Australian Government
Australian Pesticides and Veterinary Medicines Authority

DECEMBER 2017

Spray Drift Risk Assessment Manual

ISBN 978-1-925390-96-4 (electronic)

Ownership of intellectual property rights in this publication

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

Creative Commons licence

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

A summary of the licence terms is available from https://creativecommons.org/licenses/by/4.0/. The full licence terms are available from https://creativecommons.org/licenses/by/4.0/legalcode

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

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

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

Use of the Coat of Arms

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

Disclaimer

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

Comments and enquiries regarding copyright:

Director, Public Affairs & Communication
Australian Pesticides and Veterinary Medicines Authority
PO Box 6182
KINGSTON ACT 2604 Australia

Telephone: +61 2 6210 4988

Email: communications@apvma.gov.au.

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

CONTENTS

PREFACE

The possibility of off-target spray drift accompanying the application of pesticides is a concern both to the community and the agricultural industry, for whom it is a constant challenge to find ways to minimise it more effectively. The APVMA is responsible for ensuring that off-target pesticide spray drift does not harm human health, the environment or Australia's international trade.

APVMA's current approach for addressing the risk of spray drift has a number of limitations including lack of flexibility and an inability to adopt newer systems/technologies to reduce the risk of spray drift. Assessment is based around worst case scenarios and provides no incentive for spray applicators to adopt best practice, new technology and/or operations that will limit spray drift.

A new spray drift regulatory framework is proposed that will enable more reasonable buffer zones to be set and supports the use of drift reducing technologies (DRT). It is proposed to implement the new spray drift management approach in 2 stages;

Stage 1: Chapters 1 to 6 of this manual which covers all aspects up to and including the on-label instructions.
Stage 2: Chapter 7 of this manual which is the Spray Drift Management Tool (SDMT).

The APVMA is seeking stakeholder input on the proposal for spray drift risk management that is described in this manual. In particular comments should address the following topics:

1. Methodology used to determine regulatory acceptable levels (RAL's)
2. Standard scenarios and deposition curves that define realistic worst case situations and are used to generate on-label spray drift buffers
3. Spray drift data guidelines to support the generation of custom deposition curves
4. On label spray drift instructions.
5. Spray drift risk assessment tool.
6. Spray drift management tool that allows chemical users to refine these realistic worst-case risk assessments based on their own circumstances and recalculate buffer zone distances accordingly.
7. nterim measures prior to an interactive web based tool being available (stage 2) and legislative requirements to enable off-label spray drift conditions set by the tool to be enforced.

The consultation period is open until close of business on 30 March 2018.

Background

In July 2008, APVMA released a revised version of the policy document 'APVMA Operating Principles in Relation to Spray Drift Risk' and then in March 2010, implemented Regulations requiring new pesticide products seeking registration to be assessed for their potential risk of spray drift as part of the registration process. This included the development of an Operational Notice which is in effect a form of code/manual. Label instructions for new products now have to include statements that describe mandatory no-spray (buffer) zones where applicable.

APVMA's current approach for addressing the risk of spray drift has a number of limitations including lack of flexibility and ability to adopt newer systems/technologies to reduce the risk of spray drift. Assessment is based around worst case scenarios and provides no incentive for spray applicators to adopt best practice, new technology and/or operations that will limit spray drift. There is also some concern that APVMA's current approach to spray drift and labelling requirements has become a deterrent to the inclusion of some types of spray applications and uses on approved labels.

APVMA therefore began a project in 2013 to develop a new spray drift regulatory framework that will enable more reasonable buffer zones to be set. The intention of this new approach was to provide a set of on-line tools that will be publicly available on APVMA's website for calculating spray drift and setting buffers that can be used by:

- APVMA Risk Managers to set spray drift label requirements when processing a product application for registration;
- prospective registrants to enable them to predict the likely restraints that would be required on the use of their product;
- external or APVMA scientific reviewers for particular risk areas that are making recommendations on appropriate risk mitigation to the APVMA Risk Managers.
- industry to help select the most appropriate set of parameters for conducting spray operations in order to minimise drift and required buffers. This will greatly aid the adoption of new technology/best practice by industry and will be listed as an option on spray drift label statements, where applicable.

Various sectors of industry, largely coordinated through the National Working Party on Pesticide Application (NWPPA), have generated information that has assisted or been incorporated into APVMA's new spray drift management approach and/or provided comment on elements of the new approach.

The APVMA's proposed new spray drift management approach is outlined in the remainder of this manual.

1 GENERAL INFORMATION

1.1 Introduction

The APVMA conducts spray drift risk assessments in order to ensure that pesticide products can be used in a manner that will not adversely impact the health and safety of human beings or the environment and not unduly prejudice international trade.

Spray drift is defined by the APVMA as the movement of spray droplets of a pesticide outside of the application site during, or shortly after, application. It does not encompass off-target movement of a pesticide caused by runoff, volatilisation, erosion, or any other mechanism that occurs after spray droplets reach their intended target. Specific definitions for terminology used in this manual are listed in the glossary (see Section 8).

This manual applies to any spray drift risk assessment conducted during:

- the evaluation of an application to the APVMA:
  - to register a new product or to approve a label
  - to vary a registered product or approved label
  - for a permit
- for addition of a custom deposition curve in the Spray Drift Management Tool (SDMT) (see Section 7.3.1)
- the reconsideration of registered products or approved labels through the chemical review program
- for any other purpose in accordance with the provisions of the Agvet Code

1.2 Legislative basis

The APVMA must comply with its governing legislation. When a decision is made, the following sections of the Agvet Code apply:

- section 14–registration of a new product or approval of a label
- section 29 or 29A–variation of a registered product or approved label
- section 112–issuance of a permit
- section 34 or 34(A)–reconsideration of registered products or approved labels

The basis for all of these decisions, in regards to spray drift, is that the APVMA must be satisfied that certain statutory criteria are met, as defined by the following sections of the Agvet Code:

- 5A–safety
- 5C–trade
- 5D–labelling (with respect to how the product should be used in order to manage spray drift to satisfy the safety and trade criteria)

2 SPRAY DRIFT RISK ASSESSMENT OVERVIEW

As part of the standard APVMA approach to risk analysis, there are two key regulatory science questions that need to be addressed in any spray drift risk assessment:

- does the product pose a hazard to an off-target area which requires protection?
- does the manner in which the product is applied result in exposure to an area requiring protection that is outside the target area?

These questions require the problem to be defined; specifically, what are the areas that require protection in order for the APVMA to be satisfied of the statutory criteria when making a decision? In order to formulate this, the statutory criteria are used to develop 'sensitive areas' which are representative of what requires protection so that an appropriate determination of the hazard can be made. The assessment of the hazard posed by a product results in the determination of a Regulatory Acceptable Level (RAL). The maximum amount of spray drift exposure which is not expected to cause undue harm to a certain sensitive area is a RAL. The sensitive areas, and the process for determining RALs, are described in Section 3.

Once a RAL is established, the possible risk must then be determined by assessing potential exposure. This is done by selecting the downwind deposition curve/s (ie the spray drift deposition pattern) relevant for the use pattern/s being assessed. Refer to Section 4 for further details.

The hazard (RALs) and exposure (deposition curves) are then used to determine if a risk is posed, and if so what buffer zone distance is required. Buffer zones (also known as no-spray zones or setbacks) are areas where spraying does not take place between the downwind edge of the application site and an identified sensitive area. Refer to Section 2.1 for an overview of buffer zones.

The implementation of risk management through use instructions is outlined in Section 5. These instructions are included in the 'relevant particulars' on approved labels or in permit conditions that are established through the use of the Spray Drift Risk Assessment Tool (SDRAT) described in Section 6. They also provide the basis for conditions on the use of the Spray Drift Management Tool (SDMT) as described in Section 7.

Risk communication is routinely conducted on a product-by-product basis through interactions between the APVMA and applicants/holders of registrations. Specific communications on issues related to spray drift policy and procedure will be communicated via the APVMA website and emailed regulatory updates.

The SDRAT is used by the APVMA to conduct a risk assessment of the realistic worst-case scenario for the use of each product. The realistic worst-case is best summarised by considering the following assumptions for different equipment types:

- boom sprayers and aircraft
    - standard equipment is set up and used in accordance with good agricultural practice (eg boom is kept as low to the ground as is safe and practical, boom width is less than wing or rotor span, etc.)
    - spray droplet size is assumed to be the smallest/finest that could be produced within each spray droplet size category; the spray droplet size category is the largest droplet size category supported under the efficacy criteria

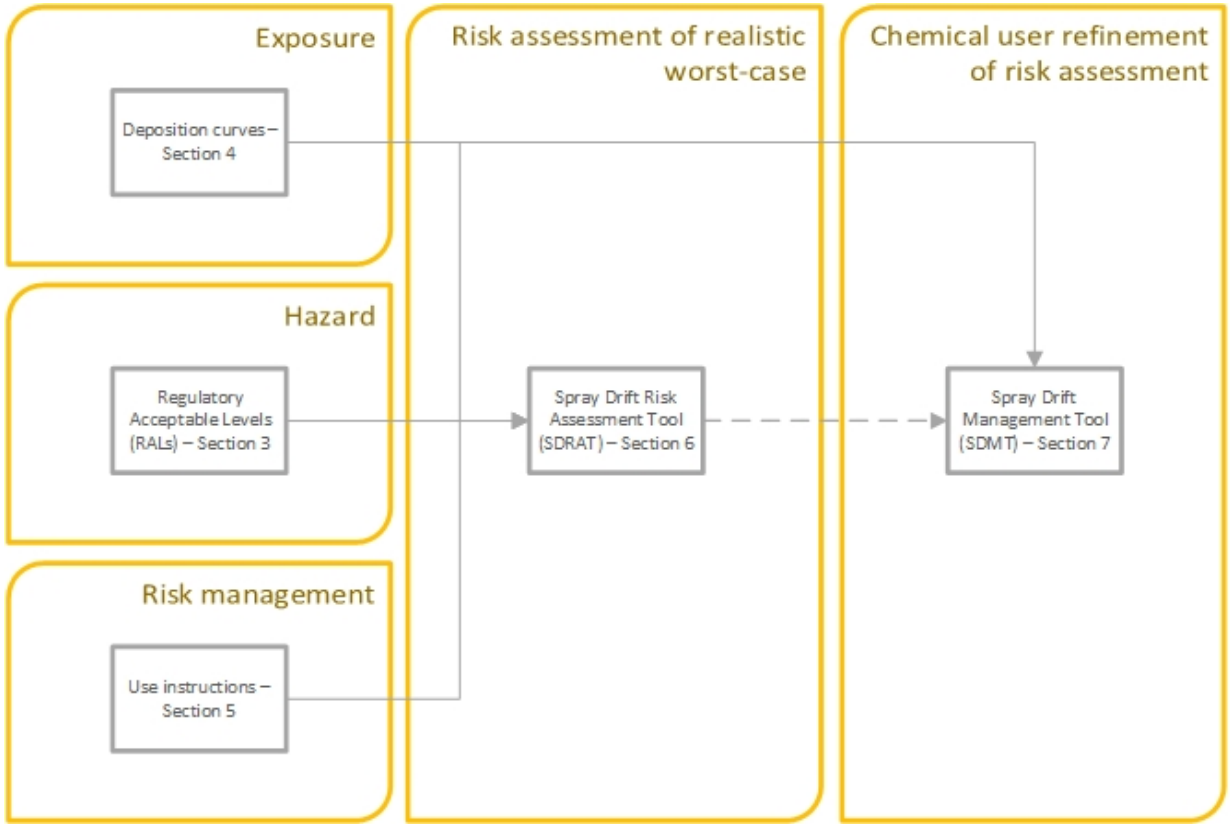
- the highest application rate on the label for the use of that equipment type is used
- wind speed is between the lowest acceptable (ie 3 km/hr) and the highest acceptable (ie 20 km/hr), and no surface temperature inversion conditions are present at the time of application.

- vertical sprayers
  - standard equipment (axial-flow airblast sprayer) is set up and used in accordance with good agricultural practice (eg nozzles are not directed above the canopy, outermost side of sprayer is turned off when turning at end of rows and last row on either side of the block, etc.)
  - the highest dilution rate and water rate associated with the largest crop on the label is used
  - wind speed is between the lowest acceptable (ie 3 km/hr) and the highest acceptable (ie 20 km/hr), and no surface temperature inversion conditions are present at the time of application.

The SDMT when adopted will allow chemical users to refine these realistic worst-case risk assessments (based on the specific equipment, application rate, weather conditions, etc. relevant to their own circumstances) and can recalculate buffer zone distances accordingly.

The relationships between key sections in this manual are shown in Figure 1 (refer to each section for further detail).

Figure 1: Relationship of key sections in this manual



2.1 Buffer zones

Spray drift can only travel with the direction of the wind, so buffer zones are always downwind and are not permanently fixed with respect to a target area. There are two types of buffer zones; advisory and mandatory.

2.1.1. Advisory buffer zones

Advisory buffer zones are established when it is reasonable to expect that an experienced chemical user can conduct a local assessment of spray drift risk and implement risk management strategies which are based on extensive prior knowledge and experience. Such risk management strategies (ie based on extensive past experience) are generally pragmatic and site-specific. They may be applied in relation to the hazard (see section 3), exposure (see section 4) or overall risk arising from the application of a particular product(s).

It is recommended that users observe advisory buffer zone distance but they may elect to either use the Spray Drift Management Tool (see section 7) or implement experiential risk management strategies to reduce advisory buffer zone distances at their discretion. Users with no or limited experience should be more cautious in reducing advisory buffer zone distances.

Should experiential risk management strategies not be sufficient, an unacceptable impact to an off-site sensitive area may occur. When advisory buffer zones are established, it is a requirement of use instructions (see section 5) that users do not cause an unacceptable impact to sensitive areas.

The compliance pathway for chemical users to protect sensitive areas when advisory buffer zones are established is shown in Figure 2.

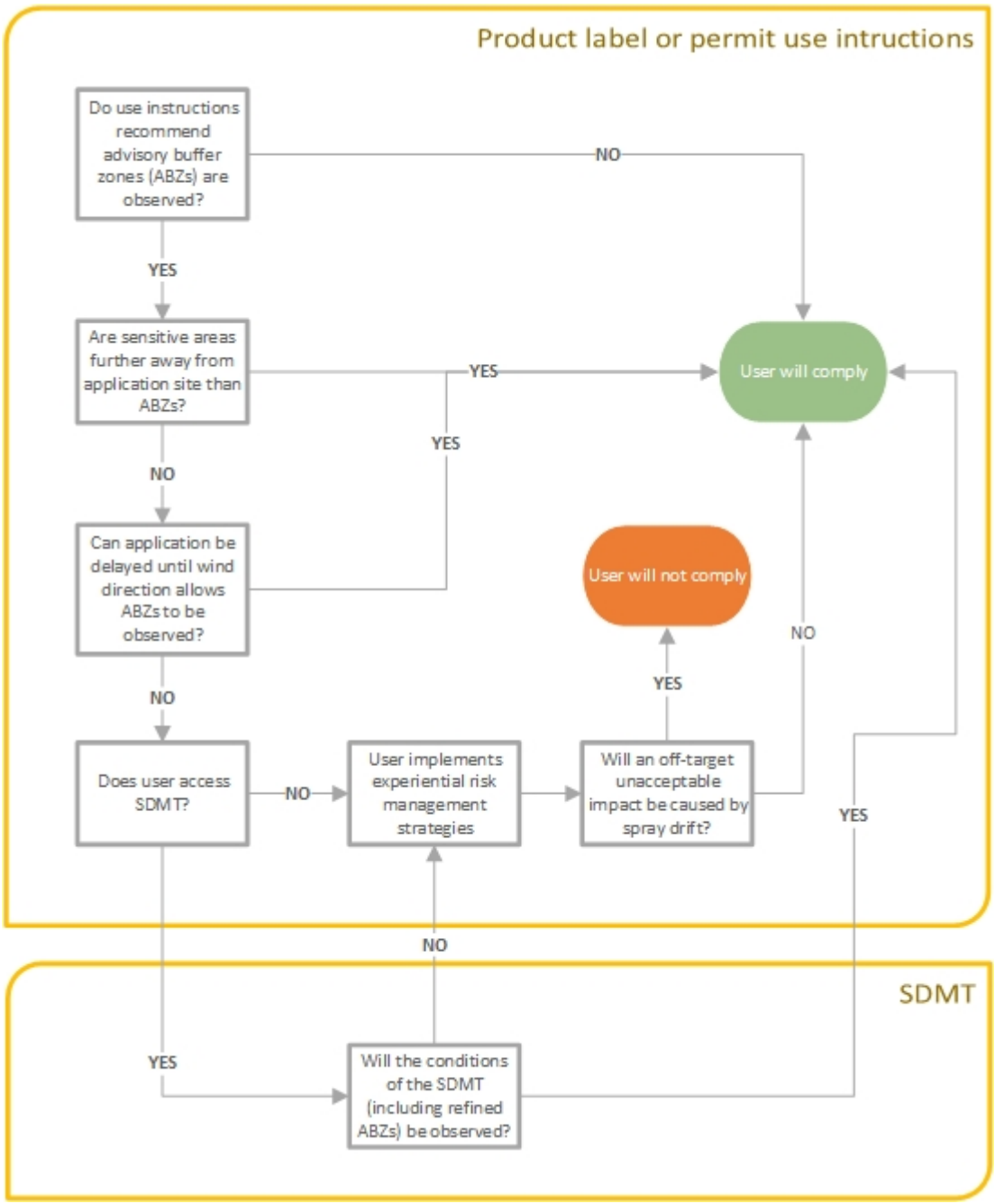
2.1.2. Mandatory buffer zones

Mandatory buffer zones are established when it is unreasonable to expect that an experienced chemical user can implement experiential risk management strategies that protect the relevant sensitive area. They may be required when it is not possible or practical to conduct a local area risk assessment, or when hazards (see section 3) are determined for a single sensitive species rather than for a number of species with a range of sensitivities.

In order to comply with use instructions (see section 5), users must observe the required buffer zone distance (either on the product label or from the use of the Spray Drift Management Tool referred to in section 7).

The compliance pathway for chemical users to protect sensitive areas when mandatory buffer zones are established is shown in Figure 3.

Figure 2: Compliance pathway for protecting sensitive areas when a buffer zones are advisory



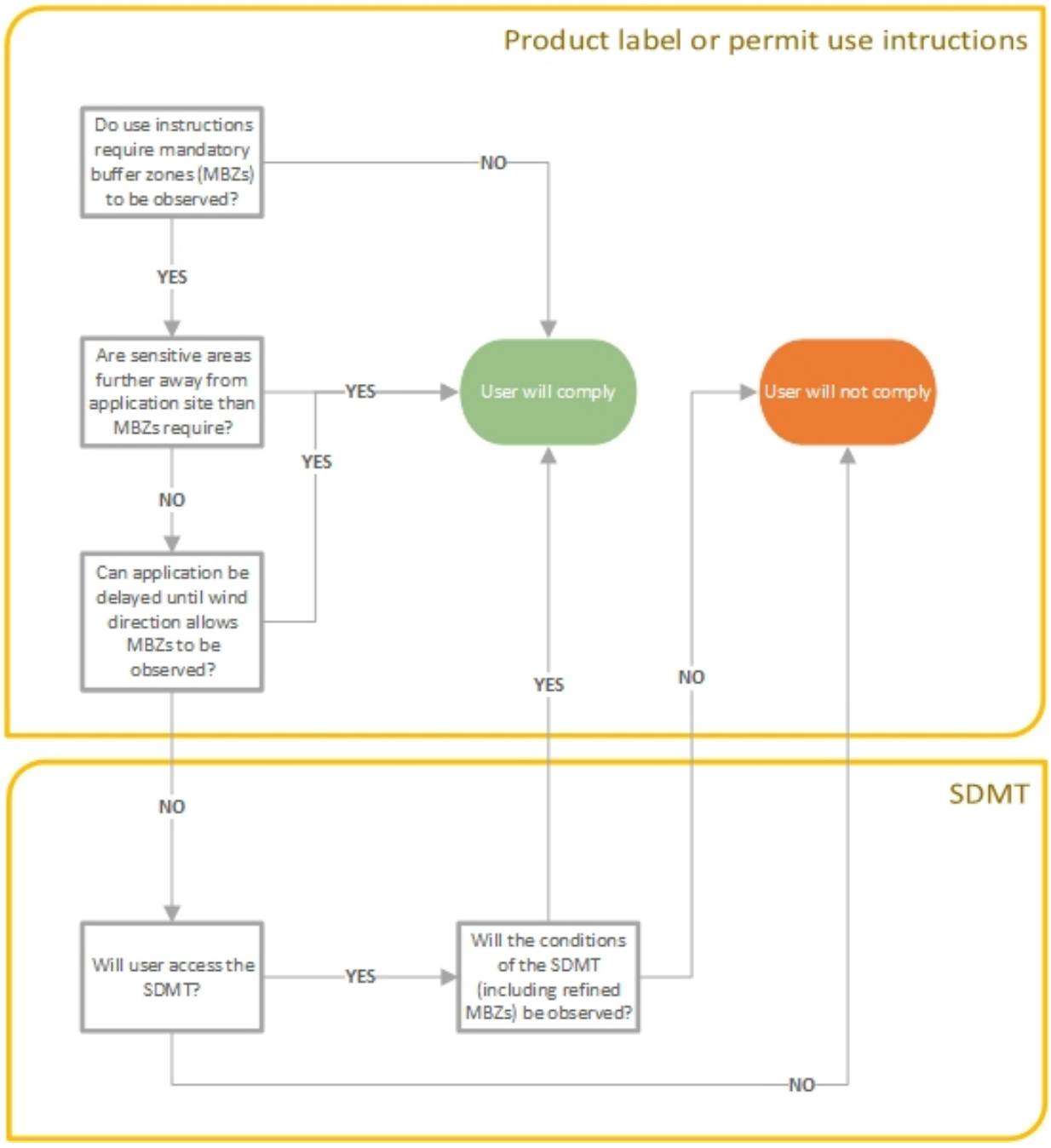


Figure 3: Compliance pathway for protecting sensitive areas when buffer zones are mandatory

2.1.3. Buffer zones and sensitive areas

Table 1 lists the different types of sensitive areas (refer to section 3) and indicates whether the respective buffer zone is 'mandatory' or 'advisory', with the reasons for this classification.

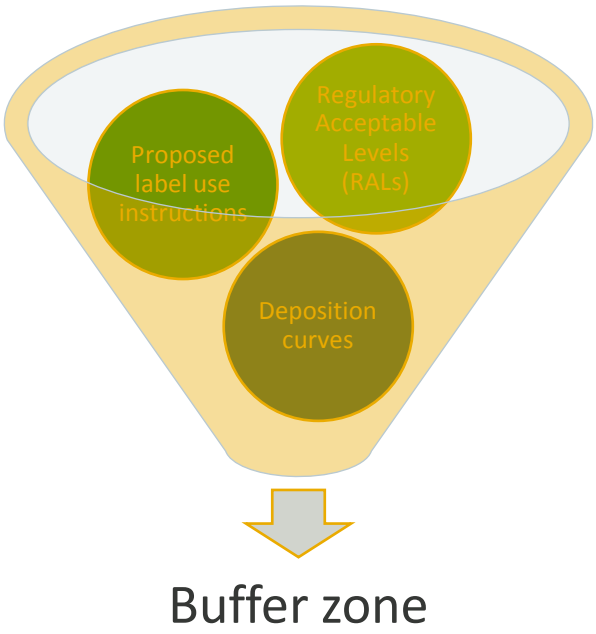
Table 1: Type of buffer zone for different sensitive areas

Buffer zone category	Sensitive area	Explanation
Mandatory	Bystander areas	It is not acceptable to allow any chemical user to apply experiential risk management strategies when the risk posed is to human health.
	Natural aquatic areas	It is not reasonable to expect that an experienced chemical user can conduct a local area risk assessment of aquatic species (ie below the surface of water) and determine that no aquatic species sensitive to the chemical being used are present.
	Pollinator areas	It is unreasonable to expect that an experienced chemical user can apply experiential risk management strategies when hazard is based on the protection of honey bees (ie a specific risk assessment has been conducted for honey bees which are the only non-target insect species that buffer zones will apply to).
Advisory	Vegetation areas	The RAL for vegetation areas is established on the basis that any area of vegetation will not be impacted at a habitat or ecosystem level (ie acceptable risk not nil risk). However, it is not possible to determine what an appropriate RAL would be for a particular area of vegetation containing only certain species at certain growth stages. This means that the RAL for vegetation areas is very conservative and only applies to the most sensitive areas (which may not be relevant for a local area). To account for this, it is reasonable to expect that an experienced chemical user can conduct a local area risk assessment of vegetation and determine that, for the chemical being used, no sensitive species are present. Experienced chemical users understand the difference between non-selective herbicides (that are likely to impact any vegetation when used in accordance with label instructions) and selective herbicides (that, when used in accordance with label instructions, are likely to only impact certain species or types of vegetation).
	Livestock areas	It is reasonable to expect that an experienced chemical user can conduct a local area risk assessment for the protection of livestock trade. When the chemical user also manages the livestock, or when neighbours communicate and work cooperatively, risk to livestock trade can be managed by moving livestock further away from the application site, and managing export slaughter intervals etc.

2.1.4. Calculating buffer zone distances

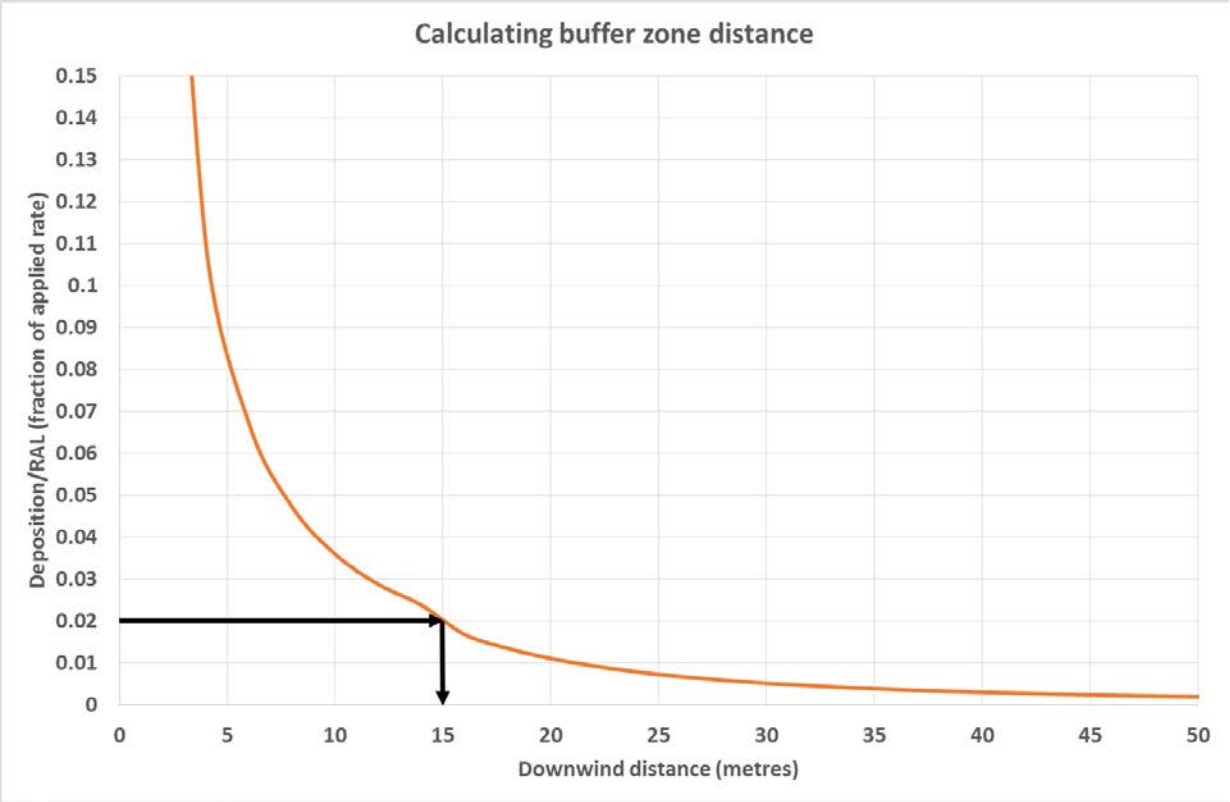
The information used to calculate a buffer zone is described throughout this manual and summarised in Figure 4.

Figure 4: Information required to calculate buffer zones



A visual representation of how buffer zones are calculated is shown in Figure 5. Here the horizontal black line is the RAL for a certain sensitive area and the orange line is the relevant deposition curve which decreases in exposure with increasing distance downwind of the target area. In this example, a 15–metre buffer zone would be required for the protection of the sensitive area.

Figure 5: Visual representation of how buffer zone distances are calculated



2.2 Products and use patterns not requiring a spray drift risk assessment

Spray drift risk assessments are required for agricultural chemical products (as defined by section 3 of the Agvet Code if the way they are used poses a spray drift risk.

The following agricultural chemical product types do not require a spray drift risk assessment under any circumstance:

- antifouling products, antifoulants or antifouling paints
- dairy cleansers
- disinfectants
- fumigants
- household insecticides
- seed treatments
- swimming pool or spa chemicals
- vertebrate poisons
- veterinary chemicals
- wood preservatives or timber treatments

Some products do not require a spray drift risk assessment when the proposed product label limits their use to:

- application below the surface of soil or water
- application with specialised equipment in cropping situations where the nozzles are orientated directly downward and spray is released at a height below the top of the crop canopy (eg drop nozzles used to direct the spray to the furrows between emerged crops, or small booms used to spray inter-row areas in tree and vine crops, etc.)
- home garden and domestic pest control use
- outdoor use when applied in a form other than a spray (eg granules, pheromone traps, non-sprayed invertebrate baits, a gel, a paste, cut stump painting, stem injection, weed wiper systems, etc.)
- post-harvest treatment of agricultural produce (including seed prior to sowing)
- preparing a poison bait for the control of vertebrate or invertebrate pests
- treatment of fertiliser prior to spreading
- use by single-nozzle application equipment (eg knapsack, hand sprayer, etc.)
- use indoors (eg protected growing situations, etc.)

If the proposed label of a product contain use patterns from the list above as well as use patterns that require a spray drift risk assessment, only those use patterns which are not listed above will be taken into account.
For example, if a label had an application rate equivalent to 10 L/ha for a single-nozzle application only and a maximum application rate for a boom sprayer of 5 L/ha, then the spray drift risk assessment will be conducted on the 5 L/ha rate applied by a boom sprayer

There may be uncommon and unusual circumstances in which the product types or use patterns listed above do pose a risk of off-target movement of pesticide prior to it reaching its intended target (eg dusts, small and/or low density granules, etc.). Whilst conceptually the risk assessment framework would be similar to what is described in this section, there are significant differences in determining deposition curves, use instructions to mitigate risk, etc. which will be unique for individual products and/or use patterns. It is expected that the number of products of concern for this type of off-target movement is considered to be very small.

Rather than add unnecessary complexity to this manual, identified risks will be managed on a case-by-case basis using this manual as a starting point. Applicants are encouraged to contact the APVMA prior to submitting an application through the pre-application assistance (PAA) process if they are concerned that their product or use pattern may be subject to this type of off-target movement.

3 REGULATORY ACCEPTABLE LEVELS (RALS)

A RAL is derived from an assessment of the hazard a product poses to a sensitive area. The maximum amount of spray drift exposure which is not expected to cause undue harm to a certain sensitive area is a RAL. RALs are established after any required safety factor (a.k.a. uncertainty factor, level of concern, margin of exposure, assessment factor, etc.) is applied to the relevant level that is determined through the assessment of information used for satisfying the statutory criteria (safety and trade) of the legislation.

All RALs are compared to a single spray drift event of a product only. Whilst the consideration of multiple applications is important for risk assessments within an application site, the same cannot be said for spray drift. The probability of spraying occurring in the same location under the same worst-case conditions (ie always the highest wind speed allowed applied in a manner most prone to spray drift) is low; therefore, multiple applications are not considered relevant for spray drift risk assessment purposes due to the low probability of spray drift resulting in accumulation from multiple applications outside the target area.

RAL units are expressed as amount of active constituent per unit area (bystander, pollinator or vegetation areas), unit volume (natural aquatic areas), or unit mass (livestock areas).

3.1 Establishment of RALs

All RALs are established by the APVMA assessment areas as part of their standard assessment processes as described in the APVMA Module Descriptors. No additional information is needed in order to conduct a spray drift risk assessment compared to what is already needed to assess hazard for other risk pathways, as described in APVMA Data guidelines:

- Environment (Part 7)
- Occupational health and safety (Part 6)
- Overseas trade (Part 5B)
- Toxicology (Part 3)

Applicants can choose to submit information such as higher tier studies which can be considered for refinement of risk assessments to establish a less conservative RAL (which remains adequately protective) compared to lower tier studies only. Any higher-tier study could also be applied in other risk assessments, not just spray drift.

An outline of how RALs are established is explained below in relation to how existing risk assessment methodologies are modified for spray drift risk assessment purposes. The intention of APVMA is to publish risk assessment manuals (where internationally recognised manuals are not available or appropriate in accordance with Australian Government Policy) for each assessment area; these will provide specific information about the establishment of RALs for spray drift risk assessment purposes (as well as all other risk assessment methodologies).

It is important to note that RALs are always expressed relative to the amount of active constituent in a product, not the amount of the product. That is, when studies conducted to determine RALs use the product instead of an active constituent, the data must expressed on an active constituent basis.

When combination toxicity is determined to be of concern, RALs will be established with formulation or tank-mix data when available. When formulation or tank-mix data are not available, the concentration-addition approach will be used, as discussed in section 3.3.

The units of a RAL depend on the sensitive area being protected. These are listed in Table 2 which includes conversion (multiplication) factors that are required to express RALs in units of g ac/ha. This conversion allows a fraction of the application rate to be calculated, for consistency with deposition curves (see section 3.2). Further details are provided in the following sub-sections.

Table 2: List of RAL units and conversion factors

Sensitive area	Units	Conversion factor
Bystander areas	mg ac/cm^2	100,000
Natural aquatic areas	µg ac/L	1.5
Pollinator areas	kg ac/ha	1,000
Vegetation areas	g ac/ha	1 (ie not required)
Livestock areas	mg ac/kg	3

3.1.1. Bystander areas

Bystanders may be contacted by spray drift in two ways, either directly by the spray cloud, or, through repeat exposure to deposited residues on the ground. This approach is based on that adopted by the US EPA (2014).

Available tools used to predict spray drift are only capable of reliably determining deposition on the ground (ie a horizontal surface) which is not relevant for direct contact of bystanders with the spray cloud (ie a vertical surface). As it is not possible to reliably estimate exposure through direct contact by the spray cloud, use instructions (see section 5) for all products will prohibit any use which causes a bystander to be contacted by the spray cloud.

Repeat exposure to deposited residues on the ground is akin to risk assessments that determine re-entry periods for applications to turf so this risk assessment approach forms the basis for the determination of the RAL for bystanders. The highest concern for this type of exposure is that of an infant/toddler who may be exposed from repeat dermal and oral (hand-to-mouth actions of infants/toddlers) exposure whilst in a backyard, etc. over an extended period of time.

Determination of bystander area RAL

The formula used to determine if a re-entry period is required after applications to turf is shown in Equation 1. The variables in this formula and any default values are explained in Table 3.

Equation 1: Exposure of infants after application to turf

$$Exposure = \frac{(Dermal\ adsorption) + (Oral\ adsorption)}{Body\ Weight}$$

$$Exposure = \frac{(AR\ \times DepR\ \times Ac \times DA\ \times TC\ \times ET) + (AR\ \times DepR\ \times Ac\ \times B\ \times SAo \times FQ \times ETo)}{BW}$$

$$If, Exposure \leq \frac{NOAEL}{MoE}\ \text{risk is acceptable and a re} - \text{entry period is not required}$$

$$If, Exposure > \frac{NOAEL}{MoE}\ \text{risk is unacceptable and a re} - \text{entry period must be established}$$

For applications to turf, the application rate (AR) is the level of active constituent deposited in the target area. When considering exposure of an off-target area through spray drift (which varies according to the way the product is applied as well as the application rate), this value is equivalent to the level of active constituent that can be deposited outside the target area and not pose an unacceptable risk (ie the bystander RAL).

This formula also normally has an additional variable to account for dissipation of residues over time. Dissipation is not relevant to spray drift because it is unreasonable to expect that a re-entry period can be implemented outside the target area.

As 'Exposure' is equal to, or less than, the NOAEL divided by the MoE, the following substitutions can be made to this formula which can then be converted to calculate the RAL, as shown in Equation 2:

- AR ≡ RAL, which becomes the unknown in the formula
- Exposure ≡ NOAEL/MoE, which become known variables in the formula

Equation 2: Conversion of application to turf formula to determine bystander area RAL

$$\frac{NOAEL}{MoE} = \frac{(RAL\ \times DepR\ \times Ac \times DA\ \times TC\ \times ET) + (RAL\ \times DepR\ \times Ac\ \times B\ \times SAo \times FQ \times ETo)}{BW}$$

$$\left(\frac{NOAEL}{MoE}\right) \times BW = (RAL\ \times DepR\ \times Ac \times DA\ \times TC\ \times ET) + (RAL\ \times DepR\ \times Ac\ \times B\ \times SAo \times FQ \times ETo)$$

$$\left(\frac{NOEL}{MoE}\right) \times BW = \text{RAL} \times ((DepR\ \times Ac \times DA\ \times TC\ \times ET) + (DepR\ \times Ac\ \times B\ \times SAo \times FQ \times ETo))$$

$$\text{RAL} = \frac{\left(\frac{NOAEL}{MoE}\right) \times BW}{((DepR\ \times Ac \times DA\ \times TC\ \times ET) + (DepR\ \times Ac\ \times B\ \times SAo \times FQ \times ETo))}$$

Table 3: Bystander area RAL units and default values

Variable		Units	Default value	Comment
AR	Application rate	mg ac/cm^2	-	Deposition on turf calculated from the application rate for the use pattern on the label.
B	Oral bioavailability	fraction	1.0–DA	Estimates of oral bioavailability are usually determined from PK studies with oral dosing. In the absence of pesticide-specific data, suitable surrogate data using a valid scientific argument, such as 'read across' would be acceptable.
BW	Bodyweight	kg	11 (1–2 year olds) OR 15 (2–3 year olds)	EnHealth (2012) recommends a bodyweight value for one to two year old children of 11 kg, and for 2–3 year olds of 15 kg.
DA	Dermal absorption factor	fraction	1.0	In the absence of product-specific data, suitable surrogate data using a valid scientific argument, such as 'read across' can be used.
DepR	Deposited Residue	fraction	Combined as 0.05	Together, these factors constitute a transferable residue factor (DepR x Ac). EnHealth (2012) states that default for the accessibility of organics on surfaces is 100% (1.0), and 0.01% (0.0001) for inorganics, and that the default values are to be used 'only when other reasonable information is not available'. On the basis that most agricultural chemicals are organics, the default Ac is 1.0. The default value for the DepR is 0.05, which is consistent with upper limits of US EPA (1997) so is considered to be derived from 'reasonable information'. Therefore, without additional information, a default transferable residue factor of 0.05 for turf is used.
Ac	Accessibility factor	fraction		
ET	Exposure time per day	hours per day	1.1 (1–2 year olds) OR 1 (2–3 year olds)	For time spent playing on turf, EnHealth (2012) recommends using the mean values of 1.1 [95th percentile of 2 hours] and 1 hour [95th percentile of 2 hours] for infants (1-<2) and toddlers (2-<3) respectively.
ETo	Duration of hand-to-mouth actions per day	Hours per day	1.1 (1–2 year olds) OR 1 (2–3 year olds)	EnHealth (2012) indicates that the duration of mouthing for children is highly variable depending on the age group and the type of objects included in the estimates. Therefore, in the absence of specific mouthing duration of the hands (including fingers), a default value equivalent to the ET (Exposure time per day) is used.
FQ	Hand-to-mouth action frequency	Contact events per hour	14 (1–2 year olds) OR 5 (2–3 year olds)	EnHealth (2012) state that the default mouthing frequency values in outdoor settings are 14 or 5 contacts per hour for 1–2 or 2–3 year olds, respectively.

MoE	Margin of Exposure	factor	100	The MoE is the ratio of no-observed-adverse-effect-level (NOAEL) for the critical effect to the estimated exposure dose or concentration of a substance, as stated in OECD (2003). A MoE of 100 or higher is considered acceptable for this risk assessment. This comprises of a 10-fold safety factor for both potential intraspecies variability and interspecies variability (ie 10 x 10 = 100).
NOAEL	No Observed Adverse Effect Level	mg/kg	-	No-observed-adverse-effect level (NOAEL): greatest concentration or amount of a substance, found by experiment or observation, that causes no detectable adverse alteration of morphology, functional capacity, growth, development, or lifespan of the target organism under defined conditions of exposure. WHO (2009) Environmental Health Criteria, No. 240.
SAo	Surface area potentially exposed from hand-to-mouth actions	cm^2 per contact event	19	The value of 19 cm^2 per contact event is used for area mouthed per mouthing event. This is based on US EPA (1997) where a value of 0.127 for the fraction of hand surface area mouthed is used and in combination with EnHealth (2012) value for the surface area of a single hand (150 cm^2) (150 cm x 0.127), the area of a hand (including fingers) mouthed equals 19.55 cm^2, rounded to 19 cm^2.
TC	Transfer coefficient	cm^2/hr	7,073 (1–2 year olds) OR 8,700 (2–3 year olds)	The default TC value for 2–3 year olds playing on turf is 8700 cm2/hr which is the US EPA (1997) upper percentile value for toddlers playing on turf. Extrapolating the value to 1–2 year olds based on a 1.23–fold lower exposed surface area vs 2–3 year olds gives a TC of 7073 cm2/hr.

NOTE: The formula above, and its variables and defaults, is based on the 1997 version of the US EPA Standard Operating Procedure (SOPs) for Residential Exposure Assessments which has since been updated to a 2012 version. [Note: In accordance with government policy on recognition of international guidelines, the APVMA is currently determining the suitability of this updated version and if accepted, this section will be updated accordingly.]

Conversion of bystander area RAL units

In order to convert mg ac/cm^2 to g ac/ha, a multiplication factor of 100,000 is required, as shown in Equation 3.

Equation 3: Conversion of units for bystander area RAL

$$\frac{1\ mg\ ac}{cm^2} \times \frac{1\ g}{1{,}000\ mg} \times \frac{100{,}000{,}000\ cm^2}{1\ ha} = \frac{1\ mg\ ac}{cm^2} \times \frac{100{,}000\ g\ cm^2}{mg\ ha} = \frac{100{,}000\ g\ ac}{ha}$$

3.1.2. Natural aquatic areas

Determination of natural aquatic area RAL

The standard non-target aquatic environment risk assessment method is followed in accordance with the Environment (Part 7) data guideline with consideration of available international guidance. It is assumed that the sensitive water body being protected runs parallel with the downwind edge of the application site and is 100 meters long (one side of a square shaped hectare), 3 metres wide, and 0.15 metres deep.

It is important to note that this determination is made on the basis of acceptable impact, not on the basis of zero impact. Therefore, whilst users may refer to buffer zones established with this RAL, these buffers should not be relied upon for the protection of areas of commercial interest (eg, aquaculture and non-target crops) in all instances since some level of impact may occur. The most effective way to prevent impact to aquaculture is to use appropriate equipment and only spray when the wind direction is away from sensitive aquaculture production areas.

Conversion of natural aquatic area RAL units

In order to convert µg ac/L to g ac/ha, a multiplication factor of 1.5 is required, as shown in Equation 4. This is derived by considering the volume of the water body described in Section 3.1.2.1 (100 m x 3 m x 0.15 m = 45 m^3) as well as the area of its surface (100 m x 3 m = 300 m^2) on which spray drift would be deposited.

Equation 4: Conversion of units for natural aquatic area RAL

$$\frac{1\ \mu g\ ac}{L} \times \frac{1\ g}{1{,}000{,}000\ \mu g} \times 45\ m^3 \times \frac{1{,}000\ L}{1\ m^3} \times \frac{10{,}000\ m^2}{1\ ha} \times \frac{1}{300\ m^2} = \frac{1\ \mu g\ ac}{L} \times \frac{1.5\ g\ m^3\ L\ m^2}{\mu g\ m^3\ ha\ m^2} = \frac{1.5\ g\ ac}{ha}$$

3.1.3. Pollinator areas

In 2017, APVMA published a short guide outlining a tiered approach to risk assessments for bees and other insect pollinators, titled the Roadmap for insect pollinator risk assessment. This included a proposal to establish buffer zones for the protection of managed honey bee hives in accordance with the recommendations of a 2014 Senate enquiry.

Determination of pollinator area RAL

The formula for determining the RAL for the protection of managed honey bee hives is shown in Equation 5 and the variables and defaults used are described in Table 4.

Equation 5: Formula for calculating RAL for pollinator areas

$$RAL\ (kg\ ac/ha) = \frac{LOC \times\ LD_{50}}{ExpE}$$

Table 4: Pollinator area RAL units and default values

Variable		Units	Default value	Comment
LOC	Level of Concern	fraction	0.4	A LOC of 0.4 is consistent with the guidance of US EPA *et al* 2014.
LD_{50}	Acute LD_{50} (contact)	µg ac/bee	-	Value determined from standard acute contact testing for adult honey bees as described in the Environmental Risk Assessment Guidance Manual for agricultural and veterinary chemicals
ExpE	Exposure Estimate	µg ac/bee	2.4	An ExpE of 2.4 µg ac/bee is consistent with the guidance of US EPA *et al* 2014.

Conversion of pollinator area RAL

In order to convert from kg ac/ha to g ac/ha a conversion factor of 1,000 is required as shown in Equation 6.

Equation 6: Conversion of units for natural aquatic area RAL

$$\frac{1\ kg\ ac}{ha} \times \frac{1{,}000\ g}{kg} = \frac{1{,}000\ g\ ac}{ha}$$

3.1.4. Vegetation areas

Determination of vegetation area RAL

The standard non-target vegetation risk assessment method is in accordance with the Environment (Part 7) data guideline with consideration of available international guidance. It is assumed that the sensitive area being protected runs parallel with the downwind edge of the application site and is three (3) metres wide.

It is important to note that this determination is made on the basis of terrestrial habitat survival, not on the basis of zero damage and/or yield loss in agricultural crops or landscaped gardens. Therefore, whilst users may refer to buffer zones established with this RAL, these zones should not be relied upon for the protection of agricultural crops or landscaped gardens in all instances since some level of damage and/or yield loss may occur. The most effective way to prevent damage and/or yield loss is to use appropriate equipment and only spray when the wind direction is away from sensitive agricultural crops or landscaped gardens.

Conversion of vegetation area RAL units

Not required (the RAL is already in units of g ac/ha).

3.1.5. Livestock areas

Determination of livestock area RAL

A standard assessment used to determine export slaughter intervals for stock in order to ensure compliance with Maximum Residue Limits (MRLs) of significant markets for major species is followed in accordance with the Overseas trade (Part 5B) data guideline.

Conversion of livestock area RAL units

In order to convert mg ac/kg to g ac/ha, a multiplication factor of 3 is required, as shown in Equation 7. This is derived by considering the density of the off-target pasture where livestock may graze. Publications from the main grazing based livestock industries (sheep, beef and dairy) indicate an approximate minimum pasture density of 1,500 kg of dry matter equivalent per hectare (1,500 kg DM/ha) before removing stock.

For the determination of the livestock area RAL, a pasture density of 3,000 kg DM/ha is used. This approximates standard extensive production practices where stock graze over a large area and/or are fed other food sources than pasture (ie it is assumed that livestock on a pasture of 1,5000 kg DM/ha would source half their dietary intake from a pasture with residues deposited from spray drift and the other half from a different source).

Equation 7: Conversion of units for livestock area RAL

$$\frac{1\ mg\ ac}{kg} \times \frac{3{,}000\ kg}{ha} \times \frac{1\ g}{1{,}000\ mg} = \frac{1\ mg\ ac}{kg} \times \frac{3\ kg\ g}{ha\ mg} = \frac{3\ g\ ac}{ha}$$

3.2 Expression of RALs as fraction of applied rate

To allow RALs to be used in conjunction with deposition curves to calculate buffer zones, they are expressed as a fraction of the applied rate. This is outlined in Equation 8.

Equation 8: Expression of RALs as fraction applied rate

$$RAL\ (fraction\ of\ applied\ rate) = \frac{RAL\ \left(\frac{g\ ac}{ha}\right)}{Product\ application\ rate\ \left(\frac{mL}{ha}\right) \times Active\ concentration\ \left(\frac{g\ ac}{L}\right) \times \frac{1\ L}{1{,}000 mL}}$$

$$For\ products\ formulated\ as\ solids, 'mL'\ is\ substituted\ for\ 'g'\ and\ 'L'\ for\ 'kg'$$

For boom sprayers and aircraft, application rates can be directly entered into the relevant equation. For vertical sprayers, application rates are stated on product labels in volumetric terms (ie g/100 L or mL/100 L) so must first be converted via Equation 9.

Equation 9: Determination of application rate for vertical sprayers

$$Product\ application\ rate\ \left(\frac{mL}{ha}\right) = Product\ dilution\ rate\ \left(\frac{mL}{100\ L}\right) \times Water\ rate\ \left(\frac{L}{ha}\right) \times \frac{1\ L}{100\ L}$$

$$For\ products\ formulated\ as\ solids, 'mL' is\ substituted\ by\ 'g'$$

The water rate in Equation 9 depends on the type and size of crop. Unless otherwise stated on the product label, defaults based on a report by the Victorian Government (2012) will be used as listed in Table 5.

Table 5: Water rates for different crops

Crop Type	Water rate for crops 2 metres tall or shorter (L/ha)	Water rate for crops taller than 2 metres (L/ha)
Vines and fruiting vegetables	1,000	Not applicable
Pome Fruit or Stone Fruit or Almonds		1,500
Mango or Avocado		2,000
Citrus or Tree Nuts (other than Almonds)		4,000
All other crops		2,000

3.3 RALs for combination products and mandatory tank-mixes

Where a product contains more than one active ingredient (ie a combination product), RALs will be expressed relative to the total proportion of active ingredients in the product. In the absence of formulation toxicity studies, if combination toxicity is relevant for a hazard assessment to determine a RAL (see section 3.1), the concentration addition approach adopted from Altenburger *et al* (2014) will be used, as shown in Equation 10. For these assessments, only acute risks of the combination to non-target species that can be directly exposed immediately after one application are conducted.

Equation 10: Formula to calculate combination toxicity through concentration addition

$$EC_x(mix) = \left(\sum_{i=1}^{n} \frac{p_i}{{F_i}^{-1}(x_i)}\right)^{-1}$$

An example of a concentration addition calculation is shown in Equation 11. The variables in Equation 10 and Equation 11 are shown in Table 6.

Equation 11: Example of a concentration addition calculation

$$Consider\ a\ combination\ product\ with\ Active\ A\ (200\ \frac{g\ ac}{L})\ and\ Active\ B\ (10\ \frac{g\ ac}{L})$$

$$-\ the\ total\ active\ concentration\ in\ the\ product\ is\ 210\ \frac{g\ acs}{L}$$

$$Both\ active\ constitents\ are\ toxic\ to\ fish, the\ LC_{50}\ for\ Active\ A\ is\ 300\ \frac{\mu g\ ac}{L}\ and\ Active\ B\ is\ 5\ \frac{\mu g\ ac}{L}$$

$$For\ two\ actives, Equation\ 10\ can\ be\ rearranged\ to:$$

$$LC_{50}(A+B) = \frac{1}{\frac{\left[{c_A}/{(c_A+c_B)}\right]}{LC_{50}(A)} + \frac{\left[{c_B}/{(c_A+c_B)}\right]}{LC_{50}(B)}}$$

$$Therefore, EC_{50}(A+B) = \frac{1}{\frac{\left[{200}/{(200+10)}\right]}{300} + \frac{\left[{10}/{(200+10)}\right]}{5}} = 79\ \frac{\mu g\ acs}{L}$$

$$Therefore, assuming\ a\ safety\ factor\ of\ 10:$$

$$-\ the\ natural\ aquatic\ environment\ RAL\ is\ 7.9\ \frac{\mu g\ acs}{L}$$

Table 6: Variables used in Equation 10 and Equation 11

Variable	
ECx(mix)	Effect concentration at effect level x for the mixture (equivalent to EC50(A+B) in Equation 11)
pi	Fraction of active in the mixture (equal to cA/(cA+cB) or cB/(cA+cB) in Equation 9, where cA or cB is the concentration of active constituent A or B)
Fi-1(xi)	Selected endpoint for active I (equal to EC50(A) or EC50(B) in Equation 11)

However, sometimes risks of the combination can be attributed to only one of the active constituents on the basis of their relative toxicity contributions to the combined toxicity estimate (see equation below). If the toxicity of one of the active constituents is determined to contribute ≥90% to the combined toxicity estimate, then the spray drift assessment is based on the individual active constituents. In these cases, a spray drift assessment on the combination or tank mix is not conducted.

$$\%_{relative\_ecotoxicity\_contribution} = \frac{\frac{p_i}{EC_{x_i}}}{\sum_{i=1}^{n}\frac{p_i}{EC_{x_i}}} \times 100$$

This approach will also be used when it is obligatory to use a tank mix (ie a mandatory tank mix). When a product label is approved for use patterns with more than one mandatory tank mix, or for uses with and without mandatory tank mixes, RALs will be established for each combination as required. For example, if a product label has approved uses for the product alone and as a tank mix with another product, one set of RALs will be established based on its use alone, and another set for its use in a mandatory tank mix. If no combination toxicity assessments are relevant for each hazard assessment, then the RALs will be identical; if increased toxicity is expected in a tank mix use pattern, then one or more RALs may be different than when the product is used alone.

Note that this does not include optional tank mixes allowed under legislation, only mandatory tank mixes when that combination of products will be used for every application.

4 DEPOSITION CURVES

Deposition curves are used to predict the amount of spray drift that deposits at different distances downwind of the application site (ie the spray drift pattern). The spray drift pattern will vary according to a number of factors including the application equipment type, equipment set-up, droplet size, target canopy, meteorological conditions, tank-mix contents, etc. Levels of deposition are expressed as a fraction of the applied rate.

It is not feasible to generate a deposition curve for every possible permutation of all factors; therefore, standard curves are used to provide realistic worst-case conservative predictions that are representative of any combination of these factors. These standard deposition curves are split into several categories for each type of application equipment as shown in Section 4.1.

Within the Spray Drift Risk Assessment Tool (SDRAT) described in section 6, the range of standard deposition curves is limited in order to simplify the risk assessment process and, ultimately, product labels and permit conditions. To provide flexibility to chemical users, additional deposition curves will be established in the Spray Drift Management Tool (SDMT) as outlined in Section 7.3.2 when it is available.

Alternatively, information (see Spray Drift Data Guideline) may be submitted to support the generation of custom deposition curves that are reflective of specific factors related to spray drift. As a result, these custom deposition curves can be less conservative and support smaller buffer zones with the same level of regulatory confidence (as long as the specific factors relevant are observed during application). The establishment of custom deposition curves is outlined in section 4.2.

4.1 Standard deposition curves

The background for each standard deposition curve is explained in the following sections. All standard deposition curves are tabulated in the ‘Standard Deposition Curves’ tab in the prototype Spray Drift Risk Assessment Tool.

4.1.1. Boom sprayers

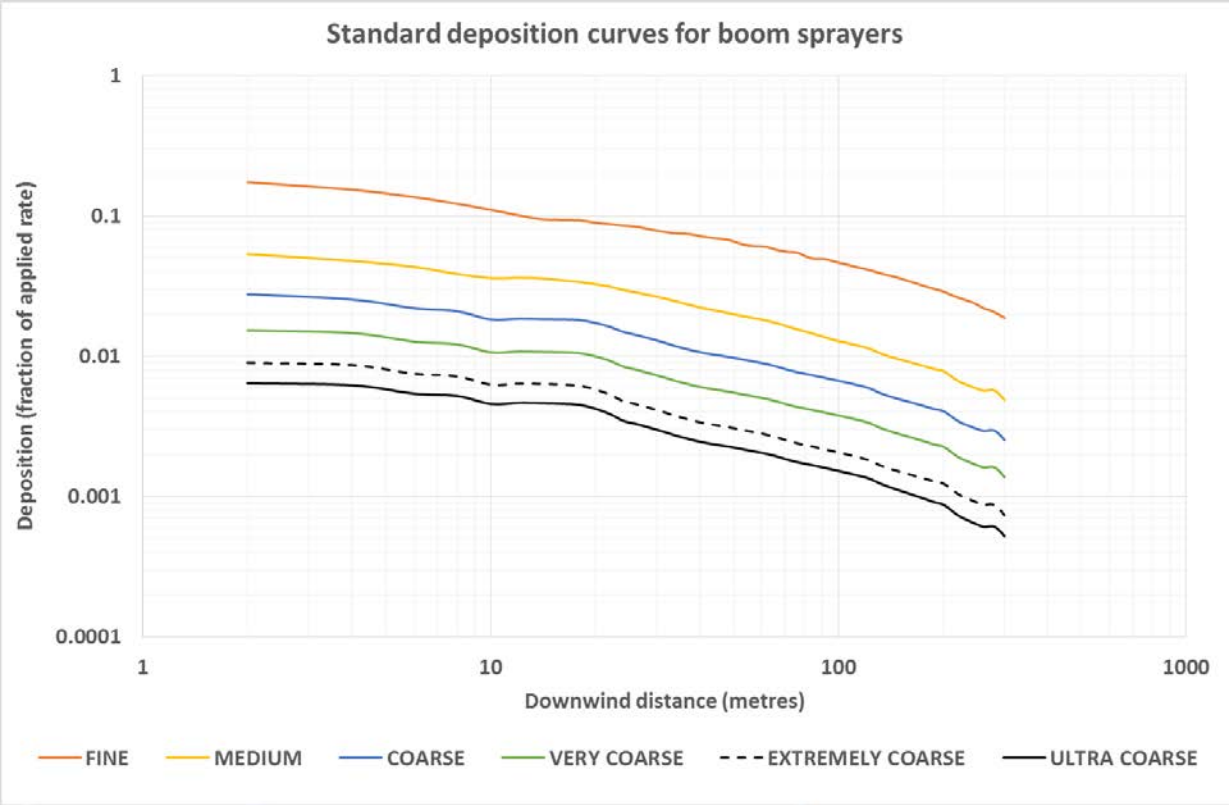
Building on work by Teske (2009), a report published by the National Working Party on Pesticides Applications (NWPPA 2015) supports the use of AGDISP™ (version 8.28) for predicting deposition curves for boom sprayers. AGDISP™ is freely available and in the public domain. Standard deposition curves for each of the droplet size distributions in Appendix 1 have been established with the model input variables in the AGDISP™ template file below. An input summary is also provided as a text file.

APVMA AGDISP—Boom sprayer.ag

APVMA AGDISP Input Summary—Boom sprayer.txt

These curves are shown in Figure 6 on a log-log chart. The validated range of these curves is 300 metres (for consistency with AgDRIFT® which was used previously).

Figure 6: Chart of standard deposition curves for boom sprayers



4.1.2. Vertical sprayers

As no validated predictive models are currently available for vertical sprayers, the '[Basic Drift Values]' are used as standard deposition curves for the use of vertical sprayers. These were generated from field trials conducted in Germany in the 1990s and have a long history of effective regulatory use in Germany and other countries, including Canada. There are also significant numbers of drift reduction technologies recognised in Germany based on these curves which may be useful for industry for the development of custom deposition curves (see section 4.3).

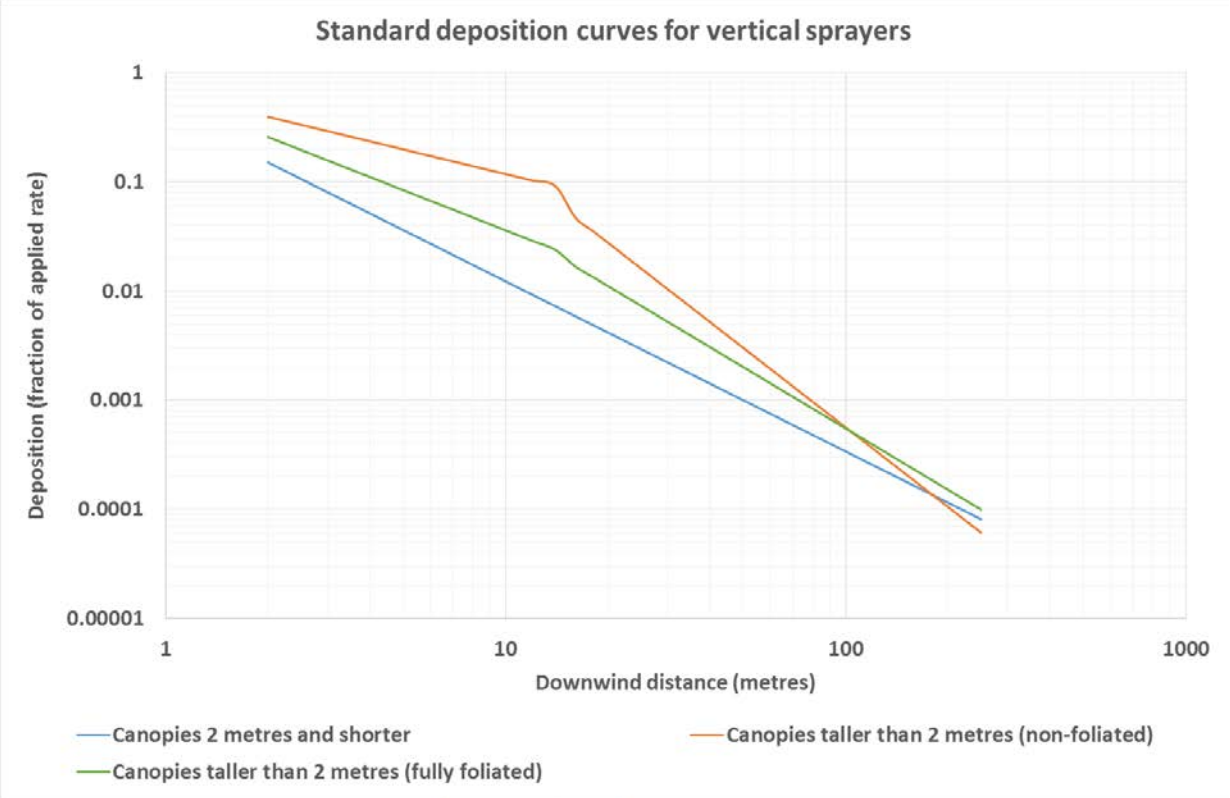
As previously-used terminology of orchards and vineyards, etc. does not capture all situations where this equipment may be used (eg banana plantations, forestry plantations, asparagus crops, trellis tomatoes, etc.), the general term of 'vertical sprayers' has been adopted. Within the category of vertical sprayers, terminology has been aligned with the nature of the canopy which the 'Basic Drift Values' are based on to ensure all situations are captured (see Table 7).

Table 7: Terminology equivalence between German 'Basic Drift Values' and APVMA vertical sprayer standard deposition curves

German 'Basic Drift Values'	APVMA vertical sprayer standard deposition curves
Fruit crops—early	Canopies taller than 2 metres (non-fully foliated)
Fruit crops—late	Canopies taller than 2 metres (fully foliated)
Grapevine—late	Canopies 2 metres and shorter

Figure 7 shows the standard deposition curves for vertical sprayers on a log-log chart. The validated range of these deposition curves is 250 metres.

Figure 7: Chart of standard deposition curves for vertical sprayers



4.1.3. Aircraft

Standard deposition curves for each of the droplet size distributions in Appendix 1 have been established using AGDISP™ version 8.28 for both fixed-wing and helicopter aircraft using the model input variables in the template files below. Input summaries are also provided as text files.

APVMA AGDISP—Aircraft—Fixed-Wing.ag

APVMA AGDISP Input Summary—Aircraft—Fixed-Wing.txt

APVMA AGDISP—Aircraft—Helicopter.ag

APVMA AGDISP Input Summary—Aircraft—Helicopter.txt

These curves are shown in Figures 8 and 9 on a log-log chart. The validated range of these curves is 800 metres.

Figure 8: Chart of standard deposition curves for aircraft (fixed-wing)

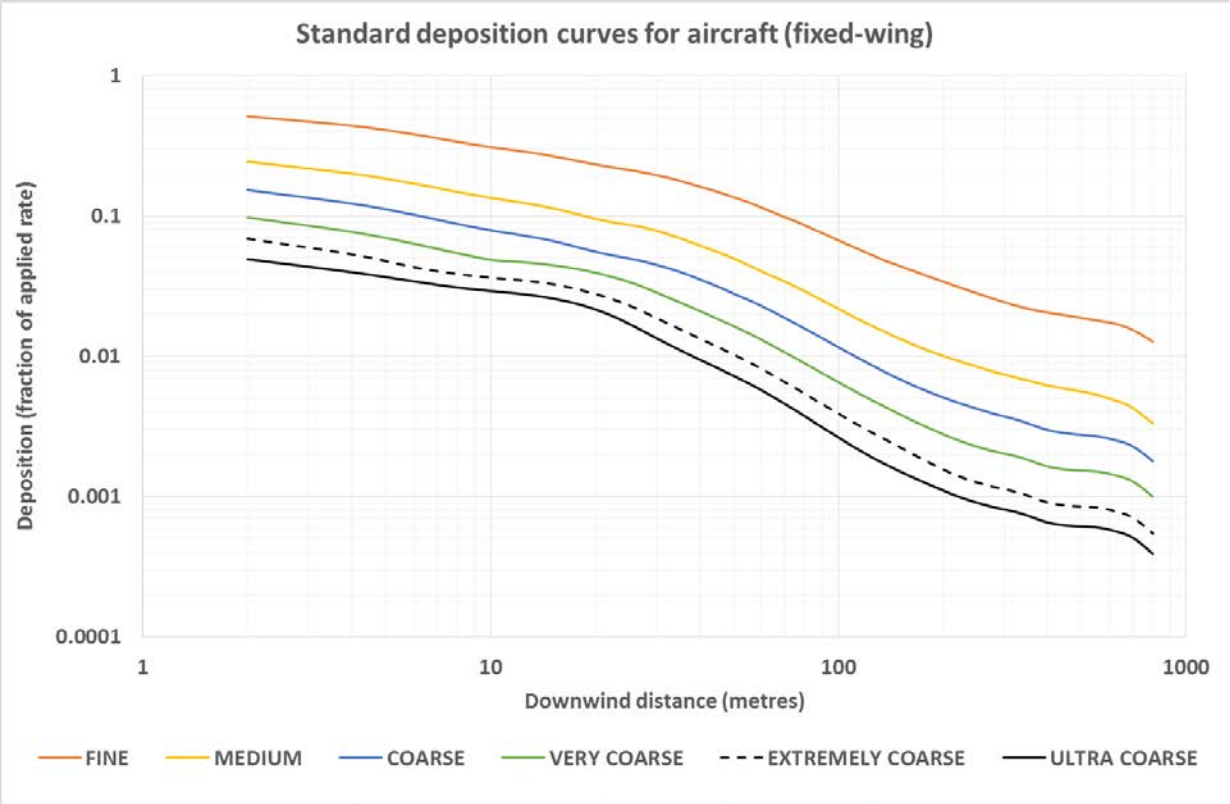
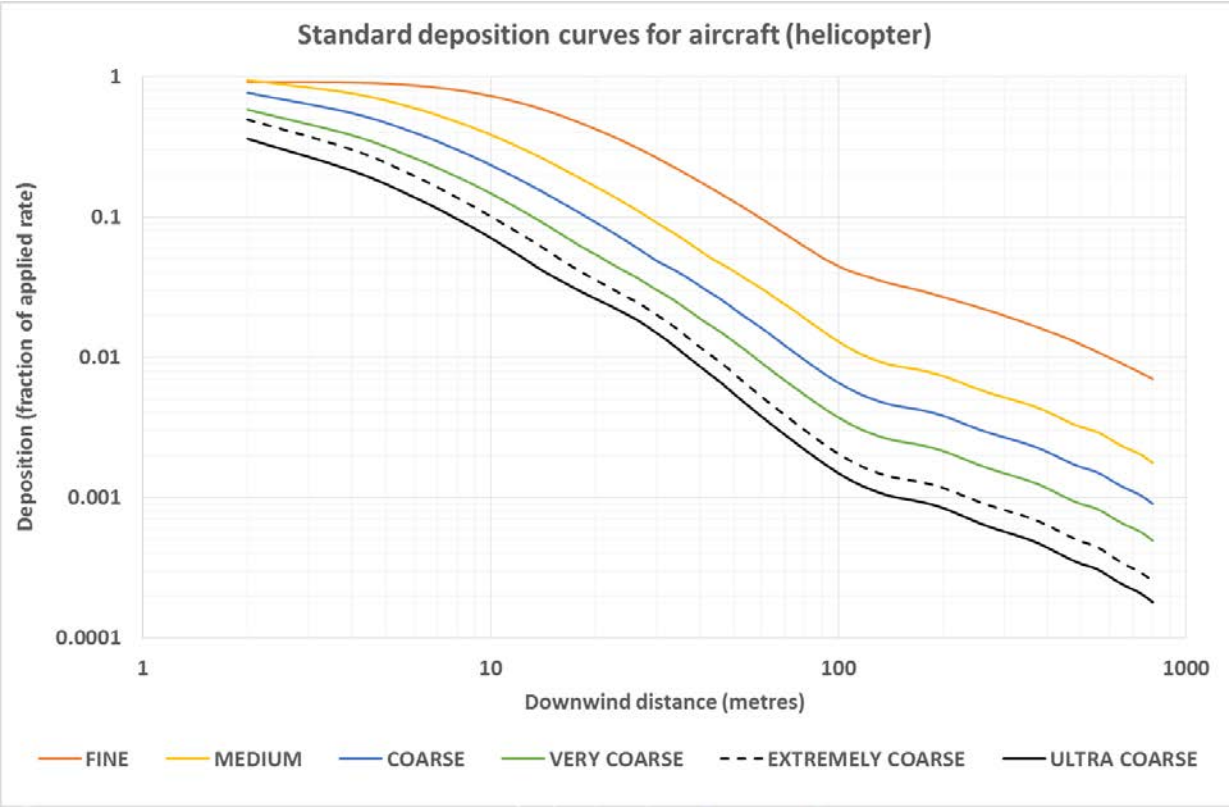


Figure 9: Chart of standard deposition curves for aircraft (helicopter)



4.2 Custom deposition curves

Custom deposition curves can be generated from information submitted with an application. The Spray Drift Data Guideline contains detailed guidance about the sorts of information which may be relevant. Custom deposition curves may be used in either the:

- Spray Drift Risk Assessment Tool (see section 6)
  - relevant only to a specific product since the information that supports the curves is related to the unique characteristics of that formulation and/or specialised application equipment, methods, etc.
- Spray Drift Management Tool (see section 7)
  - can be relevant only to a specific product but generally relevant for any product since the information that supports the curves in the Tool is independent of a specific product formulation or the equipment, methods, etc. and can be used for any product

Typically, custom deposition curves will be generated from information that relates to drift-reducing practices, technologies or innovations, including:

- specific low-drift nozzles
- improved equipment designs
- equipment modifications
- adjuvants (additives and/or components of formulations)
- improved equipment operating practices

4.2.1. Field trials

Spray drift field trials are inherently variable and therefore need to be assessed with a degree of flexibility rather than a standardised approach which may not be applicable to certain datasets. While this means that full details cannot be presented, every assessment will involve two main steps:

- regression analysis
    - rather than limit assessments to a single regression model for the entire downwind distance, the ultimate goal is to establish a deposition curve which has the best possible fit to field data.
    - the 90th percentile of field data will be used for regression analysis unless a valid scientific argument is presented for the use of an alternative percentile
    - results below the limit of detection of the study will not be considered when determining field data percentiles.
- quality assurance
    - when a field trial includes a reference sprayer, a regression analysis of the test data is compared to the relevant standard deposition curve. If there are significant differences between these curves, the field trial reference sprayer curve may be normalised to the relevant standard deposition curve and the same method applied to correct the candidate curve, in order to ensure consistency.
    - when a field trial does not include a reference sprayer, quality assurance can only be satisfied with valid scientific argument.

4.2.2. Modelling

As there is no currently validated predictive model for vertical sprayers, modelling can only be conducted for boom sprayers and aircraft using AGDISP™. Generally, modelling will be conducted using the relevant AGDISP™ template file (see section 4.1.1 and section 4.1.3) as a basis and either doing one of, or a combination of, the following steps:

- modelling the effect of a candidate (ie the nozzle or equipment being tested under certain conditions) droplet size distribution (DSD) after it has been converted to reduce inter-laboratory variability (see Section 4.2.2.1)
- modelling the effect of specific use instructions that would support varying the input settings in the relevant AGDISP™ input template

Unless the information submitted requires otherwise, modelling will be conducted at different wind speeds (10 and 20 km/hr for boom sprayers and 7, 14 and 20 km/hr for aircraft). The deposition curve for 20 km/hr will be used in the Spray Drift Risk Assessment Tool (see section 6) and all curves will be added to the Spray Drift Management Tool (see section 7). For application by aircraft, the same approach will be used to model release height (see section 7.3.2.3).

Currently accepted versions of AGDISP include version 8.26 (US EPA regulatory version that can be downloaded from www.epa.gov/pesticide-science-and-assessing-pesticide-risks/models-pesticide-risk-assessment) and version 8.28. The use of later research versions of AGDISP may be considered with argument that changes in newer version do not compromise the validity of the output deposition data.

Conversion of Droplet Size Distributions (DSDs)

To ensure that DSDs from different testing facilities can be compared and be consistent relative to APVMA DSDs (see Appendix 1), a DSD converter tool has been developed. This tool applies a distribution model, originally published by Rosin and Rammler (1933) and used in this context by Teske (2000), to both the DSD of the candidate being tested and the two nearest reference nozzles. These two modelled reference nozzle DSDs are then compared to their equivalent APVMA DSDs and a correction factor is applied to the modelled candidate DSD.

APVMA DSD Converter—V0.2.xls

4.3 Averaged deposition curves

As deposition curves are established in terms of point deposition, they must be averaged to reflect the sensitive area being protected before being used to calculate buffer zones. Levels of deposition are averaged across the following distances for each sensitive area:

- Bystander areas—20 metres
- Natural aquatic areas—3 metres
- Pollinator areas—3 metres
- Vegetation areas—3 metres
- Livestock areas—100 metres

5 USE INSTRUCTIONS

The following instructions will be required as relevant particulars for approved labels, or as conditions on permits, where a relevant assessment has been conducted in accordance with this manual. Two different approaches are supported for the determination of buffer zones:

- use of standard deposition curves (Section 5.1)
- use of customised deposition curves from submission of spray drift data (Section 5.2)

The location of these instructions on product labels is described in the Agricultural labelling code (Section 9.5).

It is essential that these use instructions are interpreted with the definitions provided in the glossary.

5.1 Standard instructions

Standard instructions contain four discrete sections:

- General instructions (Section 5.1.1)—Includes instructions applying to the use of any product that requires a spray drift risk assessment regardless of the application equipment.
- Boom sprayers (Section 5.1.2)—Provides three options for instructions specifically related to application by boom sprayer. The first option can be varied by including buffer zones calculated from the maximum label rate and a significantly lower application rate (included on the approved label for use in a different crop/situation or to control a different pest/disease/weed).
- Vertical sprayers (Section 5.1.3)—Provides three options for instructions specifically related to application by vertical sprayer, including buffer zones for three different canopy types.
- Aircraft (Section 5.1.4)—Provides three options for instructions specifically related to application by aircraft, including buffer zones for fixed-wing and helicopter aircraft. The first option can be varied by refining the instructions to account for approved labels where only one aircraft type is supported or different droplet sizes are required for different aircraft types.

The selection of application equipment is at the discretion of the applicant, provided that they are within the limits of the Agvet Code (ie they must align with the outcomes of the safety, trade and efficacy assessments). For example, if an application was not supported on the grounds that vertical sprayer application presented an un-mitigatable occupational health and safety exposure risk to users, then this section of the label must include the instruction ‘DO NOT apply with vertical sprayers’.

Applicants who do not wish to allow users to reduce buffer zones by accessing the Spray Drift Management Tool (SDMT) must vary the following instructions to remove all reference to it when submitting a proposed label. For example: ‘***DO NOT*** *apply by a boom sprayer unless the following requirements, OR the conditions of a relevant Spray Drift Management Tool output, are observed*’ would be varied to ‘***DO NOT*** *apply by a boom sprayer unless the following requirements are observed*’.

5.1.1. General instructions

SPRAY DRIFT RESTRAINTS

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

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

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

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

DO NOT apply if there are surface temperature inversion conditions present at the application site during the time of application.

5.1.2. Boom sprayers

DO NOT apply by a boom sprayer unless the following requirements, OR the conditions provided in a relevant output of the Spray Drift Management Tool (website URL to be confirmed) are met:

- spray droplets not smaller than a **[ZAA]** spray droplet size category
- for boom heights over 0.60 metres above the target, application must only occur when the conditions provided in a relevant output of the Spray Drift Management Tool (website URL to be confirmed) are met
- for boom heights 0.60 metres and lower above the target, minimum distances between the application site and downwind sensitive areas (see 'Mandatory buffer zones' section of the following table titled 'Buffer zones for boom sprayers') are observed.

Buffer zones for boom sprayers

Application rate	Mandatory buffer zones			Advisory buffer zones	
	Bystander areas	Natural aquatic areas	Pollinator areas	Vegetation areas	Livestock areas
Up to maximum label rate	[ZBB] m	[ZCC] m	[ZDD] m	[ZEE] m	[ZFF] m
A rate lower than the maximum label rate (if relevant for the product label)	[ZGG] m	[ZHH] m	[ZII] m	[ZJJ] m	[ZKK] m

OR (if an assessment required any mandatory buffer zone distance to be greater than the validated distance)

DO NOT apply by a boom sprayer unless the conditions provided in a relevant output of the Spray Drift Management Tool (website URL to be confirmed) are met.

OR (if the use of boom sprayers is not supported under any circumstance)

DO NOT apply by a boom sprayer.

5.1.3. Vertical sprayers

DO NOT apply by a vertical sprayer unless the following requirements, OR the conditions provided in a relevant output of the Spray Drift Management Tool (website URL to be confirmed) are met:

- spray is not directed above the target canopy
- the outside of the sprayer is turned off when turning at the end of rows and when spraying the outer row on each side of the application site
- for dilute water rates above the maximum listed for each type of canopy specified in table below titled 'Buffer zones for vertical sprayers', application must only occur when the conditions provided in a relevant output of the Spray Drift Management Tool (website URL to be confirmed) are met
- for dilute water rates up to the maximum listed for each type of canopy specified, minimum distances between the application site and downwind sensitive areas (see 'Mandatory buffer zones' section of the following table titled 'Buffer zones for vertical sprayers') are observed.

Buffer zones for vertical sprayers

Type of target canopy and dilute water rate	Mandatory buffer zones			Advisory buffer zones	
	Bystander areas	Natural aquatic areas	Pollinator areas	Vegetation areas	Livestock areas
2 metres tall and shorter, maximum dilute water rate of [YPP] L/ha	[YAA] m	[YBB] m	[YCC] m	[YDD] m	[YEE] m
taller than 2 metres (not fully-foliated), maximum dilute water rate of [YQQ] L/ha	[YFF] m	[YGG] m	[YHH] m	[YII] m	[YJJ] m
taller than 2 metres (fully-foliated), maximum dilute water rate of [YRR] L/ha	[YKK] m	[YLL] m	[YMM] m	[YNN] m	[YOO] m

OR (if an assessment required any mandatory buffer zone distance to be greater than the validated distance)

DO NOT apply by a vertical sprayer unless the conditions provided in a relevant output of the Spray Drift Management Tool (website URL to be confirmed) are met.

OR (if the use of vertical sprayers is not supported under any circumstance)

DO NOT apply by a vertical sprayer.

5.1.4. Aircraft

DO NOT apply by aircraft unless the following requirements, OR the conditions provided in a relevant output of the Spray Drift Management Tool (website URL to be confirmed) are met:

- spray droplets not smaller than a **[XAA]** spray droplet size category
- for release heights over 3 metres above the target, application must only occur when the conditions provided in a relevant output of the Spray Drift Management Tool (website URL to be confirmed) are met
- for release heights 3 metres or lower above the target, minimum distances between the application site and downwind sensitive areas (see 'Mandatory buffer zones' section of the following table titled 'Buffer zones for aircraft') are observed.

Buffer zones for aircraft

Type of aircraft	Mandatory buffer zones			Advisory buffer zones	
	Bystander areas	Natural aquatic areas	Pollinator areas	Vegetation areas	Livestock areas
Fixed-wing	[XBB] m	[XCC] m	[XDD] m	[XEE] m	[XFF] m
Helicopter	[XGG] m	[XHH] m	[XII] m	[XJJ] m	[XKK] m

OR (if an assessment required any mandatory buffer zone distance to be greater than the validated distance)

DO NOT apply by aircraft unless the conditions provided in a relevant output of the Spray Drift Management Tool (website URL to be confirmed) are met.

OR (if the use of aircraft is not supported under any circumstance)

DO NOT apply by aircraft.

5.1.5 Different application equipment types for different crop/situation use patterns

When the range of crop/situation use patterns on a product label are intended to be treated with the same type/s of application equipment, no further use instructions are required. However, if different application equipment types are intended for different crop/situation use patterns, specific instructions must be incorporated onto the label in order to provide clarity to users.

For example, if boom and aerial application was supported for wheat and only vertical sprayer application was supported for apples on efficacy grounds, then the use instructions would need to clarify this.

These clarifying instructions are required, in order to indicate which application type/s are intended for use with which crop/situation; they may appear in different sections of the label at the discretion of the registrant. The complexity of a label (ie the number and range of different crop/situations approved) will dictate the most efficient and effective way of providing this clarification. Some suggested locations for these statements are in the following sections of a label:

- SPRAY DRIFT RESTRAINTS
- GENERAL INSTRUCTIONS
- DIRECTIONS FOR USE (CROP/SITUATION or CRITICAL COMMENTS)

The DIRECTIONS FOR USE table could also be split into sections for each application equipment type (eg a label could have four DIRECTIONS FOR USE sections with only the relevant use pattern(s) in each: a boom sprayer section, a vertical sprayer section, an aircraft section, and a miscellaneous application equipment section for use patterns that do not require a spray drift risk assessment as detailed in Section 1.4 above).

5.2 Custom instructions

When information relating to spray drift (see Spray Drift Data Guideline) is submitted as part of an application, the standard instructions outlined in Section 5.1 will be used as a basis for establishing label instructions; the standard instructions will be refined, reduced or expanded in accordance with the nature of that application.

When an application proposes to only allow use with certain equipment, examples of potential additional instructions are:

- ‘only to be applied with a make A model B nozzle up to a maximum pressure of C bar’ (for boom sprayer application)
- ‘only to be applied with a make A model B tower sprayer’ (for vertical sprayer application)
- ‘only to be applied with a make A model B orifice C nozzle at a maximum airspeed of D with a minimum pressure of E bar and a maximum angle of F^{o} from the horizontal (where 0^{o} is directly opposite from the direction of flight and 90^{o} is directly downwards)’ (for aircraft application)

When an application proposes the addition of a drift-reducing adjuvant, examples of potential additional instructions are:

- ‘only to be applied when [Adjuvant Product Name and Number] is used in a tank mix at label rates’
- ‘minimum distances between the application site and downwind sensitive areas that appear in the ‘Mandatory buffer zones’ section of the table below titled ‘Buffer zones for boom sprayers (with or without using adjuvant) must be observed’ (where the first row of the table lists buffer zones established by a risk assessment using standard deposition curves and the second lists buffer zones established by a risk assessment using custom deposition curves)

More generally, applicants may wish to provide additional risk management use instructions in relation to spray drift. For example, as buffer zones may not always be completely protective of agricultural crops or aquacultural production (see Section 3.1.2.1 and Section 3.1.4.1), applicants may wish to include specific statements about these areas through custom use instructions. This may be particularly useful when there are known risks posed to certain crops or aquacultural species (including at certain development stages) by a certain product.

6 SPRAY DRIFT RISK ASSESSMENT TOOL (SDRAT)

To ensure consistency and evaluation efficiency, a Spray Drift Risk Assessment Tool (SDRAT) has been developed to automate the spray drift risk assessment process described in this manual as much as possible. This Tool includes the generation of complete standard instructions (see Section 5.1) based on the outcome of a risk assessment. Applicants are able to conduct self-assessments using this tool prior to making an application.

A prototype Tool will be used in the interim whilst a permanent web based tool is established:

SDRAT APVMA Assessments v0.2.xlsx

6.1 Buffer zone rounding

For simplicity, when the SDRAT is used to determine use instructions on product labels or permits (see Section 5), buffer zones will be rounded up to the nearest interval in accordance with Table 8. When a product label references the Spray Drift Management Tool (SDMT), users are able to access the actual calculated buffer zone as no rounding is used in the SDMT.

Table 8: Buffer zone rounding

Distance range (m)	Interval (m)	Boom sprayer	Vertical sprayer	Aircraft
0 – 100	5	Yes	Yes	Yes
100 – 250	10	Yes	Yes	Yes
250 – 300	25	Yes	Outside validated standard deposition curve range	Yes
300 – 800	25	Outside validated standard deposition curve range		Yes

6.2 Mandatory tank mixes

NOTE: This function is not available in the current SDRAT prototype.

When an instruction for a mandatory tank-mix instruction is considered, a set of RALs for each combination in a particular ratio (ie the product used by itself and with mandatory tank mix partner/s – see Section 3.3) will be entered into the SDRAT. As RALs are expressed as a fraction of active constituent (see Section 3.2), each set will also have an active concentration relative to the product being assessed but adjusted to the tank mix.

The SDRAT will then calculate the required buffer zones for the use pattern of each combination, but for simplicity only the worst case will be used for label/permit instructions. For products/permits that include instructions referring to the SDMT, users will be able to refine these buffer zones based on their actual use pattern (see Section 7.1.1).

The formula used to calculate the adjusted active concentration for tank mixes is shown in Equation 12 and an example is provided in Table 9. An example of determining the worst case buffer zones for label/permit instructions is shown in Table 10.

Equation 12: Formula for calculating adjusted active concentration for tank mixes

$$Conc(tank\ mix) = \frac{Conc(product) \times\ Rate(product) + Conc(tank\ mix\ partner) \times Rate(tank\ mix\ partner)}{Rate\ (product)}$$

Table 9: Example calculation of an adjusted active concentration for a tank mix

	Product used by itself	Product used with mandatory tank mix partner
Active concentration of product	250 g ac/L	250 g ac/L
Active concentration of tank mix partner	-	500 g ac/L
Maximum application rate of product	1,000 mL/ha	500 mL/ha
Maximum application rate of tank mix partner	-	2,000 mL/ha
Active concentration of tank mix	250 g ac/L	2,250 g ac/L

Table 10: Example calculation of worst-case buffer zones for a tank mix

Sensitive area	Product used by itself	Product used with mandatory tank mix partner	Label/permit use instructions
Bystander areas	10 metres	Not required	10 metres
Natural aquatic areas	Not required	100 metres	100 metres
Pollinator areas	20 metres	20 metres	20 metres
Vegetation areas	Not required	Not required	Not required
Livestock areas	250 metres	Not required	250 metres

7 SPRAY DRIFT MANAGEMENT TOOL (SDMT)

The Spray Drift Management Tool (SDMT) will initially be used by the APVMA to put buffers relevant to the use of DRTs on labels or permits. In Stage 2, its use may be expanded as outlined in this section to allow users to reduce buffer zones where they are restricting the way the product is used to a greater extent than required by the approved label (or permit).

To allow chemical users to refine risk assessments conducted with the Spray Drift Risk Assessment Tool (SDRAT), a Spray Drift Management Tool (SDMT) is proposed. This tool may in the future be accessible to users of products which specifically refer to it in label instructions (see section 5.1).

The SDRAT has been developed, based on conservative assumptions, in order to account for a variety of factors which contribute to the distance that spray drifts. This is to ensure that the risk of spray drift can be managed with any spray application in accordance with a broad set of use instructions. By contrast, the SDMT tool allows buffer zones to be recalculated by considering specific factors and specific use instructions.

As a trade-off for increasing flexibility in the way the product can be applied (compared to the use instructions and the risk assessment), the SDMT can recalculate larger buffer zone distances in certain situations (eg with a finer droplet size when using a product in a tank-mix, higher release heights for application by aircraft, etc.).

A prototype SDMT will be used in the interim while a permanent web based tool is established. Note that it is currently set up for testing purposes only as it contains hypothetical products, does not include any custom deposition curves, and limits the number of products used in a tank-mix to two:

SDMT—Chemical user refinement—v0.2.xlsx

It also allows users to see all the information used to re-calculate buffer zones, in order to allow review of the entire system. When in use with actual product information and custom deposition curves, only the ‘use details’ and ‘SDMT conditions’ screens will be accessible to users outside of the APVMA.

Users of the SDMT will be required to make a record to support their use of re-calculated buffer zones. It is proposed that this will be made possible through several mechanisms in the web based tool:

- each time the SDMT is used a unique ID number will be generated. Users can record this ID number and then retrieve the details from the SDMT at a later date. No user information will be stored and no login will be required.
- users can email themselves and/or any other person (ie an agronomist or consultants could email a client, a farm manager could email an employee, etc.).
- users can print or save as a file (eg PDF format).

The SDMT can be used by product registrants, equipment manufacturers, industry representative bodies, agronomists, consultants, etc. to select preferred options to re-calculate buffer zones and provide this information directly to users (together with the unique ID number).

It is proposed that the web based tool will include a mobile version accessible through web browsers on smart phones or tablets. It is also proposed that an external interface be made available for industry to access and incorporate the SDMT into new or existing online services and mobile apps (eg as an add-on to record keeping systems, industry specific platforms, quality assurance systems, best-management-practice portals, etc.).

7.1 SDMT overview

The SDMT allows chemical users to undertake more targeted risk assessments by entering information about how they intend to use the product into the SDMT. This information is then used to recalculate buffer zones and establish conditions through two methods:

- fraction of applied rate factors
- alternative deposition curves

These methods are explained in more detail in the section 7.2 and section 7.3. They can be applied separately, or in combination, depending on the options selected in the SDMT by the chemical user. Visual representations of how buffer zones can be recalculated by applying these methods are shown in figures 10, 11 and 12. In these examples, the solid black arrows show the buffer zone that was established through the use of the SDRAT and the hashed black arrows show the buffer zone recalculated by the SDMT.

Section 7.4 explains the conditions that apply to the use of the SDMT and section 7.5 outlines how information is managed and updates to the SDMT occur.

Figure 10: Buffer zone recalculation by applying fraction of applied rate factors

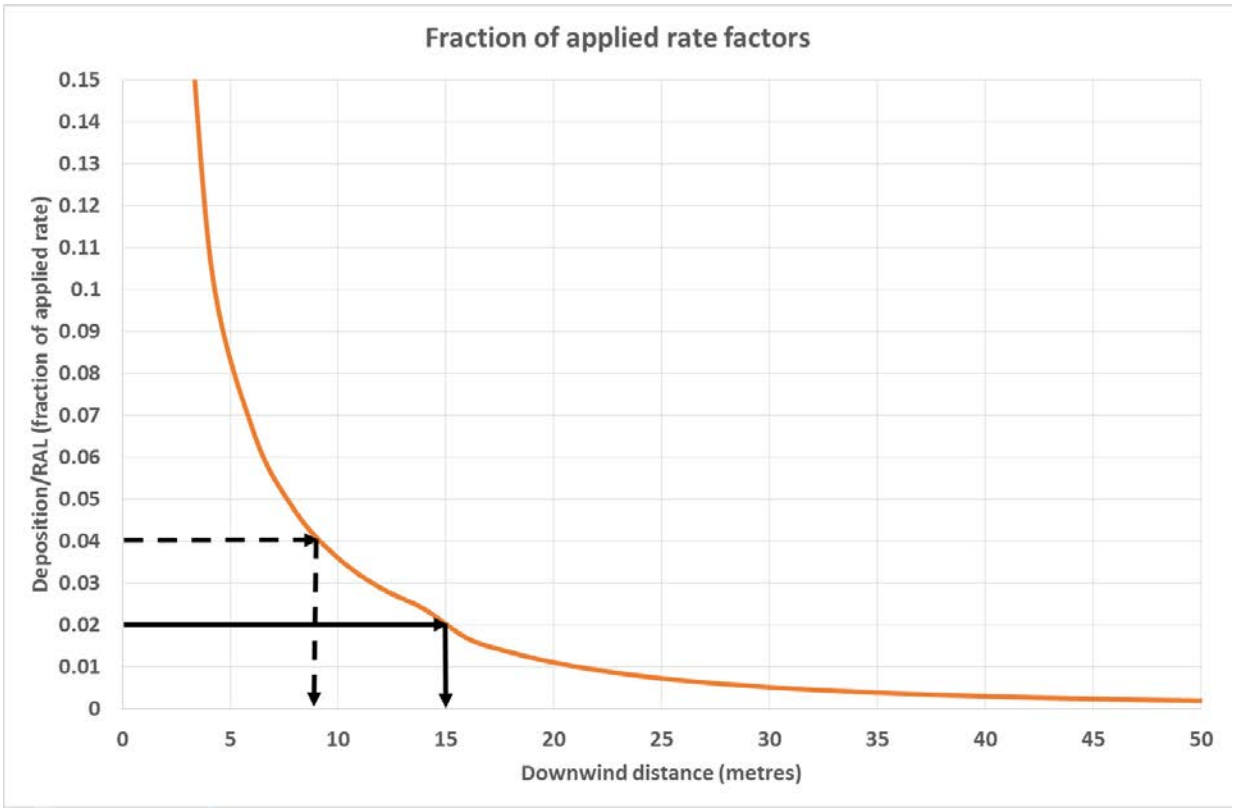
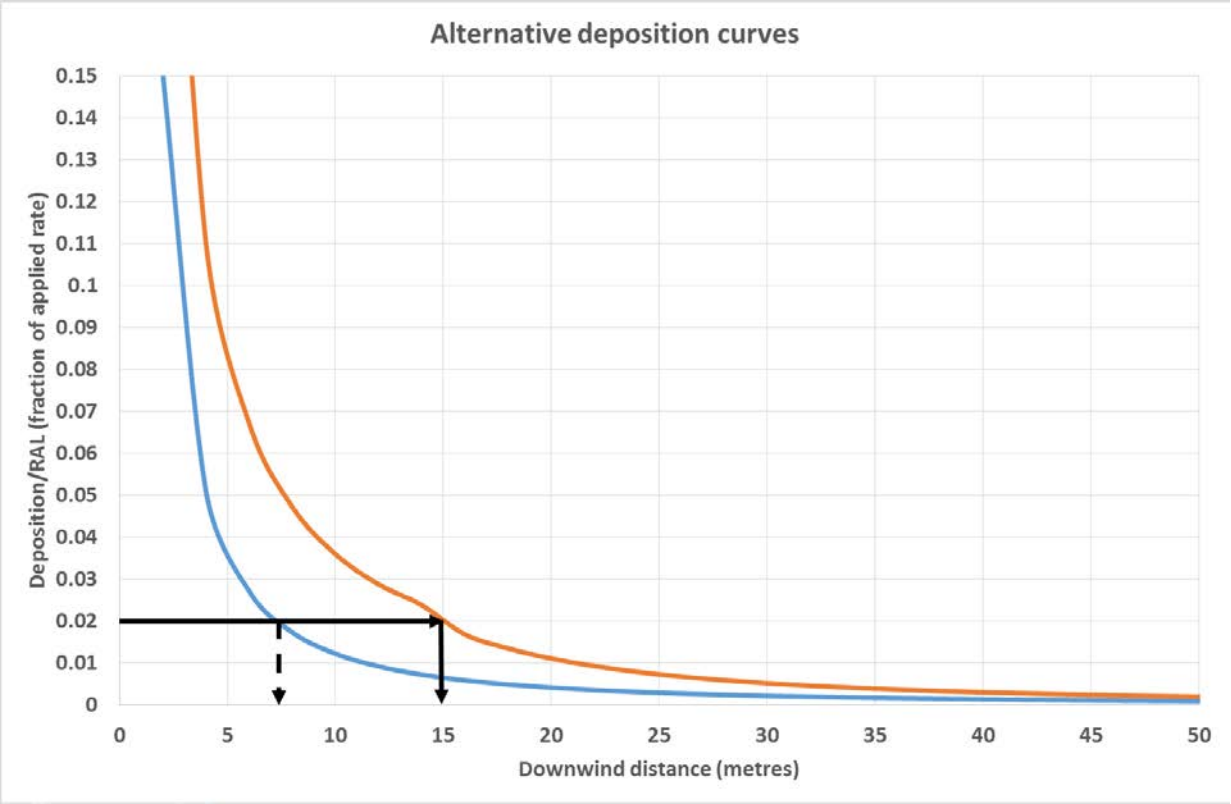


Figure 11: Buffer zone recalculation by selecting alternative deposition curves



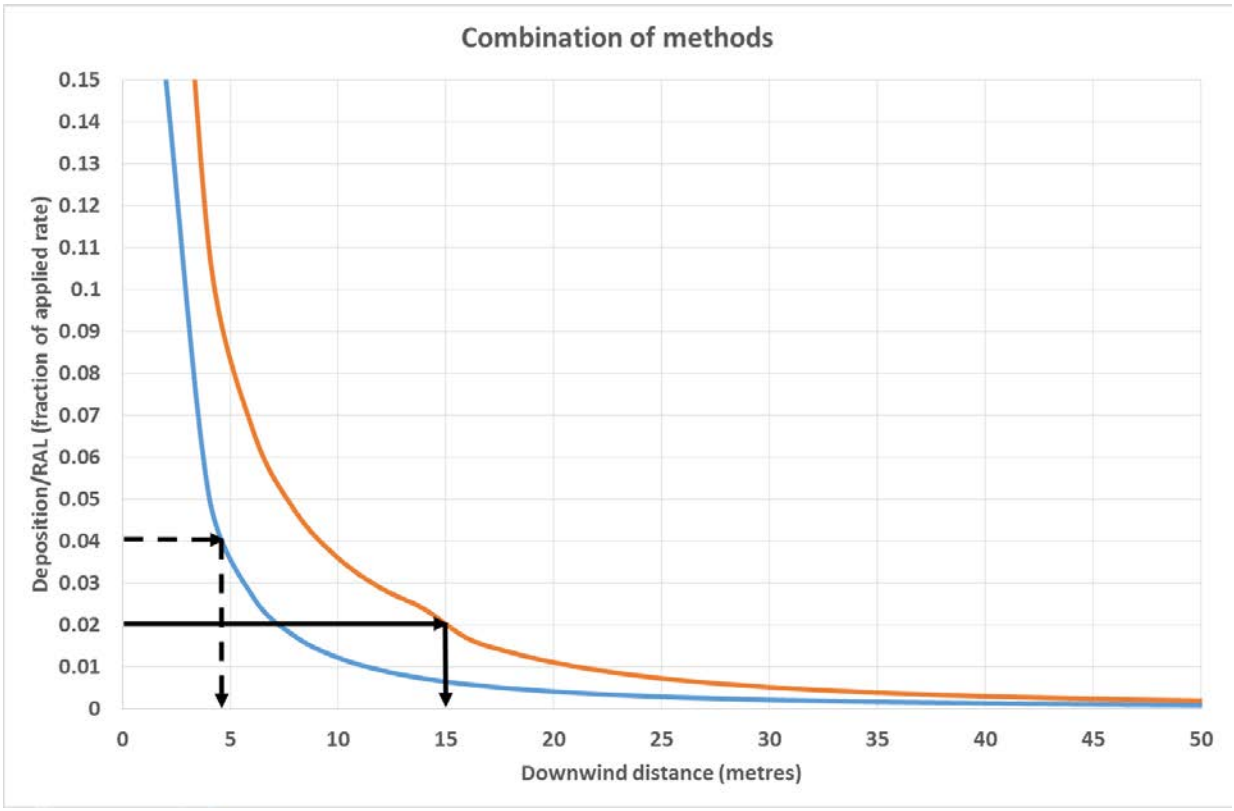


Figure 12: Buffer zone recalculation by applying both methods in combination

7.1.1 Tank-mixing

When users mix products in the tank, they must always follow the most restrictive use instruction (for the particular purpose of application) on the labels of the products used in that tank-mix. For example, if one label includes a statement that a half-face respirator must be worn by the applicator but the tank mix partner label does not, the applicator must wear the half-face respirator to apply the tank mix.

Buffer zones are no different, so if a buffer zone was 10 metres for one product in a tank-mix but 50 metres for another, the buffer zone for that tank-mix would be 50 metres. The SDMT allows users to select all the products used in a tank-mix and determine the most restrictive for each sensitive area.

An exception arises when there is determined to be a synergistic effect of the tank-mix which requires a larger buffer zone as the products pose a greater risk when used together than when used alone. The SDMT will accommodate this by including different sets of RALs for products used alone and in combination with mandatory tank-mix partners (see section 6.2). Users will be able to calculate the buffer zones relevant to their actual use pattern (ie the product used by itself or with a mandatory tank mix partner) instead of the worst-case buffer zone from the label/permit use instruction.

Note that the SDMT prototypes above only allow two products to be tank-mixed together; however, the permanent web based tool will not be restricted (noting any legal requirements regarding tank-mixing must still be observed).

7.2 Fraction of applied rate factors

Several different adjustment factors are available in the SDMT which allow the fraction of applied rate, with respect to a RALs, to be adjusted. These factors do not change the hazard determination of spray drift risk assessments, only how RALs are converted to relevant units (ie grams per hectare) or how they are expressed as a fraction of the applied rate (see section 3). Once RALs are adjusted, buffer zone distances are recalculated by the SDMT.

7.2.1. Application rate

Instead of the maximum label use for the relevant equipment type (realistic worst-case), the SDMT adjusts each RAL (fraction of applied rate) with the application rate specified by the user (equation 6 and equation 7 in section 3.2).

7.2.2. Water depth

The natural aquatic area RAL (Aquatic RAL) is calculated for a water body that is 0.15 metres (15 centimetres) deep to allow deposition on the surface of water to be converted to a concentration in water. As this (concentration in water) is the driver for protecting natural aquatic areas, not deposition on the surface of the water, a deeper water body has a greater tolerance to spray drift because of the increased dilution of the chemical.

The SDMT allows users to conduct a local area risk assessment and determine the water depth of the nearest downwind natural aquatic area, thus allowing the Aquatic RAL (fraction of applied rate) to be adjusted. Equation 13 shows how this factor is applied.

Equation 13: Accounting for increased water depth

$$SDMT\ Adjusted\ Aquatic\ RAL = Aquatic\ RAL\ (fraction\ of\ applied\ rate) \times \frac{User\ input\ water\ depth\ (cm)}{15\ cm}$$

Water depth is inputted in 15 cm (0.15 m) intervals; a maximum water depth of 0.60 m is accepted to allow for poor mixing from the surface to the bottom in deeper water bodies (which prevents dilution).

7.2.3. Optical spot spraying technologies

When optical spot spraying technologies are used on a boom sprayer, application rates can be significantly reduced. Specific directions for the use of this technology on product labels commonly specify a dilution rate (ie amount of product per 100 litres of water) and a calibration rate (ie number of litres of spray mixture per hectare the equipment is set up to apply, if the optical spot spraying technology was not in use). As this is not consistent with typical boom sprayer directions for use (ie amount of product per hectare), the reduction in application rate from the use of this technology is best accounted for as a factor.

The SDMT allows users, once they input their application rate by providing dilution rate and calibration rate, to input the percentage cover of their target (eg weed cover). Each RAL is then adjusted as shown in equation 14.

Equation 14: Accounting for optical spot spraying technologies

$$SDMT\ Adjusted\ RAL = RAL\ (fraction\ of\ applied\ rate) \times \frac{100\%}{User\ input\ percentage\ cover\ of\ target}$$

7.2.4. Vegetative and artificial spray drift barriers

The National Working Party on Pesticide Applications are currently working on a project in relation to vegetative and artificial spray drift barriers. A draft implementation of barriers has been incorporated into the SDMT to demonstrate how this may be incorporated. Further work is required to finalise and validate the proposed analysis.

7.3 Alternative deposition curves

Users are able to select different deposition curves, within their equipment type, in order to recalculate buffer zones. The SDMT is pre-loaded with the standard deposition curves (see section 4.1) and additional SDMT deposition curves (see section 7.3.2). After applications are made to the APVMA to assess information (see Spray Drift Data Guideline), custom deposition curves will be added to the SDMT (see section 7.3.1).

7.3.1. Addition of custom deposition curves

Applications to the APVMA that include submission of information (see Spray Drift Data Guideline) to establish custom deposition curve/s can be made as follows:

- Holders of a product registration (or applicants registering a product for the first time), who own (or have consent to access) information that is product specific can submit information as part of an application for registration or variation.
    - Information provided through this pathway has limits on use of information (see also the guideline) applied, so custom deposition curve/s are only ever available to users of that product. Underlying information used to establish custom deposition curves is not included in the SDMT to ensure confidential commercial information requirements are observed.
- Third parties (eg equipment/nozzle manufacturers, industry representative groups, etc.) can apply to the APVMA for technical assessment of information. This information may either be product specific or applicable to any product.
    - The third party can then seek consent of a relevant holder of a registration to make an application to vary the relevant particulars of the registration of a product (section 27(2) of the Agvet Code), in order to recognise custom deposition curve/s established from this information.
    - Alternatively, when making an application for technical assessment, written consent can be given by the third party to allow custom deposition curve/s established from this information to be available to any holder of a product registration (or applicant registering a product for the first time).

Third parties and holders of a product registration (or applicants registering a product for the first time) also have the ability to form a partnership and have information submitted as part of an application for registration or variation by the holder/applicant. If this information is intended to be applicable to any product (ie not specific to product the application relates to), the third party can provide written consent to allow custom deposition curve/s established from this information to be available to any holder of a product registration (or applicant registering a product for the first time).

The management of information within the SDMT, including custom deposition curves, is discussed further in section 7.5.

7.3.2. Additional SDMT deposition curves

Additional SDMT deposition curves have been established to provide flexibility to chemical users without unnecessarily complicating risk assessments conducted during the assessment of applications for registration or variation. All additional SDMT deposition curves are tabulated 'Deposition Curves' tab of the prototype Spray Drift Management Tool.

Boom sprayers

For boom sprayers, the AGDISP™ template in section 4.1.1 was used to model a lower wind speed of 10 km/hr for each droplet size distribution to establish additional SDMT deposition curves.

For simplicity, the standard use instructions (see section 5.1.2) align to the standard deposition curves and limit application to a maximum boom height of 0.60 metres above the target. To account for this and provide flexibility to users, additional SDMT deposition curves (for each droplet size distribution at each wind speed of 20 and 10 km/hr) have been established for boom heights between 0.60 metres and 1.20 metres, at 0.20 metre increments (using the AGDISP™ templates in section 4.1.1 without varying other input values).

At higher release heights, the canopy being treated, and the release height in relation to the canopy, should be considered with specific AGDISP™ model inputs rather than the approach above. Because of the considerable number of combinations, this can only practically be performed through the submission of information to develop custom deposition curves (see section 4.2) rather than including additional SDMT deposition curves.

To account for 'rights-of-way' and other small scale applications in turf, horticulture, etc., modelling was also conducted (for each droplet size distribution at each boom height at both wind speeds) for application sites 20, 40 and 60 metres wide.

Vertical sprayers

For vertical sprayers, the additional 'Basic Drift Values' for 'Grapevine—early' (canopies 2 metres and shorter with air assistance turned off) and 'Hops' have been used to establish additional SDMT deposition curves.

Aircraft

For aircraft, the AGDISP™ templates in section 4.1.3 was used to model two lower wind speeds (14 km/hr and 7 km/hr) for each droplet size distribution for each aircraft type to establish additional SDMT deposition curves.

For simplicity, the standard use instructions (see section 5.1.4) align to the standard deposition curves and limit application to a maximum release height of 3 metres above the target. To account for this and provide flexibility to users, additional SDMT deposition curves (for each droplet size distribution for each aircraft type at wind speeds of 20, 14 and 7 km/hr) have been established for heights between 3 metres and 6 metres at 1.0 metre increments (using the AGDISP™ templates in section 4.1.3 without varying other input values).

At higher release heights, the canopy being treated, and the release height in relation to the canopy should be considered with specific AGDISP™ model inputs rather than the approach above. Because of the considerable number of combinations, this can only practically be performed through the submission of information to develop custom deposition curves (see Section 4.2) rather than additional SDMT deposition curves.

7.4 SDMT conditions

Essentially, the Spray Drift Management Tool (SDMT) will allow users to reduce buffer zones because they are restricting the way they use the product to a greater extent than required by the approved label (or permit). These conditions fall into three categories as detailed in the following sub-sections.

7.4.1. SDMT generic conditions

The general instructions (see section 5.1.1) form the basis for SDMT conditions to ensure that users are aware that these conditions apply even if they use the SDMT.

The SDMT does not limit the crop/situation, types of application equipment and application rates, etc. based on product (in order to allow it to be applied to uses allowed under permit). Therefore the following condition is required in the SDMT:

> Use of the Spray Drift Management Tool (SDMT) does not permit the off-label use of products. Whilst higher rates, different application equipment, etc. can be selected in the SDMT compared to approved labels, a permit must be issued by the APVMA to first allow any off-label use pattern (unless state and territory legislation allows otherwise).

It is not possible to specifically consider efficacy for every possible combination of information in the SDMT. Thus the onus is on chemical users to ensure that any practices, technologies or innovations that relate to deposition curves (see section 4) are suitable for the product and the use situation. This is consistent with standard industry and regulatory approaches in that flexibility is already provided to users to implement different practices, technologies and innovations compared to what specific equipment and operational practices were used to generate efficacy data (unless use instructions include specific prohibitions). Users are reminded of this existing obligation with the following SDMT condition:

> It is the responsibility of the chemical user to ensure that any practices, technologies or innovations specified in SDMT conditions for the product and use situation will be efficacious.

The SDMT will allow users to select either one or multiple products to be used in a tank-mix. To ensure it is clear what the SDMT applies to each time the SDMT is used, one of the following conditions is be required:

> These conditions apply only to the use of [Product Name and Number].

> These conditions apply only to the use of [First Product Name and Number] tank-mixed with [Second Product Name and Number]. (if more than two products are used in a tank-mix this condition will be modified to include all products).

If a user selects options in the SDMT that do not allow mandatory buffer zones to be set within the validated range of the selected deposition curve (see Section 5.1), the following SDMT condition will be applied:

> DO NOT apply as spray drift risk cannot be managed with the information you have provided. Review the details you have entered and correct any errors or select alternate options.

7.4.2. Fraction of applied rate factor conditions

Each fraction of applied rate factor (see section 7.2) selected by an SDMT user requires a linked condition:

- 'only to be applied up to a maximum rate of A ml/ha' (for boom sprayer or aircraft application when a weed/pest/disease is controlled at a rate lower than the maximum for that use pattern)
- 'only to be applied up to a maximum dilution rate of A ml/100 L and a maximum water rate of B L/ha' (for vertical sprayer application when a pest/disease is controlled at a rate lower than the maximum for that use pattern and/or a lower water rate is used due to the canopy type or growth stage)
- 'only to be applied when the nearest downwind natural aquatic area is at least A cm deep' (for local area risk assessments of water body depth)
- 'only to be applied when optical spot spraying technology is activated and the target coverage of the application site is no greater than 20%' (for the use of optical spot spraying technology)

7.4.3. Alternative deposition curve conditions

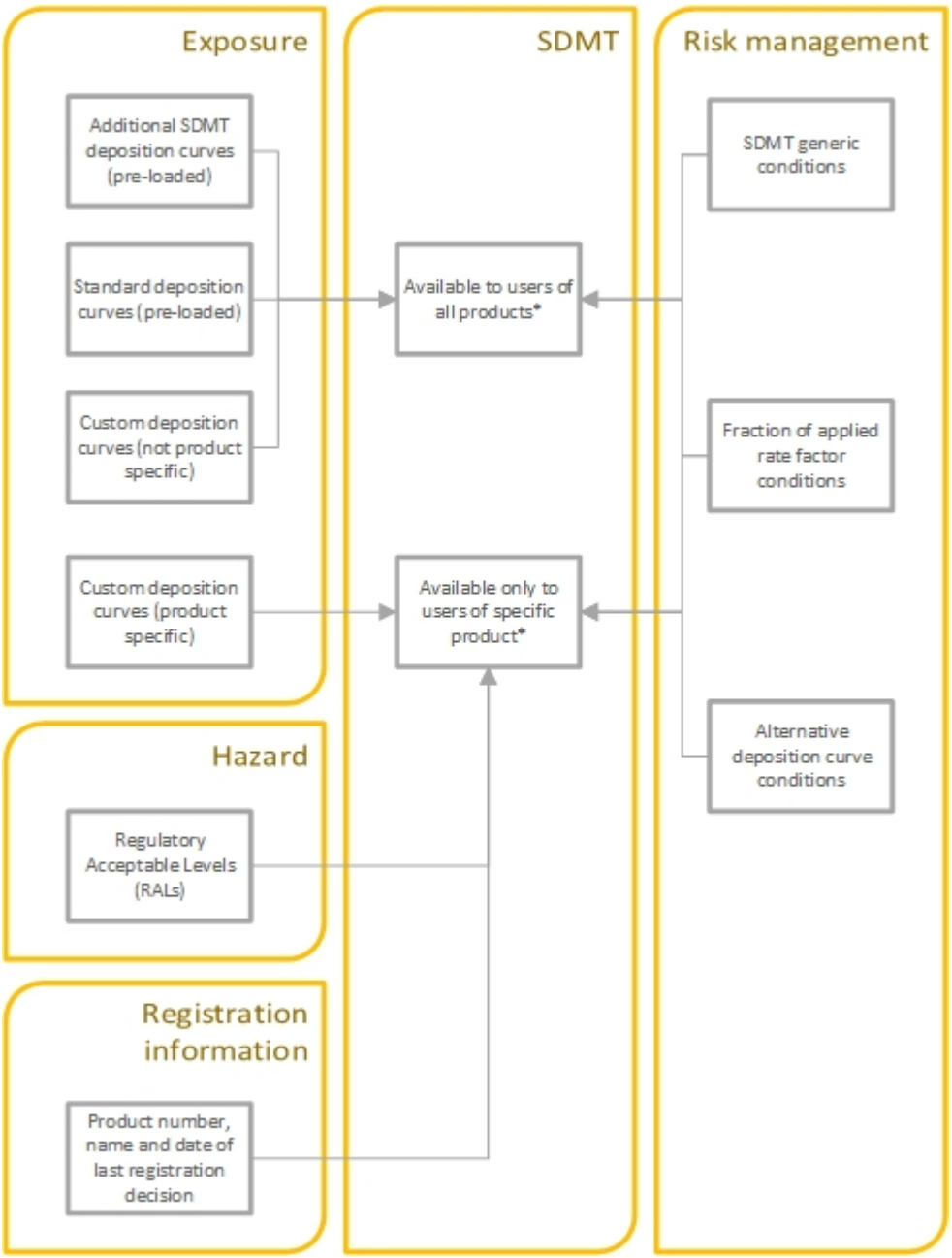
If an alternate deposition curve is selected by a SDMT user, conditions are applied to support the use of that curve. Typically, these will be the custom deposition curve examples in section 5.2.1. The following example is relevant to additional SDMT deposition curves (section 7.3.2) as well as custom deposition curve conditions:

- 'only to be applied when the wind speed is between 3 and 10 km/hr' (for boom sprayer application when a wind speed of 10 km/hr is used for modelling)

7.5 Managing information in the SDMT

Figure 13 outlines how information is managed in the SDMT. The asterisks in this figure indicate that information in the SDMT only becomes available once a registration decision is made following its addition to the SDMT (see figure 14).

Figure 13: Management of information in the SDMT



Because the SDMT will continually have information added to it (ie custom deposition curves), this creates a need to ensure information is managed appropriately. The Agvet Code and subordinate legislation supports the use of the SDMT as being in place at the time of a regulatory decision (see section 1.2), but not for additions after a decision has been made.

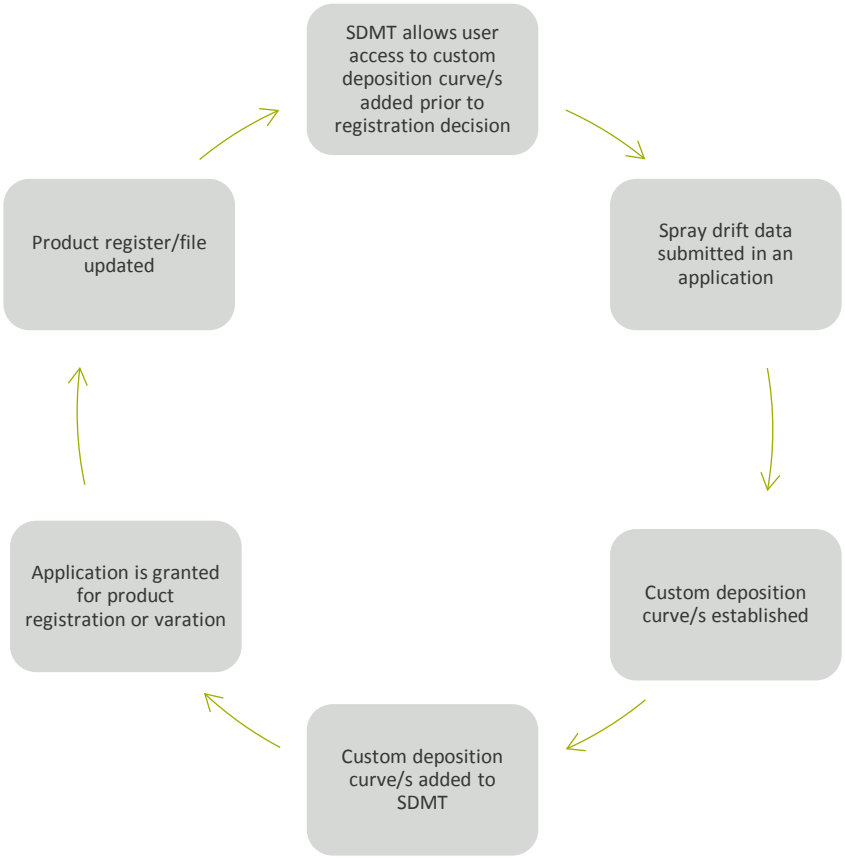
Therefore, when a decision is made, the SDMT will limit user access to information that was available in the SDMT on the day of, and prior to, that decision. For example, if there were 100 custom deposition curves present in the SDMT on the day of a decision, and 200 were added tomorrow, users of the SDMT would only be able to select the original 100 custom deposition curves until a new decision is made.

When an application is made by the holder of a registration (or an applicant registering a product for the first time) for any purpose, users will be able to access the new deposition curve/s in the SDMT (if the application is granted). This includes applications made under item 13 from the table in Part 2 of Schedule 6 to the Agvet Code Regulations, which can only be used when the change is required by APVMA (for products which already contain use instructions that refer to the SDMT).

In order to promote spray drift risk management by ensuring chemical users have access to the latest SDMT information, APVMA will periodically invite holders of registrations to make item 13 applications. The frequency of these invitations will depend on the type, and amount of, new information in the SDMT. Other applications can be made by holders of a registration at any time, in accordance with the Agvet Code.

The cycle for updating the SDMT is shown in Figure 14.

Figure 14: SDMT update cycle



Relevant particulars for approved labels only reference the SDMT, so the product register/file (and product registration information in the SDMT) will restrict this reference to the information contained in the SDMT at the time of the most recent decision. Importantly, if the only change request in an application is to amend the product register/file to recognise new information in the SDMT, product label re-printing is not necessary.

8 CASE STUDIES

To demonstrate the principles outlined in this manual, the effect it has on the pesticide label and the way in which the SDMT may in the future be used to modify no-spray buffer zones at the time of application, two case study examples for hypothetical pesticide products are set out below. The first is for a herbicide that can be applied by fixed wing aircraft, helicopter or ground boom sprayer (section 8.1). The second is for an insecticide that can be applied using a vertical sprayer or ground boom sprayer (section 8.2).

The Spray Drift Management Tool (SDMT) will initially be used by the APVMA to put buffers relevant to the use of DRTs on labels or permits. In Stage 2, its use may be expanded as outlined in this section to allow users to reduce buffer zones where they are restricting the way the product is used to a greater extent than required by the approved label (or permit).

A summary of the case study scenarios and the influence these have on the selection of no-spray buffer zones is given in the following tables for ground boom (table 11), fixed wing aircraft (table 12), helicopters (fable 13) and vertical sprayers (table 14). Full details of the various scenarios follow in section 8.1 and 8.2.

Table 11. Summary of case study 1 buffer zones for ground boom applications (section 8.1).

Scenario	Buffer zone (metres)	
	Natural aquatic areas	Vegetation areas
Current framework	10	40
Proposed framework—on label (SDRAT)		
– maximum label rate (4000 mL/ha)	25	210
- 2100 mL/ha or lower	Not required	90
SDMT Example 1—Lower wind speed (<10 km/hr)	20	152
SDMT Example 2—Lower rate, larger droplet size (very coarse)	Not required	30
SDMT Example 3—Right of way, narrow application width (<20 m), low wind speed (< 10 km/hr), larger droplet size (ultra coarse)	Not required	Not required
SDMT Example 4—Optical spot spraying (coverage < 30%), very coarse	Not required	6
SDMT Example 5—Lower rate, finer droplet size (medium), raised boom height (< 1 m)	42	Over 300
SDMT Example 6—Highest rate, larger droplet size (ultra coarse), higher release height (1m)	Not required	36

Table 12. Summary of case study 1 buffer zones for fixed wing aircraft applications (section 8.1).

Scenario	Buffer zone (metres)	
	Natural aquatic areas	Vegetation areas
Current framework	120	750
Proposed framework—on label (SDRAT)	85	300
SDMT Example 7–Lower rate, lower wind speed (<7 km/hr)	26	136

Table 13. Summary of case study 1 buffer zones for helicopter applications (section 8.1).

Scenario	Buffer zone (metres)	
	Natural aquatic areas	Vegetation areas
Current framework	90	500
Proposed framework—on label (SDRAT)	65	210
SDMT Example 8–Higher release height (< 5 m), larger droplet size (extremely coarse)	64	126

Table 14. Summary of case study 2 buffer zones for vertical sprayer applications (section 8.2).

Scenario	Buffer zone (metres)	
	Natural aquatic areas	Pollinator areas
Current framework	60	Not assessed
Proposed framework—on label (SDRAT)		
- 2 metres tall and smaller	10	10
- Taller than 2 metres (not fully foliated)	40	30
- Taller than 2 metres (fully foliated)	30	20
SDMT Example 9–Taller than 2 metres (fully foliated), deeper water body (> 60cm)	14	20
SDMT Example 10–Taller than 2 metres (not fully foliated), lower application rate	30	22

In the following case studies, an extract showing label spray drift restraints and mandatory no-spray zones from the current framework (blue shaded area) are compared to the proposed framework given in this manual (green shaded area). The current framework examples use the APVMA Operating Principles in Relation to Spray Drift www.apvma.gov.au/node/27921 and spray drift labelling guidelines www.apvma.gov.au/node/958.

8.1 Case study 1. Herbicide applied by air and ground boom

Herbicide One contains an active constituent of 500 g/L active-one. It can be applied by either ground boom or aircraft. It can be applied to cereals with a maximum rate of 2.1 L/ha or pastures, right of way or fallow with a maximum rate of 4 L/ha as shown on the product label (figure 15).

Product Name: Herbicide One

Active constituent: 500 g/L active-one

Product Number: 1001

DIRECTIONS FOR USE

Situation and Crop	Weeds	Rate
Wheat Barley Oats	Wild radish (*Raphanus raphanistrum*) Fat hen (*Chenopodium album*) Turnip weed (*Rapistrum rugosum*)	0.7–2.1 L/ha
Pastures Rights of Way Fallow	Noogora burr (*Xanthium occidentale*) Variegated thistle (*Silybum marianum*)	0.7–4 L/ha

Figure 15. Extract from Herbicide One label

It is assumed that the RAL as established by the APVMA assessment areas for Herbicide One is given in Table 15 for each of the sensitive areas. RAL is also shown as a fraction of the maximum label active constituent rate (fraction of applied rate). Note that this information is typically not available to chemical users and may be confidential commercial information.

Table 15. Regulatory acceptable levels for Herbicide One

Sensitive area	Regulator Acceptable Level (RAL)	Fraction of applied rate[1]
Bystander	31 g/ha	0.01550
Aquatic	20 µg/L	0.01500
Pollinators	900 g/ha	0.45000
Vegetation	7.5 g/ha	0.00375
Livestock	500 mg/kg	0.75000

[1] Maximum label active constituent application rate is 2000 g ac/ha (= 4 L/ha * 500 g ac/L)

An extract from the label showing the spray drift restraints and mandatory buffer zone using the current spray drift framework is shown in Figure 16. An extract from the label using the proposed framework given in this manual is shown in figure 17.

Figure 16. Extract from product label with current framework (Part 1 of 2)

SPRAY DRIFT RESTRAINTS

DO NOT apply with spray droplets smaller than a **COARSE** spray droplet size category according to 'APVMA compliance instructions for mandatory COARSE or larger droplet size categories' located under this title in the GENERAL INSTRUCTIONS section of this label.

DO NOT apply when wind speed is less than 3 or more than 20 kilometres per hour, as measured at the application site.

DO NOT apply during surface temperature inversion conditions at the application site.

Users of this product MUST make an accurate written record of the details of each spray application within 24 hours following application, and must KEEP this record for at least 2 years. The spray application details that must be recorded are:

1 date with start and finish times of application 2 location address and paddock(s) sprayed 3 full name of this product 4 amount of product used per hectare and number of hectares applied to 5 crop or situation and weed or pest 6 wind speed and direction during application 7 air temperature and relative humidity during application 8 nozzle brand, type, spray angle, nozzle capacity and spray system pressure measured during application 9 name and address of person applying this product. (Additional record details may be required by the state or territory where this product is used.)

MANDATORY NO-SPRAY ZONES

DO NOT apply if there are aquatic and wetland areas including aquacultural ponds, surface streams and rivers downwind from the application area and within the mandatory no-spray zones shown in Table 1 below.

Table 1: No-spray zones for protection of the aquatic environment

For aerial application		
Wind speed range at time of application	Downwind mandatory no-spray zone	
	Fixed-wing	Helicopter
from 3 to 8 kilometres per hour	110 metres	80 metres
from 8 to 14 kilometres per hour	120 metres	90 metres
from 15 to 20 kilometres per hour	120 metres	90 metres
For ground application		
from 3 to 20 kilometres per hour	10 metres	

DO NOT apply if there are sensitive crops, gardens, landscaping vegetation, protected native vegetation or protected animal habitat downwind from the application area and within the mandatory no-spray zones shown in Table 2 below.

Table 2: No-spray zones for protection of the terrestrial environment

For aerial application		
Wind speed range at time of application	Downwind mandatory no-spray zone	
	Fixed-wing	Helicopter
from 3 to 8 kilometres per hour	450 metres	250 metres
from 8 to 14 kilometres per hour	650 metres	400 metres
from 15 to 20 kilometres per hour	750 metres	500 metres
For ground application		
from 3 to 20 kilometres per hour	40 metres	

GENERAL INSTRUCTIONS

APVMA compliance instructions for mandatory **COARSE** or larger droplet size categories

Important information

These instructions inform those using this chemical product how to lawfully comply with the requirement of a COARSE or larger spray droplet size category for spray application.

Spray droplet size categories are defined in the ASAE S572 Standard (newer name may also be shown as ASABE) or the BCPC guideline. Nozzle manufacturers may refer to one or both of these documents, to identify droplet size categories; however, for a nozzle to comply with this requirement, the manufacturer must refer to at least one.

Complying with the label requirement to use a specific droplet size category means using the correct nozzle that will deliver that droplet size category under the spray operation conditions being used. The APVMA has approved only the following specific methods for choosing the correct nozzle. Use one of the methods specified in these instructions to select a correct nozzle to deliver a COARSE or larger droplet size category.

Figure 16. Extract from product label with current framework (Part 2 of 2)

Instructions for ground application—for COARSE droplet size or larger categories Mandatory instructions for ground applications
USE ONLY nozzles that the nozzles' manufacturer has rated to deliver a COARSE, a VERY COARSE or an EXTREMELY COARSE droplet size category, as referenced in ASAE S572 or BCPC. Choose a nozzle that is specified to provide the droplet size category required in the label Spray Drift Restraints.
DO NOT use a higher spray system pressure than the maximum the manufacturer specifies for the selected nozzle to deliver the droplet size category required in the label Spray Drift Restraint.

Instructions for fixed-wing aerial application—for COARSE droplet size or larger categories
Instructions in this section apply to fixed-wing aerial application of products for which the label Spray Drift Restraint requires a COARSE or a VERY COARSE spray droplet category.
Nozzle choices must be made using Option 1, 2 or 3 below. Option 1 nozzles are limited to a maximum aircraft speed of 110 knots and are for COARSE droplets only. Option 2 nozzles are limited to a maximum aircraft speed o 120 knots and are also for COARSE droplets only. Option 3 nozzles have their use conditions (maximum airspeed, nozzle spray angle, product used, orifice size and spray system pressure) specified in the APVMA Approved Aerial Agricultural Association of Australia (AAAA) Nozzle Calculator (described in Option 3). Depending on those use conditions, the calculator can identify a correct nozzle for either a COARSE or a VERY COARSE spray droplet category. (To use Option 3, aerial applicators must contact the AAAA for access to their approved nozzle calculator.)
Mandatory instructions for fixed-wing aerial applications Option 1
For up to a maximum aircraft speed of 110 knots and a COARSE droplet size category, USE ONLY solid stream 0º nozzles with orifice diameter greater than or equal to 1.5 mm and oriented straight back to the flight direction. USE ONLY a spray system pressure greater than or equal to 3 bar.
Mandatory Instructions for fixed-wing aerial applications (continued) Option 2
For up to a maximum aircraft speed of 120 knots and a COARSE droplet size category, USE ONLY narrow angle flat fan nozzles with spray angle less than or equal to 40° and oriented straight back to the flight direction. USE ONLY a spray system pressure greater than or equal to 4 bar.
Mandatory instructions for fixed-wing aerial applications (continued) Option 3
USE ONLY nozzles rated by the APVMA Approved AAAA Nozzle Calculator as COARSE or VERY COARSE to comply with a product label's requirement for a COARSE or a VERY COARSE spray droplet size category. Use the AAAA Nozzle Calculator, and follow the additional instructions below in a), b) and c).
To identify a nozzle to comply with the required spray droplet category, aerial applicators must use only the droplet size category given in the nozzle calculator at the DV(0.1) position. The categories shown at the DV(0.5) and the DV(0.9) positions in the calculator must not be used for making a nozzle selection.
Aerial applicators must not apply the product at airspeeds greater than the speed used to select the nozzle. If an application airspeed that is slower than 100 knots (the minimum speed specified in the nozzle calculator) is planned, a nozzle identified as COARSE or VERY COARSE at 100 knots can also be used at these slower airspeeds, provided that the nozzle angle and system pressure are kept the same.
When a particular pesticide product is chosen within the nozzle calculator as one of the conditions set to select a nozzle, then aerial applicators must use that specific pesticide product with that nozzle. When a pesticide product is planned for use and is not available as a choice within the nozzle calculator, aerial applicators must use the category 'Other product' in the calculator to set the condition for selecting a nozzle.
Instructions for helicopter aerial application—for COARSE droplet size or larger categories
Instructions in this section apply to helicopter application of products where the label Spray Drift Restraint requires a COARSE, a VERY COARSE or an EXTREMELY COARSE spray droplet category.
Nozzle choices must be made using Option 1, 2 or 3 below.

Mandatory instructions for helicopter aerial application Option 1
For helicopter applications requiring a COARSE or a VERY COARSE spray droplet size category, USE ONLY nozzles selected with the methods previously specified for fixed-wing aircraft in Section 2.
Mandatory instructions for helicopter aerial application (continued) Option 2
When using Micronair controlled droplet applicators (Micron Sprayers Ltd), USE ONLY nozzles selected with the Micronair Droplet Size Prediction Models designed for Micronair products (and located on the company website) to choose a nozzle to satisfy the label requirement for a COARSE droplet size category. Important: to qualify for the COARSE category, the DV(0.1) value must be greater than 156 microns. Adjust parameters as necessary (eg lower the atomizer rotation rate) in order to achieve a DV(0.1) value greater than 156 microns.
Mandatory instructions for helicopter aerial application (continued) Option 3
When using Accu-Flo nozzles (Bishop Equipment Mfg Inc), USE ONLY nozzles rated according to the manufacturer's instructions to select the correct nozzle to apply a COARSE, a VERY COARSE or an EXTREMELY COARSE droplet size category to satisfy the label requirement for one of those specific droplet size categories.

Figure 17. Extract from product label with proposed framework

SPRAY DRIFT RESTRAINTS

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

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

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

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

DO NOT apply if there are surface temperature inversion conditions present at the application site during the time of application.

DO NOT apply by a boom sprayer unless the following requirements, OR the conditions provided in a relevant output of the Spray Drift Management Tool are met:

- spray droplets not smaller than a **COARSE** spray droplet size category
- for boom heights over 0.60 metres above the target, application must only occur when the conditions provided in a relevant output of the Spray Drift Management Tool are met
- for boom heights 0.60 metres and lower above the target, minimum distances between the application site and downwind sensitive areas (see 'Mandatory buffer zones' section of the following table titled 'Buffer zones for boom sprayers') are observed.

Buffer zones for boom sprayers

Application rate	Mandatory buffer zones			Advisory buffer zones	
	Bystander areas	Natural aquatic areas	Pollinator areas	Vegetation areas	Livestock areas
Up to maximum label rate	15 metres	25 metres	Not required	210 metres	Not required
2100 mL/ha or lower	Not required	Not required	Not required	90 metres	Not required

DO NOT apply by a vertical sprayer.

DO NOT apply by aircraft unless the following requirements, OR the conditions provided in a relevant output of the Spray Drift Management Tool are met:

- spray droplets not smaller than a **COARSE** spray droplet size category
- for release heights over 3 metres above the target, application must only occur when the conditions provided in a relevant output of the Spray Drift Management Tool are met
- for release heights 3 metres or lower above the target, minimum distances between the application site and downwind sensitive areas (see 'Mandatory buffer zones' section of the following table titled 'Buffer zones for aircraft') are observed.

Buffer zones for aircraft

Type of aircraft	Mandatory buffer zones			Advisory buffer zones	
	Bystander areas	Natural aquatic areas	Pollinator areas	Vegetation areas	Livestock areas
Fixed-wing	75 metres	85 metres	Not required	300 metres	Not required
Helicopter	55 metres	65 metres	5 metres	210 metres	Not required

8.1.1. SDMT Examples

In Stage 2, the Spray Drift Management Tool (SDMT) may allow chemical users to refine the realistic worst-case risk assessments that are used to produce the label. Users can select specific equipment, application rate, weather conditions, etc. relevant to their own circumstances and buffer zone distances are recalculated accordingly. Some examples of how this may be used are given below.

The SDMT give the spray drift restraints in the figure below for all scenarios. In the following example these common statements have not been included.

SPRAY DRIFT RESTRAINTS

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

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

DO NOT cause an unacceptable impact to native vegetation, agricultural crops, landscaped gardens and aquacultural production outside the application site from spray drift.

DO NOT cause contamination of plant or livestock commodities outside the application site from spray drift.

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

DO NOT apply with any type of application equipment if there are surface temperature inversion conditions present at the application site during the time of application.

Example 1, Boom sprayer, maximum rate, lower wind speed

Application will be made by boom sprayer to a fallow field at the maximum label rate (4 L/ha), however the maximum wind speed at the time of application will be limited to 10 km/hr. An extract from the SDMT Conditions for this scenario is shown below. Note that this has reduced the mandatory buffer zone for natural aquatic areas from 25 m to 20 m and the advisory vegetation buffer zones from 210 m to 152 m.

DO NOT apply by a boom sprayer unless the following conditions are observed:

- a minimum droplet size of COARSE
- the boom height is not greater than 0.6 metres above the ground
- the wind speed is not greater than 10 km/hr
- minimum distances between the application site and downwind sensitive areas that appear in the 'Mandatory buffer zones' section of the table below.

Buffer zones for boom sprayers					
Application rate	Mandatory buffer zones			Advisory buffer zones	
	Bystander areas	Natural aquatic areas	Pollinator areas	Vegetation areas	Livestock areas
Up to a maximum of 4000 mL/ha	10 metres	20 metres	Not required	152 metres	Not required

Example 2, Lower rate, coarser droplet

Application will be made by boom sprayer to wheat at the maximum label rate for cereals (2.1 L/ha). The sprayer is fitted with AIXR11002 nozzle and spray pressure is 2 bar. The TeeJet catalogue shows that these nozzles produce a very coarse spray. An extract from the SDMT Conditions for this scenario is shown below. Note that this has reduced the mandatory buffer zone for natural aquatic areas from 25 m to not required and the advisory vegetation buffer zones from 210 m to 30 m.

DO NOT apply by a boom sprayer unless the following conditions are observed:

- a minimum droplet size of VERY COARSE
- the boom height is not greater than 0.6 metres above the ground
- the wind speed is not greater than 20 km/hr
- minimum distances between the application site and downwind sensitive areas that appear in the 'Mandatory buffer zones' section of the table below.

Buffer zones for boom sprayers					
Application rate	Mandatory buffer zones			Advisory buffer zones	
	Bystander areas	Natural aquatic areas	Pollinator areas	Vegetation areas	Livestock areas
Up to a maximum of 2100 mL/ha	Not required	Not required	Not required	30 metres	Not required

Example 3, Right of way application

Application will be made by boom sprayer to right of way at the maximum label rate (4 L/ha). The application area is a narrow strip which is less than 20 m wide. The sprayer is fitted with TTI11003 nozzle and spray pressure is 3 bar. The TeeJet catalogue shows that these nozzles produce an ultra coarse spray. An extract from the SDMT Conditions for this scenario is shown below. Note that this has reduced the mandatory buffer zone for natural aquatic areas from 25 m to not required and the advisory vegetation buffer zones from 210 m to not required.

DO NOT apply by a boom sprayer unless the following conditions are observed:

- a minimum droplet size of ULTRA COARSE
- the boom height is not greater than 0.6 metres above the ground
- the wind speed is not greater than 10 km/hr
- the application site is not wider than 20 metres
- minimum distances between the application site and downwind sensitive areas that appear in the 'Mandatory buffer zones' section of the table below.

Buffer zones for boom sprayers					
Application rate	Mandatory buffer zones			Advisory buffer zones	
	Bystander areas	Natural aquatic areas	Pollinator areas	Vegetation areas	Livestock areas
Up to a maximum of 4000 mL/ha	Not required	Not required	Not required	Not required	Not required

Example 4, Optical spot spraying application

Application will be made by an optical spot sprayer to a fallow field at the maximum label rate (4 L/ha). Target coverage of the application site is less than 30%. The sprayer is fitted with AIXR11002 nozzle and spray pressure is 2 bar. The TeeJet catalogue shows that these nozzles produce a very coarse spray. An extract from the SDMT Conditions for this scenario is shown below. Note that this has reduced the mandatory buffer zone for natural aquatic areas from 25 m to not required and the advisory vegetation buffer zones from 210 m to 6 m.

DO NOT apply by a boom sprayer unless the following conditions are observed:

- a minimum droplet size of VERY COARSE
- the boom height is not greater than 0.6 metres above the ground
- the wind speed is not greater than 20 km/hr
- optical spot spraying must be activated and the target coverage of the application site must be no greater than 30%
- minimum distances between the application site and downwind sensitive areas that appear in the 'Mandatory buffer zones' section of the table below.

Buffer zones for boom sprayers					
Application rate	Mandatory buffer zones			Advisory buffer zones	
	Bystander areas	Natural aquatic areas	Pollinator areas	Vegetation areas	Livestock areas
Up to a maximum of 4000 mL/ha	Not required	Not required	Not required	6 metres	Not required

Example 5, Lowest rate with finer droplet size and higher boom

Application will be made by boom sprayer to wheat at the maximum label rate for cereals (2.1 L/ha). The crop consultant is requesting that the application be made using a medium spray to increase the potential number of droplets available for coverage of the target area. The sprayer also has a higher boom height of 1 metre. An extract from the SDMT Conditions for this scenario is shown below. Note that this has increased the mandatory buffer zone for natural aquatic areas from 25 m to 42 m and the advisory vegetation buffer zones from 210 m to over 300 m.

DO NOT apply by a boom sprayer unless the following conditions are observed:

- a minimum droplet size of MEDIUM
- the boom height is not greater than 1 metres above the ground
- minimum distances between the application site and downwind sensitive areas that appear in the 'Mandatory buffer zones' section of the table below.

Buffer zones for boom sprayers					
Application rate	Mandatory buffer zones			Advisory buffer zones	
	Bystander areas	Natural aquatic areas	Pollinator areas	Vegetation areas	Livestock areas
Up to a maximum of 4000 mL/ha	32 metres	42 metres	Not required	Over 300 metres	Not required

Example 6, Highest rate with an ULTRA COARSE droplet

Application will be made by boom sprayer to a fallow field at the maximum label rate (4 L/ha). The sprayer is fitted with TTI11002 nozzle and spray pressure is 3 bar. The TeeJet catalogue shows that these nozzles produce an ultra coarse spray. Boom height will be greater than 0.6 metres above the ground but not more than 1 metre. An extract from the SDMT Conditions for this scenario is shown below. Note that this has reduced the mandatory buffer zone for natural aquatic areas from 25 m to not required and the advisory vegetation buffer zones from 210 m to 36 m.

DO NOT apply by a boom sprayer unless the following conditions are observed:

- a minimum droplet size of ULTRA COARSE
- the boom height is not greater than 0.6 metres above the ground
- the wind speed is not greater than 20 km/hr
- minimum distances between the application site and downwind sensitive areas that appear in the 'Mandatory buffer zones' section of the table below.

Buffer zones for boom sprayers					
Application rate	Mandatory buffer zones			Advisory buffer zones	
	Bystander areas	Natural aquatic areas	Pollinator areas	Vegetation areas	Livestock areas
Up to a maximum of 4000 mL/ha	Not required	Not required	Not required	22 metres	Not required

Example 7, Fixed wing aircraft, lower rate, lower wind speed

Application will be made by fixed wing aircraft to oats at the maximum label rate for cereals (2.1 L/ha). Wind speed at the time of application is between 3 and 7 km/hr. An extract from the SDMT Conditions for this scenario is shown below. Note that this has reduced the mandatory buffer zone for natural aquatic areas from 85 m to 26 m and the advisory vegetation buffer zones from 300 m to 136 m.

DO NOT apply by fixed wing aircraft unless the following conditions are observed:

- a minimum droplet size of COARSE
- the release height is not greater than 3 metres above the ground
- the wind speed is not greater than 7 km/hr
- minimum distances between the application site and downwind sensitive areas that appear in the 'Mandatory buffer zones' section of the table below.

Buffer zones for fixed wing aircraft					
Application rate	Mandatory buffer zones			Advisory buffer zones	
	Bystander areas	Natural aquatic areas	Pollinator areas	Vegetation areas	Livestock areas
Up to a maximum of 2100 mL/ha	18 metres	26 metres	Not required	136 metres	Not required

Example 8, Helicopter, highest rate, higher release height, larger droplet size

Application will be made by helicopter to a pasture at the maximum label rate (4 L/ha). Due to the undulating nature of the field and obstacles, release height has to increase to 5 m. The helicopter is fitted with Accu-Flo nozzles that produce an extremely coarse spray. An extract from the SDMT Conditions for this scenario is shown below. Note that this has reduced the mandatory buffer zone for natural aquatic areas from 65 m to 64 m and the advisory vegetation buffer zones from 210 m to 126 m.

DO NOT apply by helicopter unless the following conditions are observed:

- a minimum droplet size of EXTREMELY COARSE
- the release height is not greater than 5 metres above the ground
- the wind speed is not greater than 20 km/hr
- minimum distances between the application site and downwind sensitive areas that appear in the 'Mandatory buffer zones' section of the table below.

Buffer zones for helicopters					
Application rate	Mandatory buffer zones			Advisory buffer zones	
	Bystander areas	Natural aquatic areas	Pollinator areas	Vegetation areas	Livestock areas
Up to a maximum of 4000 mL/ha	54 metres	64 metres	8 metres	126 metres	Not required

8.2 Case study 2. Insecticide applied by vertical sprayer and ground boom

Insecticide One contains an active constituent of 500 g/L active-two. It can be applied by either ground boom or vertical sprayers. It can be applied to orchards with a maximum rate of 200 mL/100L or potatoes with a maximum rate of 2.2 L/ha as shown on the product label (Figure 18).

Product Name: Insecticide One

Active constituent: 500 g/L active-two

Product Number: **1002**

DIRECTIONS FOR USE

Situation and Crop	**Pest**	**Rate**
Pecans Macadamias	Yellow peach moth	200 mL/100L
Apples Pears	Lightbrown apple moth Codling moth	100 to 200 mL/100L
Potatoes	Potato moth Heliothis (budworms)	2.2 L/ha

Figure 18. Extract from Insecticide One label

It is assumed that the RAL as established by the APVMA assessment areas for Insecticide One is given in table 16 for each of the sensitive areas. RAL is also shown as a fraction of the maximum label active constituent rate (fraction of applied rate). Note that this information is typically not available to chemical users and may be confidential commercial information.

Table 16. Regulatory acceptable levels for insecticide one

Sensitive area	Regulator Acceptable Level (RAL)	Fraction of applied rate[1]
Bystander	450 g/ha	0.4090
Aquatic	6.6 µg/L	0.0090
Pollinators	22 g/ha	0.0200
Vegetation	2000 g/ha	1.8200
Livestock	400 mg/kg	1.0900

[1] Maximum label active constituent application rate is 1100 g ac/ha

An extract from the label showing the spray drift restraints and mandatory buffer zone using the current spray drift framework is shown in figure 19. An extract from the label using the proposed framework given in this manual is shown in figure 20.

SPRAY DRIFT RESTRAINTS

Except when applying with orchard/vineyard airblast equipment DO NOT apply with spray droplets smaller than a MEDIUM spray droplet size category according to nozzle manufacturer specifications that refer to the ASAE S572 Standard or the British Crop Production Council guideline.

DO NOT apply when wind speed is less than 3 or more than 20 kilometres per hour, as measured at the application site.

DO NOT apply during surface temperature inversion conditions at the application site.

MANDATORY NO-SPRAY ZONES

DO NOT apply if there are aquatic and wetland areas including aquacultural ponds, surface streams and rivers downwind from the application area and within the **mandatory no-spray zones** shown below.

For ground application	Downwind No-Spray Zone—25 m
For orchard application	Downwind No-Spray Zone—60 m

Figure 19. Extract from product label with current framework

SPRAY DRIFT RESTRAINTS

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

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

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

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

DO NOT apply if there are surface temperature inversion conditions present at the application site during the time of application.

DO NOT apply by a boom sprayer unless the following requirements, OR the conditions provided in a relevant output of the Spray Drift Management Tool are met:

- spray droplets not smaller than a MEDIUM spray droplet size category
- for boom heights over 0.60 metres above the target, application must only occur when the conditions provided in a relevant output of the Spray Drift Management Tool are met
- for boom heights 0.60 metres and lower above the target, minimum distances between the application site and downwind sensitive areas (see 'Mandatory buffer zones' section of the following table titled 'Buffer zones for boom sprayers') are observed.

Buffer zones for boom sprayers

Application rate	Mandatory buffer zones			Advisory buffer zones	
	Bystander areas	Natural aquatic areas	Pollinator areas	Vegetation areas	Livestock areas
Up to maximum label rate	Not required	170 metres	50 metres	Not required	Not required

DO NOT apply by a vertical sprayer unless the following requirements, OR the conditions provided in a relevant output of the Spray Drift Management Tool are met:

- spray is not directed above the target canopy
- the outside of the sprayer is turned off when turning at the end of rows and when spraying the outer row on each side of the application site
- for dilute water rates above the maximum listed for each type of canopy specified in table below titled 'Buffer zones for vertical sprayers', application must only occur when the conditions provided in a relevant output of the Spray Drift Management Tool are met.
- for dilute water rates up to the maximum listed for each type of canopy specified, minimum distances between the application site and downwind sensitive areas (see 'Mandatory buffer zones' section of the following table titled 'Buffer zones for vertical sprayers') are observed

Buffer zones for vertical sprayers

Type of target canopy	Mandatory buffer zones			Advisory buffer zones	
	Bystander areas	Natural aquatic areas	Pollinator areas	Vegetation areas	Livestock areas
2 metres tall and smaller, maximum dilute water rate of 1000 L/ha	Not required	10 metres	10 metres	Not required	Not required
Taller than 2 metres (not fully foliated) , maximum dilute water rate of 2000 L/ha	Not required	40 metres	30 metres	Not required	Not required
Taller than 2 metres (fully foliated) , maximum dilute water rate of 2000 L/ha	Not required	30 metres	20 metres	Not required	Not required

DO NOT apply by aircraft.

Figure 20. Extract from product label with proposed framework

8.2.1. SDMT Examples

Example 9, Orchard sprayer, canopies taller than 2m (fully foliated), minimum depth of nearest downwind water body greater than 60 cm

Application will be made by vertical sprayer to fully foliated macadamias at the maximum label rate (200 mL/100 L). Downwind water bodies are all greater than 60 cm deep. An extract from the SDMT Conditions for this scenario is shown below. Note that this has reduced the mandatory buffer zone for natural aquatic areas from 30 m to 14 m and the pollinator buffer zones stays the same at 20 m.

DO NOT apply by vertical sprayer unless the following conditions are observed:

- application can only be made to canopies taller than 2 metres (fully foliated)
- A maximum water rate of 2000 L/ha
- The nearest downwind water body must be at least 60 cm deep
- minimum distances between the application site and downwind sensitive areas that appear in the 'Mandatory buffer zones' section of the table below.

Buffer zones for vertical sprayers					
Application rate	Mandatory buffer zones			Advisory buffer zones	
	Bystander areas	Natural aquatic areas	Pollinator areas	Vegetation areas	Livestock areas
Up to a maximum of 200 mL/100L	Not required	14 metres	20 metres	Not required	Not required

Example 10, Orchard sprayer, canopies taller than 2m (non-foliated), lower application rate,

Application will be made by vertical sprayer to non-foliated apple trees at the lowest label rate (100 mL/100 L). An extract from the SDMT Conditions for this scenario is shown below. Note that this has reduced the mandatory buffer zone for natural aquatic areas from 40 m to 30 m and the pollinator buffer zones from 30 m to 22 m.

DO NOT apply by vertical sprayer unless the following conditions are observed:

- application can only be made to canopies taller than 2 metres (fully foliated)
- A maximum water rate of 2000 L/ha
- minimum distances between the application site and downwind sensitive areas that appear in the 'Mandatory buffer zones' section of the table below.

Buffer zones for vertical sprayers					
Application rate	Mandatory buffer zones			Advisory buffer zones	
	Bystander areas	Natural aquatic areas	Pollinator areas	Vegetation areas	Livestock areas
Up to a maximum of 100 mL/100L	Not required	30 metres	22 metres	Not required	Not required

APPENDIXES

APPENDIX A—DROPLET SIZE DISTRIBUTIONS (DSDS)

The cumulative volume distributions for the ASAE/ANSI S572 reference nozzles used to establish standard deposition curves are shown in figure 21 and in the files below which can be imported directly into AGDISP™.

APVMA VF-F DSD.txt

APVMA F-M DSD.txt

APVMA M-C DSD.txt

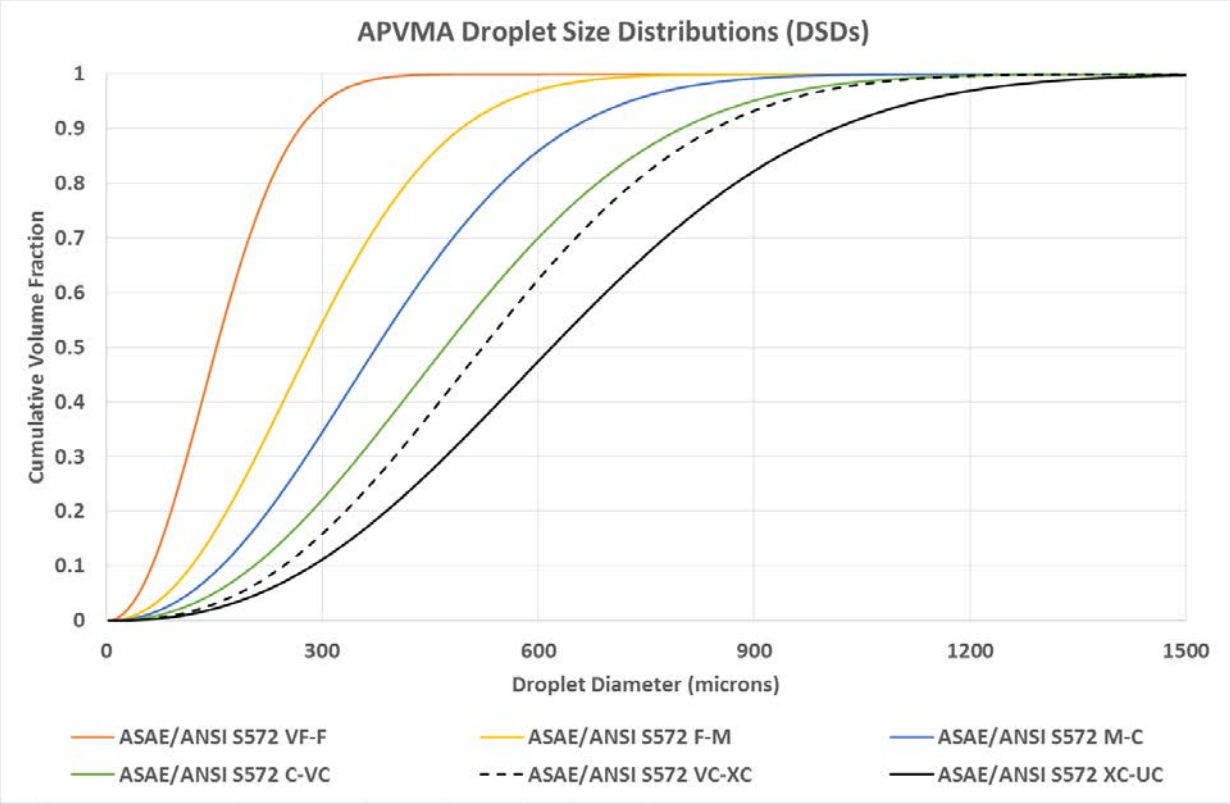
APVMA C-VC DSD.txt

APVMA VC-XC DSD.txt

APVMA XC-UC DSD.txt

These DSDs represent the boundary of each droplet size classification. For example, a DSD finer than VF-F would be VERY FINE and a DSD coarser would be FINE, so VF-F is used for risk assessments for a FINE droplet size.

Figure 21: Chart of cumulative volume distributions for the reference nozzles used to establish standard deposition curves



NOTE: These DSDs are used for both boom sprayers and aircraft. The APVMA are currently participating in a working group to establish an ASABE standard for the classification nozzles used on an 'aircraft' (designated ASABE X641). When this standard is accepted and published, the need to use aircraft specific DSDs will be reviewed.

ABBREVIATIONS

DSD	Droplet size distribution
RAL	Regulatory acceptable level
SDMT	Spray drift management tool
SDRAM	Spray drift risk assessment manual
SDRAT	Spray drift risk assessment tool

GLOSSARY

Advisory buffer zones	'Advisory buffer zones' are those that are established to be protective of 'native vegetation' or 'livestock area' and may be reduced at the discretion of experienced chemical users based on their ability to implement risk management strategies which are based on extensive prior knowledge and experience.
Agricultural crops	'Agricultural crops' means any terrestrial plant species grown commercially for food or fibre production, with the following exception: • Plants which are not part of a crop under management at the time of pesticide application (eg blackberries or volunteer grain plants which have escaped from a cropped area and become weeds in another area)
Aircraft	An 'aircraft' is a fixed-wing or rotary aircraft that applies spray in-flight. This includes unmanned aerial vehicles (UAVs). This excludes application equipment defined as a 'boom sprayer' or 'vertical sprayer' or when the product is used for any use pattern not requiring a spray drift risk assessment (see Section 2.2).
Aquacultural production	'Aquacultural production' means commercial production of any aquatic plant or aquatic animal species for food or ornamental purposes. This does not include those which are not part of an area of aquacultural production under management at the time of pesticide application (eg fish which have escaped into natural watercourses).
Boom sprayer	A 'boom sprayer' is one that applies spray directly downward from a ground-based horizontal boom. This excludes application equipment defined as a 'vertical sprayer' or 'aircraft' or when the product is used for any use pattern not requiring a spray drift risk assessment (see Section 2.2). This includes nozzles known as boomless jets which are mounted to a vehicle and used to produce a swath significantly wider than the vehicle itself.
Buffer zone	A 'buffer zone' is an area where pesticide application does not occur between the application site and an identified sensitive area which is downwind from the application site. For boom and aerial spraying, a buffer zone is measured from the edge of the sprayer swath closest to the downwind sensitive area; for vertical spraying, a buffer zone is measured from half a row width (ie trees, vines, other plants) outside the application site closest to the downwind sensitive area.
Bystander areas	'Bystander areas' are locations where it is reasonably likely that 'bystanders' will be exposed to residues deposited on the ground from spray drift on a regular basis and for an extended period of time (ie several hours per day over a period of a month). Examples of these areas include: residential properties, schools, kindergartens, day care facilities, hospitals, aged care facilities, public or private parks or recreational areas, areas where manual handling of soil or plants is required, etc.
Bystanders	'Bystanders' means people not involved in mixing, loading or applying the pesticide and are without the personal protective equipment (PPE) required by the product label.
Contamination	'Contamination' means a failure of plant or livestock commodities to comply with the APVMA Maximum Residue Limit Standard.
Droplet size distribution (DSD)	As defined by ASTM E2798, Standard Test Method for Characterization of Performance of Pesticide Spray Drift Reduction Adjuvants for Ground Application: 'mathematical or graphical representation of droplet sizes of a given spray frequently shown as a volume fraction, number fraction, or cumulative fraction distributions.' Note that only the volume fraction (or cumulative volume fraction) is relevant for this manual.

Dilute water rate	For 'vertical sprayers', 'dilute water rate' means the amount of water applied per hectare to reach the point of run-off (ie where the target plant is thoroughly wet).
Landscaped gardens	'Landscaped gardens' means any terrestrial plant species grown for ornamental purposes on private or public land, or for domestic food production on private land, with the following exceptions: • species that are declared noxious or invasive to the area of application by local, state or commonwealth legislation • plants which are not part of a garden under management at the time of pesticide application (eg flowering plants which have escaped from a home garden and have become weeds in another area)
Livestock areas	'Livestock areas' are those where livestock are grazing. 'Advisory buffer zones' for 'livestock areas' have been established to protect international trade. These 'advisory buffer zones' are based on the Maximum Residue Limit (MRL) Standards of significant export markets for livestock commodities.
Mandatory buffer zones	'Mandatory buffer zones' are those that are established to be protective of 'bystander areas', 'natural aquatic areas' or 'pollinator areas' which must be observed as it is not reasonable to expect that a chemical user could implement risk management strategies based on prior experience and knowledge alone.
Native vegetation	'Native vegetation' means any terrestrial plant species native to Australia as defined under local, state or commonwealth legislation with the following exceptions: • species that are declared noxious or invasive to the area of application by local, state or commonwealth legislation • plants that the chemical user, or the person the chemical user is applying agricultural chemical product/s on behalf of, is legally allowed to remove under local, state or commonwealth legislation 'Advisory buffer zones' for the purpose of 'native vegetation' may also be used as the basis for the protection of 'agricultural crops' and 'landscaped gardens'. However, 'buffer zones' for 'native vegetation' are based on survival at a population or ecosystem level and they may not be sufficient if yield loss or replacement cost is the issue.
Natural aquatic areas	'Natural aquatic areas' are where a 'watercourse' (as defined by the Commonwealth Water Act 2007) is present, with the following exceptions: • artificial 'watercourses' used exclusively for agricultural or ornamental purposes, such as irrigation channels, flood irrigation areas, farm dams, ornamental ponds, golf course dams, those used for aquacultural production, etc. • 'watercourses' that are dry at the time of pesticide application • 'watercourses' that are commonly identified as 'puddles' 'Mandatory buffer zones' established for the purpose of the 'natural aquatic area' may also be used as the basis for the protection of 'aquacultural production' but as the buffer zones for 'natural aquatic areas' are based on survival at a population or ecosystem level, they may not be sufficient if yield loss or replacement cost within an aquaculture operation is the issue.
Pollinator areas	'Pollinator areas' means managed bee hives. This only applies when the manager of those bee hives has provided notification regarding their location to the chemical user, or the person the chemical user is applying agricultural chemical product/s on behalf of, at least 48 hours prior to application of the agricultural chemical product/s. Whilst notification can be made directly (in writing or verbally), the use of the BeeConnected website or smartphone app is acceptable and recommended.

Release height	For the purposes of aircraft, 'release height' is the distance between the ground and the boom of the aircraft. Pilot safety is paramount, so the release height is only considered as being typical across the application site, not a maximum flying height. Increases in release height for short periods during application to avoid obstacles, or turn at the end of runs, are not considered as being non-compliant with the release height in a use instruction. These increases are expected and are adequately managed through principles of good agricultural practice by the aerial agricultural industry.
Relevant output of the Spray Drift Management Tool	For the purposes of use instructions (see section 5), a 'relevant output of the Spray Drift Management Tool' refers to the output from the Spray Drift Management Tool following the input of information relevant to the proposed application of a specific product (or products). The specific product may be identified by the APVMA approval number printed on the product label or the product name recorded on the APVMA register.
Spray cloud	'Spray cloud' means the volume of air that is directly adjacent to operating application equipment which contains large numbers of spray droplets in close proximity to each other. The area which the spray cloud covers will vary between types of application equipment and use practices, but is generally defined as the cloud of droplets which is visible by the naked eye shortly after being released into the atmosphere and excludes isolated droplets that are carried downwind from the application area by the wind.
Spray droplet size category	The characteristics of spray droplets produced by a certain nozzle operating at a certain pressure are described in several standards. Specifically, these standards are used by the APVMA for application by 'boom sprayer' or 'aircraft' only (ie they are not currently relevant for a 'vertical sprayer') and describe the following droplet size categories: • FINE (F) • MEDIUM (M) • COARSE (C) • VERY COARSE (VC) • EXTREMELY COARSE (XC) • ULTRA COARSE (UC) Standards also may refer to VERY FINE (VF) or smaller spray droplet sizes but because they pose significant spray drift risk potential, these categories will only be assessed in rare circumstances, based on the submission of spray drift data rather than standard assumptions. Different nozzle standards are used because no undisputed international standard currently exists. Nozzle manufacturers commonly rely on the standard which is used in the jurisdiction in which they are based. The APVMA currently recognises the following standards for the classification of nozzles used on a 'boom sprayer': • American Society of Agricultural and Biological Engineers (ASABE) – ANSI/ASAE S572: Spray Nozzle Classification by Droplet Spectra • British Crop Production Council (BCPC) – Southcombe, E.S.E. et al. (1997). The APVMA is currently participating in a working group to establish an ASABE standard for the classification of nozzles used on an 'aircraft' (currently designated ASABE X641). This definition will be updated as soon as the new standard is accepted and published and will immediately apply to a product label that contains the instructions that are described above (ie labels will not require updating since they already refer to this definition). In the interim, the general principles of the modified ANSI/ASAE S572 classification system described in the following research will apply to the classification of nozzles used on an 'aircraft' (noting that this will no longer be included in this definition once the ASABE standard is recognised): Hewitt, A.J. (2008).

Unacceptable impact	For the purposes of native vegetation, 'unacceptable impact' means a loss of native vegetation that has an impact at a population or ecosystem level. For example, damage to leaves on a small percentage of plants in an area that does not cause a change in the diversity of plants in that area is not an 'unacceptable impact' but damage that causes a species of plant in an area to be replaced by another species is an 'unacceptable impact'. However, it is important to note that this ultimately depends on relevant local, state or commonwealth legislation, which varies between jurisdictions. For the purposes of 'agricultural crops', 'landscaped gardens' or 'aquacultural production', unacceptable impact will be determined by the policies of the relevant Control-of-Use jurisdiction.
Vegetation areas	'Vegetation areas' are where 'native vegetation', 'agricultural crops' or 'landscaped gardens' are present.
Vertical sprayer	A 'vertical sprayer' is one that applies spray in a direction other than directly towards the ground. This excludes application equipment defined as a 'boom sprayer' or 'aircraft' or when the product is used for any use pattern not requiring a spray drift risk assessment (section 2.2).
Watercourse	For the purpose of 'natural aquatic areas', the current definition of 'watercourse' under the Commonwealth Water Act 2007 is a river, creek or other natural watercourse (whether modified or not) in which water is contained or flows (whether permanently or from time to time); and includes: • a dam or reservoir that collects water flowing in a watercourse • a lake or 'wetland' through which water flows • a channel into which the water of a watercourse has been diverted • part of a watercourse • an estuary through which water flows A 'wetland' is an area of land where water covers the soil – all year or just at certain times of the year. They include: • swamps, marshes • billabongs, lakes, lagoons • saltmarshes, mudflats • mangroves, coral reefs • bogs, fens, and peatlands. A 'wetland' may be natural or artificial and its water may be static or flowing, fresh, brackish or saline.

REFERENCES

Altenburger, R. A., Arrhenius, Å. A., Backhaus, T. A., Coors, A. A., Faust, M. A. and Zitzkat, D. A. 2014, 'Ecotoxicological combined effects from chemical mixtures Part 1: Relevance and adequate consideration in environmental risk assessment of plant protection products and biocides.', *Umweltbundesamt*, http://www.umweltbundesamt.de/publikationen/ecotoxicological-combined-effects-from-chemical

American Society of Agricultural and Biological Engineers (ASABE) – ANSI/ASAE S572: Spray Nozzle Classification by Droplet Spectra http://elibrary.asabe.org/abstract.asp?search=1&JID=2&AID=44208&Abstract=S572.1_R2013.htm

ASTM E2798, Standard Test Method for Characterization of Performance of Pesticide Spray Drift Reduction Adjuvants for Ground Application: http://www.astm.org/Standards/E2798.htm

EnHealth 2012, *Australian Exposure Factor Guide (2012)*, Environmental Health Standing Committee (enHealth) of the Department of Health, Canberra, http://www.health.gov.au/internet/main/publishing.nsf/Content/health-pubhlth-publicat-environ.htm

Hewitt, A.J. (2008). Droplet size spectra classification categories in aerial application scenarios, Crop Protection, 27, pp. 1284-1288 http://espace.library.uq.edu.au/view/UQ:182689

National Working Party on Pesticide Applications (NWPPA) 2015, *An Assessment of AGDISP™ Ground for Determining the Downwind Spray Deposition from Boom Sprayers*, Canberra, http://nwppa.net.au/nwppa-reports/

OECD 2003, *Descriptions of selected key generic terms used in a chemical hazard/risk assessment*, Series on Testing and Assessment, No. 44, Organisation for Economic Co-operation and Development, Paris, France, http://www.oecd.org/chemicalsafety/testing/seriesontestingandassessmentpublicationsbynumber.htm

OECD 2011, *Guidance notes on dermal absorption*, Series on Testing and Assessment, No. 156, Organisation for Economic Co-operation and Development, Paris, France, http://www.oecd.org/chemicalsafety/testing/seriesontestingandassessmentpublicationsbynumber.htm

Rosin, P. and Rammler, E. 1933, 'The laws governing the fineness of powdered coal', *Journal of the Institute of Fuel*, vol. 7, pp. 29-36.

Southcombe, E.S.E. et al. (1997). The International (BCPC) Spray Classification System Including a Drift Potential Factor. Proc. BCPC Conf. – Weeds, pp. 371-380 http://dropdata.net/bcpc_ewg/ESES_noz.pdf

Teske, M.E., Miller, P.C.H., Thistle, H.W. and Birchfield, N.B. 2009, 'Initial development and validation of a mechanistic spray drift model for ground boom sprayers', *Transactions of the ASABE*, vol. 52, pp. 1089-1097.

Teske, M.E. and Thistle, H.W. 2000, 'Droplet size scaling of agricultural spray material by dimensional analysis', *Atomisation and Sprays*, vol. 10, pp. 147-158.

US EPA 1997, *Standard Operating Procedure (SOPs) for Residential Exposure Assessments*, United States Environmental Protection Agency, Washington D.C., United States, http://www.epa.gov/pesticides/trac/science/index.htm

US EPA 2014, *Residential Exposure Assessment Standard Operating Procedures Addenda 1: Consideration of Spray Drift*, United States Environmental Protection Agency, Washington D.C., United States, http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPP-2013-0676-0003

US EPA, Health Canada PMRA and California Department of Pesticide Regulation 2014, *Guidance for Assessing Pesticide Risks to Bees*, United States Environmental Protection Agency, Washington D.C., United States, http://www.epa.gov/pollinator-protection/pollinator-risk-assessment-guidance

Victorian Government 2012, *Water rates used in horticulture*, Prepared by Alex Perera, former Department of Primary Industries, Melbourne, http://agriculture.vic.gov.au/agriculture/farm-management/chemical-use/publications/water-rates-used-in-horticulture

WHO Environmental Health Criteria, No. 240 (2009) Principles and Methods for the Risk Assessment of Chemicals in Food.