Australian Government

Australian Pesticides and Veterinary Medicines Authority

DIURON REVIEW

Volume 4 of 4

Supplemental Environmental Assessment Report

Submission responses

This Report was prepared for the APVMA by

Department of Sustainability, Environment, Water, Population and Communities

9 July 2012

ISBN 978-1-922188-03-8 (electronic)

Ownership of intellectual property rights in this publication

Creative Commons licence

Use of the Coat of Arms

Disclaimer

Comments and enquiries:

The Manager, Public Affairs
Australian Pesticides and Veterinary Medicines Authority
PO Box 6182
KINGSTON ACT 2604 Australia

Telephone: +61 2 6210 4701

Email: communications@apvma.gov.au

This publication is available from the APVMA website: www.apvma.gov.au

Supplemental Environmental Assessment Report

Diuron

Responses to Submissions

Volume 4 of 4

Australian Government

Department of Sustainability, Environment, Water, Population and Communities

Environment Protection Branch

9 July 2012

This volume provides responses to individual submissions provided to the APVMA in response to the release of APVMA (2011).

Submission 1	Author: Mr Colin Pearse
Issue 1	Application in wheat belt in Western Australia – Use rates in the range of 200-500 g/ha with the most common rate being 280 g/ha.
Response:	The general arguments provided have been considered in the revised report – see Volume 2, Section V2.2.

Submission 2	Author: Lindsay Dowley
Issue 1	Use in viticulture in the Riverland of South Australia.
Response:	The author appears to be of the view that the diuron assessment recommendations were based on use in sugar cane, and possible effects on the marine environment. This is incorrect, and the main concern relates to freshwater effects from runoff. The author advises that in 40 years use they can reduce rates by 50% and still retain the same effect. While the assessment can only be undertaken for currently registered application rates, consideration of reduced rates has been given when information is provided. Unfortunately with this submission, there is no information provided on the actual rates used.

Submission 3	Author: Unknown
Issue 1	Diuron use in cereal production areas of Southern Australia
Response:	The arguments provided have been considered in the revised report - see Volume 2, Section V2.2.

Submission 4	Author: South Australian Farmers Federation
Issue 1	Diuron is only used every 2, 3 or 4 years in cropping rotations in the major broadacre areas of South Australia.
Issue 2	Application of diuron in broadacre crop situations is commonly restricted to one application per annum in the cereal phase. Active constituent rates would generally be between 220 to 360 g ac/ha per annum.
Issue 3	Annual rainfall in the South Australian cropping zone averages between 250-650 mm.
Response:	The arguments provided have been considered in the revised report - see Volume 2, Section V2.2 and Section V2.3.

Submission 5	Author: Canegrowers
Issue 1	Several issues to be addressed.
Response:	Please refer to Appendix 1 for a detailed response to this submission

Submission 6	Author: Kennedy et al (University of Sydney)
Issue 1	Large submission with several issues to be addressed.
Response:	Please refer to Appendix 2 for a detailed response to this submission.

Submission 7	Author: Ms Alison Anderson (NSW Farmers)
Issue 1	Argument provided for different farming systems including cereal production and cotton relating to aspects such as: • Soil coverage at the time of application; • Annual rainfall characteristics; • Diuron field half-lives; • Relevant use of monitoring data; • Actual versus label rates; • Incorporated by sowing.
Response:	The arguments provided have been considered in the revised report. DSEWPaC understands the basis for the arguments, but is often limited in the way certain aspects can be applied in the assessments. They are provided as broad level assessments that must account for the worst likely conditions. In the revised assessment, considerable changes have been made with a much more regional approach now allowing consideration of rainfall characteristics and the likelihood of runoff producing rain events. We have allowed for application methods such as incorporated by sowing, and have moved away from a reliance on monitoring data to a much more enhanced runoff model than available at the time of the previous assessment.

Submission 8	Author: Dr Angus Crossan (Quicktest Technologies)
Issue 1	This was not a diuron specific submission. The two issues raised were the risk assessment framework in general (clearly expressed protection endpoints for ecological risk assessment without reliance on a "one size fits all" approach), and promotion of technology owned by the company for rapid testing of diuron and other herbicides in water.
Response:	DSEWPaC undertakes environmental risk assessments at a national regulatory level consistent with approaches in other OECD jurisdictions. This is documented in the Risk Assessment Manual (EPHC, 2009)

Submission 9	Author: Alex Fahy (Victorian Department of Primary Industries)
Issue 1	The submission provided results from several consultants contracted to obtain information on diuron use patterns and the importance or otherwise of diuron in the different cropping systems.
Response:	We thank the Victorian Department of Primary Industries for their efforts in obtaining this information. The assessment for runoff has been highly modified from the previous version and the application rates and use patterns provided in the submission have been included in the assessment. DSEWPaC is not able to take information such as diuron's importance in different industries into account in their scientific environmental risk assessments.

Submission 10	Author: Mr Richard Way (YP Alkaline Soils Group)
Issue 1	The submission provided argument relating to broadacre cereal and pulse cropping on the Yorke Peninsula of South Australia
Response:	The arguments provided have been considered in the revised report – please refer to Section V2.2 (cereal crops) and V2.9 (pulse crops).

Submission 11	Author: Professor Ivan Kennedy (University of Sydney)
Issue 1	This was not a diuron specific submission. It related to the general risk assessment framework and suggested improvements.
Response:	As noted in the response to submission 8, DSEWPaC undertakes environmental risk assessments at a national regulatory level consistent with approaches in other OECD jurisdictions. Discussions relating to overall risk assessment and management frameworks, while important, are generally outside the scope of this diuron assessment. Please note, however, a new runoff risk assessment framework has been developed for this assessment.

Submission 12	Author: Dr John Moore (Department of Agriculture and Food Western Australia)
Issues	The submission provided several arguments relating to agriculture in Western Australia including: • Runoff rates in WA; • Soil characteristics in WA; • Use patterns and timing of application; • Annual rainfall; • Slopes of application; • Incorporation at the time of application.
Response:	We thank the Department for their comments. The arguments provided have been considered in the revised report, in particular, Volume 2, Section V2.2. The runoff assessment now allows for consideration of slopes, soil characteristics and different rainfall patterns in different agricultural regions.

Submission 13	Author: Ms Stephanie Leach (Nufarm Australia Limited)
Submission 14	Author: Ms Melanie Gengos (Farmoz Pty Ltd)
Issue 1	Cross referenced Submission 6.
Response:	Please refer to responses given for Submission 6.
Issue 2	In addition, a new maximum rate of 1.8 kg ac/ha was proposed with application limited to one per annum. New risk mitigation practices were proposed as follows: • DO NOT apply by air; • DO NOT use in water logged areas; • DO NOT apply if greater than 50 mm rain fall is expected within 3 days of application; • DO NOT apply to fields where the slope exceeds 3%; • DO NOT irrigate within 3 days of application. For sugar cane, bananas, coffee, paw paws and tea plantation, further restraints included a no spray window (1 December to 30 April) with application in accordance with the Great Barrier Reef Protection Amendment Act 2009.
Response:	These restraints have been considered in detail in the revised risk assessment.
Issue 3	Provision of argument and information related to broadacre/winter cropping (adoption of no-till farming practices), and water management systems in cotton growing.
Response:	DSEWPaC has included consideration of this in mitigating risk associated with cereals and pulse crops. The previous assessment concluded that farms that contain runoff on-farm (primarily expected to be cotton farms) could continue to use diuron and this has not changed.

Submission 15	Author: Dr Rohan Rainbow, GRDC
Issue 1	Hazard parameters such as use of the Kd value to estimate bioavailability of diuron; comparison with high rainfall areas (sugarcane); use of probability of occurrence.
Response:	Please refer to responses given for Submission 6 regarding the issue of Kd. The revised assessment makes use of a much enhanced runoff model and uses historic rainfall data for inputs to the model and to conclude on probability of runoff producing rain events in different regions – please refer to Volume 2.
Issue 2	Tillage systems, particularly the high adoption of no-till cropping practices in Australian grain growing regions.
Response:	DSEWPaC has included consideration of this in mitigating risk associated with cereals and pulse crops (see Sections V2.2 and V2.9).

Submission 16	Author: Ms Hannah Loller
Issue 1	Diuron use in cereal production and break crops, South Australia
Response:	The arguments provided have been considered in the revised report. Please refer to Volume 2, Sections V2.2 and V2.9.

Submission 17	Author: Mr Andrew Broad; Mr Andrew Weidemann (Victorian Farmers Federation)
Issues	No new data were provided. The submission raised several issues such as inadequate assessment of dryland agriculture; reliance on international field data; inadequate field studies to base conclusions on; modelling assumptions.
Response:	The arguments provided have been considered in the revised report. As a general point, it is not the responsibility of DSEWPaC to generate data – detail on data requirements are described in the APVMA Manual of Requirements and Guidelines (http://www.apvma.gov.au/registration/morag/index.php). In undertaking our assessments, we rely on data generated and supplied by registrants. We need to use what we have and if relevant data can not or will not be generated, need to default to conservative assumptions. In the latest round of submissions, DSEWPaC actually received very useful information on some different cropping systems and practices that now allow us to undertake further refinement. We have further enhanced our runoff model and can now rely much more on quantitative climatic data with assessments focussed on different agricultural regions.

Submission 18	Author: Dr Geoffrey Smart (GFS Genetics and Solutions)
Issue 1:	"Concern for algae appears frequently throughout the 2011 report. But the registered uses of diuron have been in place for some time and any deleterious effect upon freshwater algae have not been a major issue or of great public concern until the release of the report."
Response:	Adverse effects will only be observed if actually looked for. The idea of the review is to assess the available toxicity data and use patterns to determine if exposure is likely to cause a problem. DSEWPaC has current monitoring data showing exposure concerns are not unjustified and off site movement can definitely occur. While it can be argued that these are only available for sugar cane, this really reflects the lack of monitoring efforts for diuron in other systems.
Issue 2:	Groundwater contamination
Response:	The author states DSEWPaC's conclusions with respect to potential groundwater contamination are inconsistent with the conclusions by Stork et al (2008), who concluded there is negligible potential for groundwater contamination. DSEWPaC used the Stork et al (2008) data only in consideration of the potential for diuron and metabolites to be found in sediments as it helped fill a gap in our data. Our report (APVMA, 2011; Section 1.13.3 used much more information than this one literature paper to draw conclusions on the potential for ground water contamination. We conclude that diuron has the potential to move to ground water. That is all. We do not conclude this poses an unacceptable risk, but the statement itself is accurate.
Issue 3:	The author provided a recent paper (Abbot and McKillup, 2010) and further abstract of a paper accepted for publication regarding the lack of effects of diuron on mangroves.
Response:	We thank the author for these documents. They do not lead to any change in our previous assessment on this matter, which already agreed there was no correlation with diuron levels and mangrove dieback.

Submission 19	Author: Growcom
Issue 1	Field runoff data used in the diuron environmental assessment is heavily based on cane specific information.
Issue 2	Conclusions drawn from the cane focussed data are not necessarily relevant to pineapples due to the difference in plant production practices with respect to irrigation and density of major planting areas.
Response:	The submission provided useful information about the pineapple industry, and included a literature report (Yu et al 2000) assessing the validation of WEPP (Water Erosion Prediction Project) to predict runoff and soil loss from a pineapple farm on a sandy soil in subtropical Queensland. DSEWPaC has considered the information provided in the submission, and pineapples are addressed in Volume 2, Section V2.16. While the information from Yu et al (2000) was considered, it was not included in the report as the results were related to runoff and soil erosion in general. For this assessment DSEWPaC has significantly extended the runoff model to allow consideration of different soils and cropping practices. The results of this model in terms of runoff (not diuron concentrations) has been compared to the information in Yu et al (2000). In that paper, it is reported that in March 1994 there were 7 separate runoff events in a sandy soil in SE Queensland, and the average rainfall and runoff were 24.7 mm and 9.5 mm respectively. A daily rainfall of 24.7 mm in the DSEWPaC model predicts runoff of 5.7-8.8 mm (bare soils) and 2.2-6.0 mm (covered soils). These results suggest the model is not likely to overestimate runoff from pineapple growing practices. A further paper Wong (2007) was also provided. While this paper was examined by DSEWPaC, it has not been included in Volume 3 or used in the risk assessment (Volume 2). The toxicity component of the study exposed diatoms to a concentration of 0.25 µg/L, which is well below the 95th percentile protection level of 1.56 µg/L. There is no indication in the paper of diuron application rates and levels found in the French Polynesian streams where the study was done, to be able to able to compare this value to. In a separate submission related to pineapples (see Submission 47 below), some water quality monitoring data from an on-farm dam was provided, which enabled further validation of the DSEWPaC model as applied in this assessment.

Submission 20	Author: Mr Neville Pfieffer
Issues	Diuron use in cereal production and lucerne, South Australia
Response:	The arguments provided relating to exposure have been considered in the revised report. Unfortunately, DSEWPaC can not undertake cost/benefit analysis in their assessments to the APVMA so arguments provided relating to increased costs through use of other herbicides have not been able to be taken into account. This is a risk management issue and needs to be addressed separately by the APVMA.

Submission 21	Author: Ms Felicity Turner (MacKillop Farm Management Group Inc)
Issues	Diuron use in cropping, south eastern region of South Australia and western Victoria.
Response:	The arguments provided have been considered in the revised report. Please refer to Section V2.2 (cereal crops), V2.6.2 (lucerne seed production) and V2.9 (pulse crops).

Submission 22	Author: Mr Mike Norton (WA Farmers Federation)
Issues	Exposure arguments relating to broadacre cropping in Western Australia.
Response:	The arguments provided have been considered in the revised report, in particular Section V2.2. We thank the WAFF for their map of different regions and rainfall in the cereal production areas of Western Australia. Please note, while we did not use these specific regions, we have adopted a similar region approach in which we have been able to better quantify rainfall characteristics and probabilities of runoff events within these regions in the revised report.

Submission 23	Author: Mr C Butler (Roseworthy Rural Supplies)
Issues	Arguments relating to use rates and conditions (soil characteristics; no-till/stubble retention) in oats and lucerne, South Australia.
Response:	The arguments provided have been considered in the revised report. The enhanced runoff modelling used in this report allows consideration of some different soil types and levels of organic carbon content in them. Further, we have been able to assess impacts from both application to bare soils and those with no-till practices. Please note, while DSEWPaC can only assess label rates, the information provided in this submission regarding lower use rates has been considered separately (Section V2.6.1).

Submission 24	Author: Mr David Gregor (Bayer CropScience Pty Ltd)
Issues	Statement that suspension of the Bayer CropScience product 59777 Dropp UltraMax Cotton Defoliant is not necessary or warranted.
Response:	The previous report supported the continued use of cotton defoliating products (APVMA, 2011; Section 1.19).

Submission 25	Author: Mr Shane Oster; Ms Nicola Raymond (Lucerne Australia).
Issues	The submission was on behalf of lucerne seed producers in Australia with arguments provided for environmental exposure in Australia's main lucerne seed production area (Keith, South Australia). Arguments centred around the lack of natural waterways in the production area, sandy soil types, lower in-field use rates to those on the label, and importantly, use of on-farm retention systems to contain excess irrigation water.
Response:	The arguments provided have been considered in the revised report – please refer to Volume 2, Section V2.6.2. However, it should be noted that DSEWPaC can only assess the label rates. Where rates lower than those used on current labels occur, DSEWPaC is advised by the APVMA that these rates need to be registered separately. Nonetheless, DSEWPaC has considered lower application rates (up to 750 g ac/ha) in lucerne in the revised risk assessment – see Section V2.6.1. The previous assessment concluded that where farms can retain runoff waters, uses remain supported. This has not changed.

Submission 26	Author: Mr Roy Morgan (Conquest Crop Protection)
Issues	The submission provided an assessment by J E Holmes providing information and argument to support continued use of diuron in dryland broadacre cropping systems in Western Australia. Information and argument related to rainfall, topography, planting methods and application rates.
Response:	The arguments provided have been considered in the revised report, in particular, Section V2.2. DSEWPaC has used an enhanced model with consideration of rainfall characteristics in different agricultural regions and different soil types and moisture conditions. The enhanced runoff model used in this assessment has relied heavily on the equations and data described in Probst et al (2005). Further, based on this and other submissions, consideration of no-till cropping systems has been made and included in the assessment. We thank the author for their provision of runoff estimations for various seasonal rainfalls and land forms. While this was not used directly in the report, we advise that topography has been considered (limiting slopes to <3%) along with a more quantitiative analysis of rainfall conditions in different growing regions in Australia, which is considered to make the outcomes more appropriate to these specific regions.

Submission 27	Author: Synergy Consulting
Issues	The submission supported information and argument in relation to continued use of diuron in dryland broadacre cropping systems in Western Australia, cross referencing Submission 26.
Response:	Please refer to response for Submission 26 above.

Submission 28	Author: Mr Andrew Roberts (Grain Industry Association of Western Australia)
Issues	General argument for continued use on grain crops (more specifically, oats) in Western Australia.
Response:	The arguments provided have been considered in the revised report. Please refer to Volume 2 Sections V2.2 and V2.9.

Submission 29	Author: Mr Mark Scott (NSW Department of Primary Industries)
Issues	Provision of information on IBS (incorporated by sowing).
Response:	We thank the author for this information and have considered IBS within the general risk assessment for pulse crops in the revised report (Section V2.9.1).

Submission 30	Author: Mr Evan Kakoschke (Agricultural Bureau of South Australia)
Issues	General argument for continued use on cereal and legume crops, Central Yorke Peninsula, South Australia.
Response:	The arguments provided have been considered in the revised report. Please refer to Volume 2 Sections V2.2 and V2.9.

Submission 31	Author: Mr Mark Scott (NSW Department of Primary Industries)
Issues	Arguments regarding use in Citrus.
Response:	Tree and vine crops have been considered in Volume 2, Section V2.10. The assessment was performed at use rates identified in this submission, and for pome fruit, resulted in highly variable outcomes depending on where cropping occurred. At this stage, without further characterisation of citrus growing regions, a conclusive assessment has not been possible. We note the arguments provided regarding irrigation and measured levels reported in the previous assessment (APVMA, 2011) not being considered representative. However, that report also provided recent data from the MIA (no more recent data were available for the Riverina), which showed diuron still be found at elevated levels, in monthly grab samples that are expected to understate peak concentrations, and give no indication for the length of time such exposure may continue. These results were questioned separately (see Submission 44) as being representative of use in drains, not on citrus. However, the most recent data (2011) from this region continues to show several elevated levels of diuron and it is not possible to determine whether these result from field runoff or from use in drains as both use patterns have continued.

Submission 32	Author: Ms Nina Murray (AgForce Queensland)
Issues	Provision of information on no-till farming and use pattern in bore drains (Mitchell Grasslands, Queensland).
Response:	The arguments provided relating to use in bore drains have been considered in the revised report – please see Volume 2, Section V2.18. No-till farming has been considered in the report for cereals (Section V2.2) and pulse crops (Section V2.9).

Submission 33	Author: Mr Hamilton Ackland
Issues	Arguments relating to environmental exposure from use of diuron in dryland broadacre agriculture in the mallee region of South Australia and Victoria.
Response:	The arguments provided have been considered in the revised report. Please refer to Volume 2, Sections V2.2 and V2.9.

Submission 34	Author: Mr Nick Heath (WWF Australia)
Issues	Several issues raised.
Response:	Please refer to Appendix 3 for a detailed response to this submission.

Submission 35	Author: Mr Chris Rosin; Mr Peter Spence (Desert Channels Group)
Issues	Arguments relating to diuron use in bore drains (inland QLD) for control of prickly acacia.
Response:	The arguments provided have been considered in the revised report. Please refer to Volume 2, Section V2.18.

Submission 36	Author: Ms Nina Murray (AgForce Queensland)
Issues	Arguments relating to aspects of the report along with information for use in bore drains to control Prickly Acacia and on dryland cropping situations in QLD. Provision of experimental data on diuron concentrations in bore drains.
Response:	We thank the author for the provision of the data, which has now been assessed along with the associated arguments and considered in the revised report. Please refer to Volume 2, Section V2.18 for bore drains. Dryland cereal production has been considered in detail in Section V2.2. While that assessment discusses outcomes with respect to the southern states (Vic, ACT and NSW), the northern most region considered in this assessment covers also the southern part of Queensland, and the outcomes of the cereals risk assessment is therefore considered applicable to the cereal growing regions of Queensland.

Submission 37	Author: Mr Peter Blacket (Mallee Slopes Pastoral Co.)
Issues	Arguments relating to diuron use in low rainfall wheat and canola region, South Australia.
Response:	The arguments provided have been considered in the revised report. Please refer to Volume 2, Section V2.2.

Submission 38	Author: Dr Kath Cooper
Issues	Arguments relating to diuron use in low rainfall cereal growing region, South Australia.
Response:	The arguments provided have been considered in the revised report. Please refer to Volume 2, Section V2.2.

Submission 39	Author: Mr John Campbell (Macspred Australia)
Issues	Arguments and volumes of use information for defending use of two Macspred Australia products in industrial use situations.
Response:	The arguments and information provided have been considered in the revised report. Please refer to Volume 2, Section V2.20.

Submission 40	Author: Dr Christine Williams (QLD DERM)
Issues	Provision of DERM monitoring data in the Noosa River and lakes (2009-10)
Response:	We thank DERM for the provision of the data.

Submission 41	Author: Mr Mike O'Hare
Issues	Arguments relating to mixed farming (cereals, lucerne pastures) in lower rainfall area of NSW.
Response:	The arguments provided have been considered in the revised report. It is noted in this submission the author refers to a rate of 500 g ac/ha for use in lucerne. This does not appear to be a registered rate, with the lowest rate in lucerne registered at 900 g ac/ha. While DSEWPaC should restrict the assessment to label rates, the acceptability of lower use rates in lucerne has been considered separately – please see Volume 2, Section V2.6.1.

Submission 42	Author: Mr Tom Knox (Australian Asparagus Council)
Issues	Arguments relating to area of use and associated local characteristics with respect to asparagus production in Australia.
Response:	The arguments and information provided have been considered in the revised report. Please refer to Volume 2, Section V2.17.

Submission 43	Author: Ms Louise Moloney (National Prickle Bush Management Group)
Issues	Arguments relating to aspects of the report along with information for use in bore drains to control Prickly Acacia in QLD (Mitchell Grasslands).
Response:	The arguments provided have been considered in the revised report. Please refer to Volume 2, Section V2.18.

Submission 44	Author: (Citrus Australia)
Issues	Provision of several mitigating arguments including: 1. detections of diuron in the MIA are the result of application to irrigation channels and drains rather than from an in-crop use, and the understanding of Citrus Australia is that use of diuron in the MIA includes application to dry channels prior to commencement of irrigation; 2. move away from flood irrigation to drip and under-tree irrigation systems. 3. utilisation of diuron and residual herbicides in general, has become more a targeted use with growers relying more on the application of strategically timed knockdown herbicides for their primary weed control. The application of diuron is more an issue of weed spectrum and concerns over herbicide resistance or as a rotational option. The outcome of which is that the estimated frequency of use as well as the rate of application of diuron in citrus has been greatly reduced; 4. proposal for the adoption of a 10 m vegetated buffer to water courses and referenced literature reports (Reichenberger et al, 2007; Liu et al, 2008) supporting the use of vegetated buffer strips.
Response:	Tree and vine crops have been considered in Volume 2, Section V2.10. The assessment was performed at use rates identified in this submission, and resulted in highly variable outcomes depending on where cropping occurred. At this stage, without further characterisation of growing regions, a conclusive assessment has not been possible. Responses to the specific mitigation proposals made by Citrus Australia are as follows: 1. DSEWPaC accepts that the MIA does not represent all citrus growing regions, and the variety of climatic and geographic conditions has been demonstrated above in this assessment. In areas wetter and with higher slopes than the MIA, surface water contamination is more probable from runoff and the assessment has tried to account for all ranges. Nonetheless, the most recent monitoring data from the MIA continue to result in elevated levels from monthly grab samples, and DSEWPaC has no way of attributing these findings to actual use patterns. However, they illustrate that in the irrigation area, diuron can move off site; 2. The runoff assessment is based on the occurrence (and probability) of rainfall events following application. As demonstrated in the report, the very large range of geographic and climatic regions where citrus can be grown makes the assessment problematic; 3. This is a valuable argument and may well allow further mitigation, for example, by assessing the more appropriate use rates for the industry. Unfortunately, no figures relating to this were provided in the

Submission 44	Author: (Citrus Australia)
	submission, so further refinement is not currently possible; 4. DSEWPaC has considered the use of vegetative buffer/filter strips in assessments in the past and has concluded current information does not allow us to include the use of such tools in our assessments see Volume 2, Section V2.11.5). From an examination of the two references provided, DSEWPaC notes that they support this conclusion.

Submission 45	Author: (Cotton Australia)
Issues	Various issues relating to methodology of the previous assessment (APVMA, 2011), and applicability to cotton, along with provision of use information for diuron in cotton allowing refinement of this use pattern.
Response:	We thank Cotton Australia for their submission. The arguments have been taken into account in the revised assessment – please refer to Volume 2, Section V2.4.

Submission 46	Author: (DuPont (Australia) Ltd)
Issues	Several issues raised.
Response:	Please refer to Appendix 4 for a detailed response to this submission.

Submission 47	Author: Ms Janine Clark (on behalf of the Australian pineapple industry))
Issues	Provision of anecdotal evidence and data for on-farm water quality testing of diuron content.
Response:	We thank the author for the submission of this argument and associated water monitoring data. These have been considered in the report – see Volume 2, Section V2.16.2. The measured water concentrations found in the farm dam being considered in the submission were used to compare results from the DSEWPaC runoff model, and the outcomes were in good agreement. The monitoring results were provided along with argument that the concentration of diuron found in water derived from a diuron treated pineapple farm applied at below label rates (indicative of industry good practice) is not toxic to fish, or phytoplankton and zooplankton species used in the fish rearing system. The industry argues that this aquatic environment is an example of "the worst case scenario" of sensitive organisms, and that if the sensitivity to diuron contamination is not evidenced here, the effects on primary streams can't be as bad as indicated. Such an argument can't be supported. The diuron environmental risk assessment reports a wealth of toxicity data to several trophic levels of aquatic organisms. DSEWPaC has concluded that risk to fish and aquatic invertebrates is acceptable. The issue is with aquatic flora (algae and aquatic macrophytes), and evidence from good quality laboratory studies and long term higher tier studies continues to demonstrate the potential for toxic effects on these organisms from diuron exposure.

Submission 48	Author: Mr Adrian Pederick MP, JP
Issues	General argument on applicability of methodology to broadacre farming in South Australia's Mallee region.
Response:	The arguments have been considered in the revised report – please refer to Volume 2, Section V2.2 and Section V2.9.

Submission 49	Author: Mr Stephen Ryan (Australian Cane Farmers)
Issue 1	This submission contained queries related to process, which is outside the scope of the scientific review and should be addressed separately by the APVMA. The following issues relating to the scientific review were raised: The review fails the definition of "scientific" in that, although it proposes hypotheses through the models used, it does not test the predictions of these models in real world situations. In fact the process fails in three respects: 1. Input data to the models are not correct; 2. The models used may bear no relevance to the real-world situation – bobwhite quail and mallard ducks do not occur in Australian canefields; 3. The output of the model and interpretation of that output are not tested relative to independently collected real-world data.
Response:	While the author comments that input data are not correct, they do not actually provide any alternative input data or describe which data were not correct. It should be noted that the modelling in this revised assessment has been significantly enhanced to allow region specific environmental data. In terms of sugar cane (see Volume 2, Section V2.11), the assessment has been performed based on 5 separate sugar growing regions and used climatic and real world river flow data from all these regions individually. The comment that bobwhite quail and mallard ducks do not occur in Australian canefields is a common criticism relating to the avian risk assessment. Australian specific bird toxicity data are rarely available, and in the interest of limiting testing on animals and reducing the cost burden on industry, we use test data from standard test species based on OECD and other recognised test guidelines. It is not the role of the APVMA or DSEWPaC to generate such data. In fact it is illegal to conduct tests on local species in some states such as NSW. Finally, it should be noted the local Pacific Black Duck is closely related and may interbreed with the mallard, therefore the use of mallard duck test results is relevant for this assessment. The final point, that interpretation of the output are not tested relative to real-world data, is unclear. Real-world data will exist only to the extent someone actually looks for or collects it. DSEWPaC considers model outputs against known toxicity data as generally obtained from laboratory tests. In this respect, we do have current monitoring data showing exposure concerns are justified. Arguments that the substance has been used without impact for 30 years are not possible for us to assess. The model used in this current assessment has been validated against current monitoring data, and while it can be used with reasonable confidence, has been shown to be under predictive where soils are heavier than loams.
Issue 2	Several other issues were summarised as follows:

Submission 49	Author: Mr Stephen Ryan (Australian Cane Farmers)
	1. The assessment does not consider restrictions on rates and usage imposed by the Queensland Government; 2. Does not consider unintended consequences of the cancellation of diuron registration; and 3. Imposes timelines that are too short for adequate response.
Response	The second and third points are outside the scope of the scientific/technical risk assessment and need to be addressed separately by the APVMA. The current assessment has considered the latest outcomes of studies undertaken in the Paddock to Reef program, and assessed to the extent possible, initiatives under the Queensland Government's Reef Protection Package (see Volume 2, Section V 2.11.7 for the sugar cane assessment). The revised assessment now supports several of the currently registered uses of diuron in sugar cane.

Appendix 1: Detailed Response To Submission 5 - Canegrowers

The following responses are provided for the series of recommendations and conclusions made by Canegrowers in their submission:

Recommendation 1: CANEGROWERS supports the work undertaken by the University of Sydney and the counter-argument it brings to the risk diuron poses to the environment. CANEGROWERS recommends that APVMA fully consider this work in determining new levels of unacceptable risk to primary streams, birds and secondary streams.

> **Response:** Please refer to Appendix 2 for a detailed response to the work undertaken by the University of Sydney. DSEWPaC has considered to the extent possible the arguments and data provided in this and other submissions. The updated runoff risk assessment is considerably revised from that released in APVMA (2011). The bird risk assessment has been revised through refinement of exposure calculations and now concludes an acceptable chronic risk to birds up to application rates of 1800 g ac/ha when applied as a pre-emergent spray (bare soils) or a post-emergent spray directed to the base of plants, as is the case in sugarcane.

Recommendation 2: CANEGROWERS supports the continued use of diuron at a rate of 1.8 kg active constituent per hectare per year.

> **Response:** The assessment has been undertaken at this rate, and lower rates also currently registered for use in sugar cane. The revised assessment now supports several of the currently registered uses of diuron in sugar cane up to 450 g ac/ha.

Recommendation 3: CANEGROWERS recommends that $200 million Reef Rescue Program that sits under the Reef Plan is evaluated in the APVMA's review of diuron. Both have targets to improve water quality and reduce herbicides by 25% and 50% respectively. Herbicides of interest under both programs include diuron.

> **Response:** Available experimental data generated as a result of this program has been considered in Volume 3, and within the runoff risk assessment (Volume 2, Section V2.11.7)

Recommendation 4: CANEGROWERS recommends that the Queensland State Government's Reef Regulations that targeted residual PSII herbicides, particularly diuron, is evaluated in the APVMA's review of diuron.

> **Response:** This recommendation has been noted. Any new data available from recent experimental work, and the most recent monitoring have been examined (Volume 3) and used as appropriate in the risk assessment (Volume 2, Section V2.11).

Conclusion 1: CANEGROWERS concludes that diuron products are used by more than 80% of the industry. This demonstrates the importance of the product to the sugarcane industry.

> **Response:** This issue is outside the scope of the scientific/technical environmental risk assessment and needs to be addressed separately by the APVMA.

Conclusion 2: CANEGROWERS concludes that on average growers apply diuron once on plant cane and once on ratoon cane.

Response: The risk assessment has been undertaken using a much more advanced modelling approach than available previously. The outcomes of this modelling have been validated to the extent possible by the most recent monitoring data. These validation exercises showed a good agreement between the modelling output and detections in the environment. However, the modelling was done on the assumption that the full 1800 g ac/ha was used, and there is a general concern that in areas such as where sugar cane is grown, where soils may be heavier than loamy soils, the model underpredicts outcomes.

The risk assessment has been separated into pre-emergent and post-emergent use. If current monitoring is reflective of the above conclusion, then it lends support to the view that the model is underpredictive for sugar cane. Nonetheless, the outcomes from the revised sugar cane risk assessment are found in Volume 2, Section V2.11. The revised assessment now supports several of the currently registered uses of diuron in sugar cane.

Conclusion 3: CANEGROWERS concludes that diuron is generally used at rates of 1.8 kg ac/ha, which is half the current label rate. This indicates that it is efficacious at these rates.

Response: The revised assessment has been undertaken based on a maximum application rate of 1.8 kg ac/ha.

Conclusion 4: CANEGROWERS concludes that diuron is an important product to manage the broad weed spectrum in the sugarcane industry.

Response: This scientific/technical environmental risk assessment needs to focus on use patterns of the active constituent, and can not take into account other important factors such as cost/benefit analysis and substitution chemicals. Those issues need to be addressed separately by the APVMA.

Conclusion 5: CANEGROWERS concludes that diuron is mainly used as a mixture with other herbicide products. This demonstrates the importance of the product to the sugarcane industry.

Response: The submission provided a table of typically applied mixtures including diuron rates in sugar cane. Several mixtures were reported with typical diuron application rates of 275-500 g ac/ha. The revised report (see Section V2.11) has concluded that application of diuron at 1800 g ac/ha for pre- and post-emergent use still results in an unacceptable runoff risk. However, lower registered use rates (250 and 450 g ac/ha on diuron only products and 280 g ac/ha on products coformulated with hexazinone) remain supported (see section V2.11.5).

Conclusion 6: CANEGROWERS concludes that diuron is an effective product in controlling weeds and its loss would lead to greater weed pressure, more herbicide substitution and greater use of products such as paraquat.

Response: DSEWPaC fully appreciates this argument. The current assessment is performed as a technical risk assessment for diuron and only with respect to environmental risk. Unfortunately, consideration of important considerations such as product substitution and cost benefit analysis relating to removal of an active constituent is outside the scope of this technical assessment.

Conclusion 7: CANEGROWERS concludes that diuron is applied with several different spray rigs and nozzle configurations. The use of Irvin legs and air inducted nozzles is favoured but other application methods should continue to be available.

Response: The spray rigs used in application have not been considered within the runoff risk assessment. However, it is noted that based on previous advice the assessment assumes a reduction in the application rate of 1.8 kg ac/ha to 85% coverage when applied as a band spray in post-emergent uses. If spray rigs allow a consistent application to less than this area (for example, 50-60%), then post-emergent risk quotients can be re-calculated. This has been addressed to some extent in Volume 2, Section V2.11.6.

Conclusion 8: CANEGROWERS concludes that loss of diuron would place a significant cost burden on growers. This could lead to alternative weed management systems such as cultivation which could lead to perverse water quality outcomes.

Response: Please see response to "Conclusion 6" above.

Conclusion 9: CANEGROWERS concludes that the majority of growers have undertaken chemical training over the last five years. Sugarcane growers have been voluntarily undertaking chemical training for growers since this training was first introduced with support from CANEGROWERS.

Response: This conclusion is noted.

Conclusion 10: CANEGROWERS concludes that industry practices, products and systems have considerably reduced the potential risk to the environment from diuron. CANEGROWERS believe the industry is continually improving through RE&E and these changes need to be acknowledged and assessed in the review of diuron.

Response: We acknowledge the work and efforts that have been undertaken in this industry over the last several years. As part of this assessment, DSEWPaC was provided with the ReefWise Farming Sugarcane Growing Environmental Risk Management Plan for farmers growing sugar on >70 hectares in the wet tropics. This document also provides a suite of considerations for farmers to mitigate impacts of runoff including laser levelling of fields, runoff retention and treatment and use of vegetated filter strips. While DSEWPaC commends this approach, we are not in a position to undertake a farm specific risk assessment. It is reasonable to assume that not all farms are undertaking such risk mitigation strategies and we remain unable to assess to that very refined level for a national assessment.

Conclusion 11: CANEGROWERS notes that the use of diuron is an essential part of the green cane trash blanket harvesting systems which provides benefits including:

- Dramatic reduction in soil erosion and run-off;
- Recycling of nutrients;
- Improved soil structure and moisture holding capacity; and
- Reduced weed infestation.

An essential part of this farming system is the ability to control weeds that do emerge chemically, rather than mechanically. There are significant concerns if diuron is no longer available, farmers would revert to mechanical cultivation which would see increases in soil loss and run-off and declines in water quality.

Response: DSEWPaC has assessed the data generated from the Paddock to Reef program, which has amongst other management factors, considered runoff where a green trash blanket is present and where different growing practices (wider rows with controlled traffic) are employed. We agree these practices help with lowering runoff water volumes leaving the field. While these practices did not appear to restrict levels of diuron present in runoff waters as edge of field concentrations, DSEWPaC agrees they will lower the overall load entering

surface waters. This has been considered in the revised risk assessment, Volume 2, Section V2.11.7.

Appendix 2 – Detailed Response to Submission 6 – University of Sydney

General comments

P 5, last dot point. The concern regarding surface and pore water was strongly influenced by claims that diurons metabolites (DCPMU, DCPU, DCA and mCPDMU) could be up to three times more toxic than the parent diuron (Tixier et al, 2001; Stork et al, 2008).

> **Response**: This observation is wrong. In assessing toxicity, DSEWPaC made it quite clear that the reliance was on regulatory studies. Appendix E in APVMA (2011) provides the regulatory algae data for *Scendesmus subspicatus*. In fact, while we thought it should be more appropriate to consider **total residues** given the toxicity of the main metabolites, this was not done and we only used parent diuron metabolites. The reference to Stork et al (2008) was only to demonstrate DCPMU was found in sediments, it did not rely on any toxicity data for this metabolite that may have been mentioned in this reference.
>
> The result from Tixier et al (2001) was again, just reported for completeness. We make it quite clear in the report that such results **cannot** be used for regulatory decision making. Comments regarding toxicity of metabolites compared to diuron are based on regulatory studies. In this regard, the regulatory test for the green alga *Scenedesmus subspicatus* showed an E_rC50 of 22 µg/L for diuron and an E_rC50 for DCPMU of 62.8 µg/L. These values are not overly different, particularly considering they are the only common species for which equivalent test results are available.

P 6, second para: Significant levels of DCPMU residues have not been found in primary or secondary streams and the Kd values for binding of diuron and DCPMU to sediment are both likely to be greater than 50 (Simpson, 2007) resulting in Q-values for pore water much less than 1.

> **Response**: Residues will only be found if someone actually looks for them. Stork et al (2008) is one example that did look for, and found DCPMU present at levels higher than diuron. DSEWPaC agrees though, the Kd values in this should reflect desorption rather than adsorption. Unfortunately, for the regulatory studies received, the desorption Kd values were often lower than the adsorption values. However, these reflected several (5) rounds of intense desorption. The field evidence based on the new data now assessed indicate the Kd for desorption in the field will be larger than the adsorption Kd values. This has now been included in the revised assessment (see Volume 1, Section V1.7.3).

General comments addressing concerns raised throughout the document:

- The general concerns surrounding the use of monitoring data as the basis for risk conclusions is accepted. At the time, there was no regulatory accepted model for runoff in Australia. The screening level runoff model described in the report was only introduced by DSEWPaC in the later stages of the assessment, and not considered robust enough at the time to use consistently throughout the report. For that reason, reliance was placed on the available monitoring data.

- Unfortunately, those data were only reflective of a limited number of situations (sugar cane and irrigation areas). We agree that the non-detects form a valuable part of the overall monitoring picture. However, while these were removed from the data set for establishing

exposure concentrations, it is equally not appropriate to simply set them as zero as in reality, the chemical could be present anywhere from 0 to the limit of detection.

- To overcome this concern, the latest assessment has been undertaken using a much more enhanced model, which was assessed at the OECD level and considered suitable for regulatory assessments. Further, a runoff risk assessment framework has been developed to allow the runoff approach to be applied consistently to all different diuron agricultural uses including the large number for which no representative monitoring data have been available. The most recent monitoring data provided by QLD DERM have been used, along with relevant literature and other experimental results, to validate this model down to the level of in-stream concentration predictions. For example, refer to Sections V2.11.4.2, V2.11.4.4 and V2.11.4.6.

- This approach no longer requires a definition or segregation of primary versus secondary streams as stream flow data from different catchments have now been relied on where an in-stream analysis has been required, thereby allowing consideration of the range of stream sizes within a particular area.

- We note the recommendation to undertake risk assessments based on degree of ecosystem disturbance leading to a graded percentile for exposure and species toxicity. This approach is adopted in the sense that 95^{th} and 99^{th} SSD levels are applied to agricultural and high protection areas respectively. This is standard for national regulatory assessments, and we have adapted further for the runoff assessment as indicated above. It is not possible for DSEWPaC to undertake more site specific assessments as the outcomes even within single regions can be quite different. Therefore, we must assess for more conservative outcomes to ensure protection over a wide range of areas.

Avian risk assessment concerns:

The use of Kenaga calculations for estimating residue levels in birds diets as opposed to the residue unit dose (RUD) approach in the European guidance (EFSA) was queried. 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. The calculated doses are not overly different.

However, in the European methodology, the 90^{th} percentile residue levels are used for acute exposure and mean residue levels for chronic exposure assessment. The Kenaga residues that DSEWPaC had used previously were the 90^{th} percentile values and for this refinement, these will be

amended to the mean residues through the US EPA T-REX model, which results in significant decreases in exposure concentrations.

In addition, more realistic exposure calculations were undertaken accounting better for the use patterns of diuron:

- For **pre-emergent** use, 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.

- For **post-emergent** use, where application in broadacre and tree and vine cropping situations is as a directed spray either to the base of rows, or the base of trees/vines, refinement in the exposure calculations has been performed accordingly. Due to the need to avoid spraying the crop, there will be considerable foliage in the treated area that is not contaminated. However, to this end it is noted that 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. For over the top spray applications (for example, cereals), the only refinement in residues has been to move to the 50^{th} percentile residue data from the 90^{th} percentile values.

  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. In the assessment, this was 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.

We thank the authors for their information relating to diuron dietary residues from cotton, as published in Sanchez-Bayo et al (1999). These data have not been incorporated into the assessment as the changes to the modelling assumptions have essentially allowed for the mitigation of avian risk.

Comments regarding Stork et al (2008):

We have considered the arguments made regarding the findings of the Stork et al (2008) paper. We agree with the analysis of DCPMU to Diuron findings from the on-farm study. A comparison with the other international field studies confirms that these findings, particularly DCPMU at 2 days after spraying, are very curious and no explanation is offered by the authors.

Please note, however, that while the paper itself was reviewed and reported in Appendix I (Environmental Fate), the only findings from this paper that were used in the risk assessment related to the stream sediment monitoring component of the study as it was providing some information in an area where we had no other data. We did not rely on, or use the field dissipation data or runoff values found from this study in our risk assessment.

Regarding the issue of metabolite toxicity, as advised above, we have relied on regulatory studies to make this comparison. In the updated assessment, with respect to sediment toxicity, some additional explanation has been included to try and make the issue clearer (Volume 1, Section V1.7.3).

Finally, please note our updated assessment relating to sediment pore water concentrations that now rely on higher organic carbon content of sediments and the use of a desorption Kd value rather than an adsorption Kd value.

Comments on Risk Mitigation Options

Thank you for the various risk management options provided in the submission. We have a fundamental difficulty in incorporating many risk management measures into the technical assessment. For example, we are well aware of the good work illustrated in the "Sugarcane Growing Environmental Risk Management Plan", which provides a suite of considerations for farmers to mitigate impacts of runoff including laser levelling of fields, runoff retention and treatment and use of vegetated filter strips. While DSEWPaC commends this approach, we are not in a position to undertake a farm specific risk assessment. It is reasonable to assume that not all farms are undertaking such risk mitigation strategies, and we are therefore unable to assess to that level. Additionally, while we agree that use of physical methods such as silt traps, dams or constructed wetlands can be beneficial in limiting off site transport, we have no way of knowing the extent of implementation of such measures.

Appendix 3 – Detailed Response to Submission 34 – World Wildlife Fund (WWF)

We thank the WWF for their submission. Our comments are made based on the major headings from this submission.

1) The toxicity of Diuron in the environment is well understood.

DSEWPaC agrees with this statement. Our assessment of environmental toxicity data has included all standard regulatory studies provided for review, and the ever growing list of non-standard test reports. While our end-points have been based on the regulatory studies, the non-standard results have been considered and we are of the view that our end-points remain protective.

2) Diuron is persistent and cannot be managed within its application area.

Based on the available laboratory data and field evidence, DSEWPaC has set a field half-life of 79 days for use in our assessment. In terms of runoff modelling, this half-life is not a limiting factor as the assumption is that the runoff event will occur 3 days after application.

DSEWPaC agrees that restricting application to the dry season may not help restrict movement off-farm in wetter areas, as there are still runoff producing rain events outside the wet season. In any event, this has not been assessed as a viable management option in sugar cane as the peak body itself does not agree with or support such a measure.

In our current assessment we have taken into consideration the latest results from Paddock to Reef field experiments to assess the effectiveness of different crop management practices in sugar cane at reducing runoff from farm.

3) Diuron metabolites are just as toxic as diuron.

In the previous report (APVMA, 2011), a very small section was provided describing results from a literature paper indicating some metabolites of diuron were more toxic than the parent compound to a bacterium. These results were provided only for illustrative purposes and the paper was not even fully assessed in the technical appendix. The metabolite toxicity data relied on in the assessment came from regulatory studies where several metabolites were tested to a single green alga species, *Selenastrum capricornutum*, and these could be compared to the result of the parent diuron to the same species. While they showed that mCPDMU and DCPMU were both still highly toxic to algae with E_rC50's <1 mg/L, only DCPMU actually had toxicity approaching that of the parent compound (E_rC50 = 62.8 µg/L compared to diuron E_rC50 = 22 µg/L to the same species).

4) Diuron has been consistently detected in the Great Barrier Reef ecosystem.

DSEWPaC has taken into account the available monitoring from reef in-shore areas that has been compiled over the last several years.

5) Current application rates in Queensland are ineffective at protecting aquatic ecosystems.

The previous report did consider that there was the potential for harm to sediment flora through exposure to diuron and the soil metabolite DCPMU based on measured levels of these substances in sediments downstream from a sugar cane farm. No actual data have been provided to assess the effects, and there do not appear to be any further sediment monitoring levels for DCPMU available. However, in this current assessment some additional information on diuron mineralisation in

sediments has become available. DSEWPaC has reassessed this aspect in the current report (Volume 1, Section V1.7.3).

We disagree with the statement "In a study just released, flood plumes in the GBR were shown to inhibit photosynthesis in zooxanthellae due to the presence of PSII herbicides (of which diuron has previously been shown to dominate) (Shaw et al. 2012)". In that study (examined by DSEWPaC in Volume 3, Section V3.3.2), at concentrations found within the flood plumes, there did not appear to be any significant inhibition of photosynthesis. It was only when zooxanthellae were exposed to increased concentrations of the herbicide levels in the plumes that effects began to appear. Around 10% inhibition was found at 3X the concentration (diuron concentration of around 1.3 µg/L) at one site, with almost 50% inhibition at 10X the concentration (~4.4 µg/L). While this appears more sensitive than diuron alone, there were several other PSII herbicides in the flood plume water. For the other sites, inhibition remained <10% at 3 X the flood plume concentrations. Only 1 site remained at <10% inhibition at 10X the flood plume concentration, while inhibition of between 15% and 40% was found for the other sites at 10X the flood plume concentration.

In our current assessment we have taken into consideration the latest results from Paddock to Reef field experiments to assess the effectiveness of different crop management practices in sugar cane at reducing runoff from farm.

6) Water quality guideline criteria are frequently exceeded under current application rates.

DSEWPaC does not use the QLD DERM water quality guidelines. Rather, we have established our own acceptable water concentrations based on the regulatory data provided for the diuron review. We do, however, take into consideration all the available monitoring data.

7) Sub-lethal effects not included in trigger values.

This is incorrect. The SSD developed for algae/aquatic plants was done so using standard regulatory studies, and end points were based on growth not mortality. This is a sub-lethal effect. In the previous assessment, and also in the latest version, several non-standard tests were provided for review.

The results in these tests are primarily based on effects on chlorophyll fluorescence, and it is unclear how this end-point relates in terms of biological significance compared to traditional end-points such as growth or reproduction. While DSEWPaC did not consider it appropriate to use these results in determining the final end-point as they could not be directly compared to the standard test results, we do consider from reviewing these studies that impacts on chlorophyll fluorescence to the range of test species considered is not remarkably different to growth/reproduction toxicity data for a range of algal/diatom results that were obtained following standard test guidelines.

8) Diuron poses a direct threat to the dugong and turtle.

This statement is made on the basis of results from a study by Haynes et al (2000) and WWF state the seagrass *Halophila ovalis* experienced reduced photosynthesis at exposure concentrations nine times lower than current GBRMPA trigger value of 0.9 µg/L. DSEWPaC assessed this study in the previous assessment. While we noted that *H. ovalis* showed significant declines in effective quantum yield for all test exposures (down to 0.1 µg/L) we concluded that the effective quantum yield was significantly lower for all sea grasses tested at the two highest concentyrations of 10 and 100 µg/L. The results of this test need to be treated with caution due to the small sample size. Further, it is unclear how the quantum yield measurement may relate in terms of biological significance, for example, as compared to growth and reproduction.

9) Diuron adds to the effects of other herbicides and environmental stressors.

While we agree with the notion of additive effects of toxicity for chemicals with the same mode of action such as the PSII herbicides, unfortunately our assessment for the APVMA is for diuron and does not allow us to take into account other herbicides that may be present at the same time.

10) Diuron poses a direct threat to internationally important ecosystems.

Please refer to responses for points 1, 5, 7 and 8 above.

11) Current passive monitoring of diuron is likely to underestimate actual levels in the environment.

DSEWPaC agrees with this statement. The advantage of passive sampler results is they provide a longer term average concentration, and through comparison with earlier data, can identify how these chronic concentrations may change over time. The problem is, however, they can't identify peak concentrations, or the likely time higher concentrations have existed. This is a concern for our assessment. While we have long term average concentrations that, to our conclusion remain below our 99^{th} percentile trigger value, we need to conclude the risk is acceptable. However, as noted in our previous assessment, diuron is routinely detected in coastal waters and properties of persistence in water and very high toxicity make the presence of such chemicals undesirable.

Appendix 4: Detailed Response To Submission 46 – DuPont Australia

In their submission, DuPont provided a list of issues that they agreed with, and a list that were not supported. Only the latter are considered here along with responses:

Issue 1: DuPont does not agree with the conclusions on the risk to primary productes in freshwater primary and secondary streams for the following reason:

> The most sensitive organisms are algae and aquatic plants, and the NOEC values are very importantly based on **population growth**, not lethality. Because NOEC values are based on population growth, when diuron concentrations decrease below threshold levels, algal and aquatic plant population growth would rapidly increase. It is essential to factor into the risk assessment the algistatic/phytostatic properties of diuron.

Response: DSEWPaC has now allowed for recovery of algae/aquatic plants in the risk assessment (refer to Volume 2, Section V2.1 for description and rationale of the runoff risk assessment framework). While data still have not permitted a revision of the toxicity end-points, the issue of recovery has been considered within the development of the new runoff risk assessment framework (see Volume 2, Section V2.1.3). Specifically, this factor is considered in the first level of refinement (Step 2 calculations) where it is noted that:

1. DSEWPaC accepts that aquatic flora has the ability to recover following exposure to diuron, and based on new data evaluated in this assessment these plants can probably recover from a repeated exposure. However, monitoring data and field experimental data continue to demonstrate that repeat exposures could actually continue for sustained periods of time.

2. The Step 2 calculations therefore are performed on the acceptance that a runoff even may occur that will lead to exposure concentrations exceeding the toxicity end-point. However, the end-point relating to growth inhibition rather than mortality, and the acceptance that initial adverse effects should not be long lived. Consequently, the Step 2 calculations essentially consider the probability of a runoff event, and implicitly in these calculations is consideration of the likelihood of repeated runoff events.

Issue 2: DuPont does not agree with the conclusions on chronic risk to birds for the following reason:

> Diuron use can be limited to application when nesting and egg laying is not occurring. In this scenario the lowest chronic value based on egg production is no longer the most relevant to NOEC. The most relevant NOEC value for the mallard duck reproduction test becomes 100 mg/kg. The chronic risk assessment to birds then changes considerably (by a factor of 10) using the most relevant endpoint. DuPont has previously provided a refined risk assessment on lon term affects to birds and found a low risk to birds.

Response: While DSEWPaC does not agree with the claim that egg production is no longer the most relevant end-point for the diuron risk assessment (considered wider than just sugar cane), the chronic risk assessment to birds has been considerably revised on the exposure calculations and the outcome supports a conclusion of acceptable chronic risk to birds up to an application rate of 1800 g ac/ha in pre-emergent situations, and as a post-emergent spray to the base of crops (see Volume 1, Section V1.6.1).

Issue 3: DuPont does not agree that mitigation practices will be ineffective in reducing diuron run-off.

> DuPont supports the principle that mitigation of the risk that diuron poses to the aquatic environment can be achieved primarily through reduction in transport of diuron in runoff. The watershed scale modelling submitted by DuPont illustrates the value of higher tier modelling as a tool to investigate the potential for exposure and the reductions in exposure. The significant reductions in exposure predicted by moving the applications into a time frame where major run-off events are unlikely reinforces the conclusion that diuron losses in runoff can be reduced by minimising applications when major storms are likely.

Response: DSEWPaC did consider the mitigation options proposed by DuPont and agreed that the two most effective measures included restricting the application rate, and based on the higher tier DuPont modelling, applying outside the wet season. However, this strategy is strongly opposed by the end-users as being impractical (see Volume 2, Section V2.11.6) and as such, there is little reason to take it further.

DSEWPaC has increased significantly the modelling capacity for runoff in this assessment and made strong use of real world data and region specific attributes to consider runoff. The modelling has been validated against the most recent monitoring results, although the modelling was performed on highest application rates and there is concern that results actually under predict concentrations where soils heavier than loamy soils are present.

Issue 4: DuPont does not accept DSEWPaC's contention that runoff mitigation cannot be implemented for the following reason:

> There is adequate data in the literature demonstrating that the practices suggested by DuPont can be effecting in reducing the loading of diuron, and other herbicides, although this is subject to the caveat that reduction to zero runoff is not possible and cannot be the goal in a regulatory decision based on risk assessment.

Response: DSEWPaC agrees that zero runoff is not possible and can assure DuPont that this is not the aim of the risk assessment. For this assessment, a comprehensive runoff risk assessment framework has been developed. The assessment has been performed using a slope restriction of 3% or less, and use specific information to the extent possible. Other mitigation measures as proposed by DuPont in the previous assessment, and in submissions relating to that assessment, are discussed in Volume 2 Section V2.11 with respect to sugar cane.