 100 ppm ($p > 0.05$) and 160 ppm ($p > 0.01$) were statistically significantly different to the control, although a reduction of almost 30% at

33 ppm is of concern, and the study NOEC of 10 ppm based on egg laying seemed biologically relevant and appropriate for use in the risk assessment.

Criticisms were received in submissions relating to the bird assessment, the lack of data on Australian species being one of these. It is not the role of the APVMA or DSEWPaC to generate such data. These types of local studies are almost never available and in fact it is illegal to conduct them in some states such as NSW. Consequently, the standard test species used by other OECD regulators are relied upon. It should be noted the local Pacific Black Duck is closely related and in fact may interbreed with the mallard, therefore the use of mallard duck test results is relevant for this assessment.

Further, Australia does not have standard indicator species for different cropping situations. That is why birds with two different dietary intakes are considered rather than focussing on specific species where significant additional information such as food intake rates and dietary compositions would be required.

The assessment methodology described in EFSA (2009), requires all toxicity end-points as mg ac/kg bw/d, rather than as a dietary concentration. From the mallard duck study, the NOEC of 10 ppm diet corresponded to 1.7 mg ac/kg bw/d. However, in the EU methodology, there has been significant research into developing indicator, or focal species for different cropping situations. Diets used for the risk assessment for generic focal species is considered a more realistic approach. In determining these diets, all available literature was considered and a quartile approach adopted to try and account for the range of a particular food item that may occur in the diet. For example, when determining the diet of the generic focal species ‘lark’, use was made of all the published information on the diet of all lark species so as to obtain a generic diet. In addition, to determine daily dietary requirements in order to compare these results with the end point in terms of a daily dose, there has been significant research into indicator species and their food intake rates in terms of body weight.

Australia has not undertaken this type of activity. The appropriateness of simply adopting European indicator species is questionable. As a result, the risk assessment here remains one of comparing the dietary NOEC (mg/kg diet) from the reproduction study with the PEC_{food} (mg/kg fresh weight). However, there is now a closer examination of the possible diet in the refined assessment below, and the mean predicted residues rather than the 90th percentile predicted residues has been used as described in V1.6.1 above.

V1.6.3 Pre-emergent application

In this situation, application is expected to be essentially to bare ground. Therefore, exposure to plant matter is less likely (although, it is noted that EFSA, 2009 assumes leaf matter from small weeds are always available) and the exposure estimate will be based on residues on insects only. In line with the previous assessment it will be assumed 50% of the bird’s diet is taken from the treated field.

EFSA (2009) assumes a half-life of residues on food of 10 days, and a 21 day time weighted exposure (TWA) is calculated by multiplying the initial mean concentrations by 0.53.

The following calculation is provided as an example. With an application rate of 1000 g/ha, the 90th percentile residue levels on large insects (diet A) is 13.4 mg/kg, while the mean residues are 6.2 mg/ha. Diet A consists of 70% large insects (= 6.2 X 0.7 = 4.34 mg/kg). This is then multiplied by 0.53 to give the 21 d TWA, and then further multiplied by 0.5 to account for 50% diet taken from the treated field. The final PEC_{food} for diet A at 1000 g ac/ha is therefore 1.2 mg/kg.

Table V1.2: PEC_{food} (21 d TWA) calculations and avian Q values – pre emergent application.

Application rate kg ac/ha	PECfood Diet A[1] mg/kg	PECfood Diet B[2] mg/kg ww	Q-value Diet A	Q-Value Diet B
180	0.2	0.6	0.02	0.06
250	0.3	0.8	0.03	0.08
450	0.5	1.4	0.05	0.14
900	1.0	2.9	0.10	0.29
1800	2.1	5.7	0.21	0.57

1) Residues based on 30% grain (same as long grass) and 70% large insects – for example, Mallard duck;
2) Residues based on 70% grain (long grass) and 30% small insects – for example, Bobwhite quail.

This revised assessment indicates that, refining exposure to allow for bare ground application as in the case of pre-emergent applications, the chronic risk to birds is acceptable up to the maximum rate of 1800 g ac/ha considered here.

V1.6.4 Post-emergent application

V1.6.4.1.1 Broadcast (over the top) application

This type of post-emergent application is applicable to cropping situations such as cereals and pulse crops where application is not by a directed spray, but rather to the whole treated area.

The following table shows predicted dietary concentrations and associated risk quotients using mean residues with a 21 day time weighted average, and assuming 50% of the birds diets come from the treated fields.

Table V1.3: PEC_{food} (21 d TWA) calculations and avian Q values – post emergent application to whole hectare.

	Diet A		Diet B	
Rate	PECs	RQ	PEC	RQ
180	0.83	0.1	2.06	0.2
250	1.16	0.1	2.87	0.3
450	2.08	0.2	5.13	0.5
500	2.33	0.2	5.74	0.6
640	2.98	0.3	7.35	0.7
880	4.10	0.4	10.1	1.0
1710	7.97	0.8	19.6	2.0

Risk quotients are at application rates up to 880 g ac/ha are indicative of an acceptable risk (at or below a value of 1.0). The rate of 880 g ac/ha is for control of soursob in South Australia only with instructions to apply when the crop is in the 2-5 true leaf stage.

The high rate of 1710 g/ha is for application to lucerne. Information provided in submissions relating to lucerne are discussed in Volume 4 and also discussed in Volume 2 (Section V2.6.1). These submissions refer to much lower rates than 1710 g ac/ha being used. For example, when tank mixed with other substances, rates as low as 250-300 g ac/ha are provided. Information provided in submissions to the review indicate that in-field rates of 750 g ac/ha are used in lucerne seed production in South Australia. This rate results in a risk quotient to birds (Diet B) of 0.86, which indicates an acceptable risk.

Given the potential chronic risk to birds from post emergent application when the whole hectare is treated, there is sufficient evidence to reduce the currently registered rates for use in lucerne.

V1.6.4.1.2 Directed spray application

Post-emergent application in broadacre and tree and vine cropping situations can be as a directed spray either to the base of rows, or the base of trees/vines. Further, due to the need to avoid spraying the crop, there will be considerable foliage in the treated area that is not contaminated. EFSA (2009) takes the view that birds will not eat large leaves, nor that they will eat at all from the crop, rather it is assumed that animals will eat monocotyledonous and dicotyledonous weeds or young crop plants (if palatable) and that these weeds will always be present.

If the standard diets A and B are maintained, the main refinement that can be made for post-emergent application relates to the percentage of the diet obtained from the treated area. It has previously been assumed that, for broadcast application and the chronic assessment, birds obtain as a worst case, 50% of their diet from the treated area. If this is reduced by a further 50% to account for the large untreated areas of a field in the case of directed sprays for post emergent use, the following matrix of PEC_{food} and corresponding risk quotients is derived:

Table V1.4: PEC_{food} (21 d TWA) calculations and avian Q values – post emergent application.

Application rate kg ac/ha	PECfood Diet A[1] mg/kg	PECfood Diet B[2] mg/kg ww	Q-value Diet A	Q-Value Diet B
180	0.33	0.82	0.03	0.08
250	0.46	1.14	0.05	0.11
450	0.84	2.06	0.08	0.21
900	1.67	4.12	0.17	0.41
1800	3.34	8.23	0.33	0.82

1) Residues based on 30% grain (same as long grass) and 70% large insects – for example, Mallard duck;
2) Residues based on 70% grain (long grass) and 30% small insects – for example, Bobwhite quail.

This assessment indicates that, refining exposure to allow for more targeted application as occurs with directed post-emergent applications, the chronic risk to birds is acceptable up to the maximum rate of 1800 g ac/ha considered here.

V1.6.4.1.3 Industrial uses/bore drain application

The use of diuron in industrial situations, or for control of prickly acacia in bore drains involve very much higher application rates than those shown above to be acceptable. However, overall exposure to birds is expected to be minor due to these use patterns as significantly larger percentages of land from which birds may obtain their diets will remain untreated (narrow strip application in the case of bore drains and small areas of application in industrial uses). Therefore, the chronic avian risk from these two use patterns is considered acceptable.

V1.7 Risk to Aquatic Organisms

V1.7.1 Risk from Spray Drift

Buffer zones were previously calculated (APVMA, 2011), however, these were only for cotton defoliation products where application rates are very low (24 g ac/ha).

In the draft labels provided in submissions from Nufarm and Farmoz, the two restraints for all crops that are directly applicable to the spray drift risk assessment are to use only coarse or larger spray quality according to the ASAE S572 definition for standard nozzles, and to not apply by air.

This spray drift assessment has only considered ground application and coarse droplet sizes. If aerial application or a finer spray quality is required, appropriate downwind buffer zones will need to be calculated separately.

Spray drift from ground application was performed according to the AgDRIFT model (APVMA, 2008). This model is limited in the parameters that can be changed. The downwind limit for this model is 300 m, and cannot be extended. The following provides a summary of the set values used in the modelling:

Tier	Tier 1 Agricultural
Boom height	High/Low
Swath width	13.72 m
Number of swaths	20

While the model does not allow for changes in droplet size, DSEWPaC and the APVMA have adopted the use of the 50th data percentile and fine to medium/coarse droplets to represent coarse spray quality. The following table provides indicative downwind buffer zones for the different application rates (absolute values as predicted with the model):

Table V1.5: Downwind aquatic buffer zones, Ground Application, Coarse droplets, High boom

Rate (g ac/ha)	180	250	450	500	750	900	1800
Buffer zone (m)	9	12	24	28	44	53	107

Based on the maximum application rate of 1800 g ac/ha, a downwind buffer zone to waterbodies of 100 m is required using ground application techniques and coarse droplets.

Buffer zones above have only been calculated based on high boom (post-emergence) use. Label buffer statements will be dictated by the highest application rate. Pre-emergence application will be undertaken with a lower boom height, but because both pre- and post-emergence use will be defined on the same label, pre-emergence buffer zones have not been calculated separately.

In the case of lupins, pre-emergence use is the only method on the label. At a rate of 990 g ac/ha, a downwind aquatic buffer zone for this use of 30 m is calculated. The same would apply to pulse crops where IBS (incorporated by sowing) techniques are used as this use has a maximum application rate of 990 g ac/ha and a low boom is expected.

V1.7.2 Risk from Runoff

A very detailed risk assessment for runoff is provided in Volume 2. The following findings are summarised but Volume 2 should be consulted for all methodology, calculations and justification underpinning the outcomes. These results are all dependent on slopes where diuron is used being 3% or less:

Table V1.6: Summary of Findings from Runoff Risk Assessment – Acceptable uses based on runoff risk.

Situation	Rate (g ac/ha)	Notes
Broadacre Crops/Situations		
Winter Cereals		
Wheat, barley, triticale, cereal rye and oats, WA only	250-500	
Wheat, barley, triticale and oats, WA only	180-250	1
Wheat, barley and oats, NSW, Vic, ACT and SA only	450	
Wheat and barley, SA only (soursob control)	640-880	2
Wheat and barley, NSW, Vic, ACT and SA only	250	
Summer Fallow, SA only (mixed with paraquat)	250	
Cotton Irrigated cotton, capacity to retain runoff	900 to 1800	
Lupins, WA Only	990	3
Pulses Incorporated by Sowing	750 to 990	4
Post sowing pre-emergent	495 to 750	5, 6
Tree and Vine Crops – Apples and Pears, Goulburn Valley only	900 to 1800	7
Tropical/Sub-Tropical Crops – Sugarcane; Bananas	250 to 450	8
Miscellaneous		
Asparagus	1800	9
Desert Channels (Bore drains)	32000	10

1) These rates are when tank mixed with MCPA or 2,4-D.

2) These higher rates in cereals are restricted to South Australia, and the more localised assessment allowed the use of higher organic carbon in the soil, which lowers the runoff risk.

3) This apparently high application rate is supported based on acceptable runoff risk due to application being restricted to lighter (sandy) soils, which lowers the runoff potential and application occurring earlier in the season where soils are expected to be drier, again lowering the potential for runoff.

4) With restrictions on tillage system and application machinery.

5) With restrictions on tillage system (only for use in no-till situations).

6) Use on Faba Beans in Western Australia is not supported for post sowing pre-emergent application at the higher application rate.

7) Runoff risk assessment could confidently predict an acceptable risk for use only in the Goulburn Valley, Victoria.

8) General use rates in sugar cane and bananas up to 450 g ac/ha are included on labels where the product is tank mixed with paraquat. These have been shown to have an acceptable runoff risk. In sugar cane, diuron in combination with hexazinone has general use rates of 280 g ac/ha and 560 g ac/ha, also when tank mixed with paraquat. For products co-formulated with hexazinone, the runoff risk with the lower rate is acceptable (and is within the range in the above table), but the runoff risk with the higher rate was not considered acceptable.

9) The runoff risk for this high application rate is acceptable in asparagus based on the highly localised assessment demonstrating very high organic carbon in the soils within the primary asparagus growing region in Australia (Victoria), which significantly lowers the runoff potential. The highest tier of assessment (in-stream analysis) was undertaken and this demonstrated acceptable runoff risk.

10) While these rates are very high, application is limited to 1 m strips along the sides of bore drains, which are man-made structures that do not drain to natural surface waters.

Lucerne seed production

The lucerne label rate is currently 900-1710 g ac/ha. However, the post-emergence rate is expected to be an over the top spray, and consequently an avian chronic risk is identified. In their submission to the APVMA, Lucerne Australia stressed that use of diuron in the lucerne production system is one which has evolved over several decades. As part of this, the rates of use have been tested at both high and low rates. This long term use has seen the rates reduced significantly from the high label rates down to 750 g ac/ha.

An over the top pre-emergence spray rate of 750 g ac/ha has been shown to result in both an acceptable risk to birds and algae/aquatic plants in the runoff risk assessment for the lucerne seed production area.

Table V1.7: Summary of Findings from Runoff Risk Assessment – Unacceptable uses based on runoff risk.

Situation	Rate (g ac/ha)	Notes
Broadacre Crops/Situations		
Cotton		
Irrigated cotton, no capacity to retain runoff	900 to 1800	1
Dryland cotton	900 to 1800	1, 2
Phalaris Pastures	1530	3, 4
Grass seed crops	1530-3000	3, 4
Lucerne	900 to 1710	3, 5
Peas, WA Only	750 to 1080	2,6
Tree and Vine Crops		
Apples and pears (other than the Goulburn Valley)	900 to 1800	2, 3
Citrus	900 to 1800	2, 3
Grapevines	900 to 1800	2, 3
Tropical/Sub-Tropical Crops		
Sugarcane		
Pre-emergent	560-1800	1
Post-emergent	560-1800	1
Bananas	1800	1
Tea Plantations	900	1,2
Coffee	1755	1,2
Paw Paws	1800	1,2
Pineapples	2 000 to 4 000	1
Miscellaneous		
Gladioli, Tulips, Daffodils, Lilium and Iris	1350 to 1800	2
Industrial uses	1800-8800	7

Notes:

1) Highest tier of refinement undertaken and unacceptable Q-values still calculated.
2) Based on available data, the tier 1 assessment indicated an unacceptable risk. A higher tier assessment was not possible due to insufficient data to properly characterise use area, for example, a lack of representative stream flow data in more localised use areas.
3) Use areas too diverse to adequately characterise.
4) It is possible that lower use rates could be supported in certain areas if these were shown to be efficacious.
5) The assessment demonstrated that if use remained efficacious at lower rates (up to 750 g ac/ha), the runoff risk was acceptable in dryland agricultural regions (cereal and cotton growing regions) as rainfall patterns in these were sufficient such that P(com) was <10% and slopes were predominantly 3% or less.
6) This outcome may appear counter intuitive given the result for lupins in WA. Volume 2, Section V2.8 should be consulted, but essentially, the difference is due to application in lupins to relatively dry and sandy soils resulting in significantly lower runoff potential to that for peas in heavier and moist soils.
7) DSEWPaC accepts that some industrial uses could be supported, however, based on current labels and use rates it is not possible to do so. The report provides recommendations to limit environmental exposure through some use patterns.

V1.7.3 Sediment Flora

APVMA (2011) considered there were insufficient data to adequately assess risk to aquatic plants (rooted vascular plants; sediment algae) where exposure was through the sediment. There was concern that the soil metabolite, DCMPU, which has been found at levels similar to diuron in Australian stream sediments, was not able to be considered sufficiently.

Sediment monitoring results reported in APVMA (2011) show levels up to 10 µg/kg sediment in estuarine environments with much higher concentrations in irrigation ditches (up to 340 µg/kg from cotton use and 120 µg/kg from sugar cane use). An Australian field study measured diuron levels in stream sediment where the stream was located below a sugar cane catchment (Stork *et al*, 2008, reported in APVMA 2011). In this study, diuron was detected in all sediment samples when measured at concentrations between 3 and 19 µg/kg while DCPMU was found (again in all samples) at concentrations of 4 to 31 µg/kg. Based on values read from a graph, the mean concentration of diuron (10 samples) was ~ 15.1 µg/kg while that for DCPMU was ~18.2 µg/kg.

Based on regulatory studies to the same species of green algae (*Scenedesmus subspicatus)*, the toxicity of these two substances is not dissimilar. The growth rate EC50 for diuron was 22 µg/L while that for DCPMU was 62.8 µg/L. The risk assessment for aquatic organisms has focussed on diuron residues only, as DCPMU is largely considered to be a soil metabolite. However, where found in sediments, it may be more appropriate to consider a combined residue approach. In the table below, a stream sediment level of 33 µg/kg is also considered. While this is essentially taken as being "diuron equivalents", it is noted that the toxicity of DCPMU to the single species for which comparative data are available, is lower than diuron, so the risk quotient derived below may be an overestimate.

Diuron is not a strongly bound chemical. However, this assessment has shown the relationship between diuron sorption and organic carbon levels. It is possible to estimate the likely water column diuron levels based on known sediment levels using equilibrium partitioning (EqP). As explained in Di Toro *et al* (1991), the sediment concentration (Cs) and free dissolved pore water concentration (Cd) share the following relationship:

$$Cs/Foc = Koc \times Cd, \text{ or conversely, } Cd = Cs/(Foc \times Koc) \ (= Cs/Kd).$$

Australia now uses a default value of 4% OC in sediments (EPHC, 2009). Using the relationship between adsorption Kd and %OC developed in this assessment, 4% OC corresponds to a predicted Kd value of 18.6 L/kg. These calculations are summarised in Table V1.4.

Table V1.8: Predicted Pore Water Concentrations (µg/L) and Algae/aquatic Plant RQ-values based on Measured Sediment Concentrations

Sediment level (µg/kg)	Example as measured	Predicted pore water concentration (µg/L)	RQ-value, 95% protection level
10	Sub-tidal sediment	0.54	0.77
15	Stream sediment	0.81	0.52
33	Stream sediment	1.77	1.13

This analysis still indicates a potential risk when a "total residues" approach is considered, although the risk quotient only marginally exceeds 1. While Australian sediment data for diuron metabolites is very limited, it is important to note that the Kd value used above relates to an adsorption coefficient, not desorption as is the case when soil runoff containing bound diuron enters a water body and becomes part of the sediments.

Field data considered in Volume 3 indicate that these Kd values are expected to be higher than adsorption Kd values, and also increase as ageing time in the field increases. One study (Simpson, 2007) showed an increase from 0-3 days after application of around 3.6 times. Another study (Louchart and Voltz, 2007) showed this effective Kd increased by a factor of 10 one month after application. Further, Wauchope et al (2002) conclude that true Kd values in a field may be underestimated in the longer term from batch equilibrium studies by up to a factor of two.

Accepting that the Kd for desorption will be larger than the adsorption Kd used here, it can be seen that even with a total residues approach, the stream sediment level in the above table will result in proportionately lower predicted pore water concentrations, and the risk (based on these known sediment levels) is considered acceptable. For example, doubling the Kd to allow for a desorption Kd with a runoff event occurring some days after application, the predicted pore water concentration from a sediment level of 33 µg/kg is reduced to 0.89 µg/L, and the resultant Q-value is 0.6.

Since APVMA (2011), further data have become available that allow a better understanding of the issue of diuron impacts on sediment biota. Pesce et al (2010), reported in more detail in Volume 3, demonstrated that diuron contamination via runoff and/or erosion may stimulate the diuron mineralization capacities of the sediments. The resulting mineralization potentials provide evidence for increased diuron biodegradation potential of benthic microbial communities in chronically exposed watersheds. The results suggest that interrelations in soil–water–sediment systems involve not only chemical functions but also biological functions. Long term impacts on sediment microbiota would appear unlikely based on the results of this study, however, short term (2-4 weeks) effects on bacterial community structures could occur.

New data also now available showed no effect on growth of submerged (including rooted) aquatic macrophytes at a diuron water column concentration of 5 µg/L (Knauert et al, 2010). While this study did not assess exposure from contaminated sediments, it is noted from Table V1.3 above that sediment levels needed for a pore water concentration of 5 µg/L will be well in excees of those measured in Australian sediments to date.

This is an important finding as it allows increased confidence that, while diuron and its metabolites may remain bound to sediment, release through desorption to the associated pore waters is less likely to result in persistent, elevated diuron concentrations.

Finally, the metabolite of concern, DCPMU, is a soil metabolite, not one associated with aquatic metabolism. A major mitigation measure assessed in this report is limiting slopes of application to 3% or less, which will assist in greatly reducing soil runoff, hence decrease exposure of this metabolite where it may exist in soil, to the sediments from runoff events.

V1.8 Risk to Terrestrial Fauna

This risk was only identified for bees and other insects at rates exceeding 10 kg ac/ha. No rates at this level remain supported, with the exception of use in bore drains in Queensland, which is not expected to lead to adverse impacts on non-target arthropods.

V1.9 Risk to Terrestrial Plants

Buffer zones were previously calculated (APVMA, 2011), however, these were only for cotton defoliation products where application rates are very low (24 g ac/ha). In the draft labels provided in submissions from Nufarm and Farmoz, the two restraints for all crops that are directly applicable to the spray drift risk assessment are to use only coarse or larger spray quality according to the ASAE S572 definition for standard nozzles, and to not apply by air.

This spray drift assessment has only considered ground application and coarse droplet sizes. If aerial application or a finer spray quality is required, appropriate downwind buffer zones will need to be calculated separately. AgDRIFT input parameters are described above in Section V1.7.1.

The following table provides indicative downwind buffer zones for the different application rates (absolute values as predicted with the model):

Table V1.9: Downwind aquatic buffer zones, Ground Application, Coarse droplets, high boom

Rate (g ac/ha)	180	250	450	500	750	900	1800
Buffer zone (m)	18	27	52	58	88	104	191

Based on the maximum application rate of 1800 g ac/ha, a downwind buffer zone to non-target vegetation of 200 m is required using ground application techniques and coarse droplets.

Buffer zones above have only been calculated based on high boom (post-emergence) use. Label buffer statements will be dictated by the highest application rate. Pre-emergence application will be undertaken with a lower boom height, but because both pre- and post-emergence use will be defined on the same label, pre-emergence buffer zones have not been calculated separately.

In the case of lupins, pre-emergence use is the only method on the label. At a rate of 990 g ac/ha, a downwind aquatic buffer zone for this use of 70 m is calculated. The same would apply to pulse crops where IBS (incorporated by sowing) techniques are used as this use has a maximum application rate of 990 g ac/ha and a low boom is expected.

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