HERBICIDE SPRAY DRIFT INJURY TO VINEYARDS

BEST PRACTICE FOR SPRAY DRIFT MINIMISATION AND ACTIONS FOR AFFECTED PARTIES

NEW ZEALAND WINE
PURE DISCOVERY

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Herbicide Spray Drift Injury to Vineyards

Best Practice for Spray Drift Minimisation And Actions for Affected Parties

Purpose

This document has been prepared to serve two purposes:

- As a best practice guide to avoid spray drift injury to sensitive crops such as grape vines in vineyards.
- It provides a guide to rules that councils can adopt in their district plans.
- As a resource for grape growers and wineries who suspect they have suffered herbicide injury.

It includes specific instructions to guide affected parties through the process of seeking recompense for injury, as the process, particularly the burden of proof, is onerous.

Introduction

Agrichemical spray application is a fact of life in New Zealand, and off-target drift from some types of herbicide has the potential to inflict significant damage in vineyards. This document covers the following aspects of this issue:

1. Spray Drift Defined
2. Examples of Spray Drift Injury
3. Costs of Spray Drift Injury
4. The Legal Perspective
5. Major Types of Herbicide Associated with Grape Vine Injury
6. Factors Affecting Spray Drift and Best Practice Spray Application
7. Grape Vine Sensitivity
8. Actions for Parties Affected by Spray Injury

1. Spray Drift Defined

Spray drift is the uncontrolled airborne movement of droplets, aerosol particles or vapours away from the spray target.

Drift can cause many problems including damage to off-target crops, elevated soil residues, environmental contamination of waterways and reduced effectiveness on the target.

Spray drift injury can cause devastating financial losses to parties who are affected.

2. Examples of Spray Drift Injury

There are numerous examples of spray drift injury in the New Zealand wine industry; in different grape-growing regions, involving varying products and resulting in a range of outcomes in terms of injury and remedy.

Plate 1 Aerial view of New Zealand vineyard with suspected sulfonylurea damage.

The extent of the problem in terms of product, injury type and region affected is evident in the recent cases summarised below in Table 1.

Table 1
Examples of Spray Drift Injury

Product	Contamination via	Spray Method	Injury	Region
Sulfonylurea	Direct wind drift and irrigation water contamination	Hand gun	Crop loss. Vines recovered	Hawkes Bay
Growth regulator	Drift on katabatic winds	Aerial	Crop loss. Vines recovered	Auckland
Sulfonylurea	Application over a waterway	Aerial	Vine loss*	Central Otago
Growth regulator	Direct wind drift	Aerial	Crop loss. Vines recovered	Central Otago
Sulfonylurea	Suspected container dump	Aerial	Vine loss	Marlborough

Glyphosate	Direct wind drift	Boom	Severe crop loss. Vines recovered	Gisborne

*Vines are rarely killed outright by herbicide drift but they can be affected so greatly that the viticulturist deems them uneconomic to keep in production. In this document this is called vine loss.

3. Costs of Spray Drift Injury

The cost of crop and vine loss in a vineyard can be substantial. Below are some examples of loss calculations. They demonstrate a method that can be applied to actual cases.

The cost of crop loss may be limited to the gross margin on the fruit in a vineyard operation that grows and sells fruit, or extend to the gross margin on the wine production in a vineyard operation that includes winemaking.

If vines are lost and replaced, then the cost extends firstly to the loss of crops for each season until replacement vines produce the same quantity of crop; and secondly to the removal of dead vines, replacing and replanting new vines, and bringing them into production.

- The costs used below are indications only. Each actual case is unique so actual losses will vary. The crop yield and fruit value used are conservative. They are the average yield and average grape price as published in the NZ Winegrowers Annual Report 2010. Vineyard maintenance cost is the average vineyard working expenses as published in MAF 2009 Horticulture and Arable Monitoring Report – Viticulture. Other costs come from contract processor quotations from vintage 2010.

They exclude the consideration of goodwill, which is much harder to quantify objectively, but equally worthy of attention. Goodwill may include the costs of losses arising out of inability to meet a supply contract, loss of customers or other business losses.

They also exclude considerations of other costs such as canopy and crop management as these are difficult to generalise.

Scenario 1: Crop loss to a contract grower.

- Total crop loss in affected area.
- Vines recover fully.
- Claimant calculates cost of fruit not available for sale, less cost of vineyard management not incurred (assumed 25% of normal vineyard management costs).

Parameters	
Fruit Value	$1,300 per tonne
Crop Yield	8 tonnes per ha
Vineyard Maintenance Costs	$9,300 per ha
% of Vineyard Costs not Incurred	25%

Cost of Crop Loss	
Fruit Value	less Vineyard Costs Saved
$1,300 x 8	- $9,300 x 25%
$10,400	- $2,325
= $8,075/ha	

Scenario 2: Crop loss to a winery growing its own grapes with reduced wine production.

- Total crop loss in affected area.
- Vines recover fully.
- Claimant calculates cost of wine not available for sale, less cost of production of fruit and wine not incurred.

Parameters	
Wine Value (export)	$8 per bottle
Crop Yield	8 tonnes per ha
Wine Yield	1,000 bottles per tonne
Vineyard Maintenance Cost	$9,300 per ha
% of Vineyard Costs not Incurred	25%
Wine Making Cost	$2 per litre
Wine Bottling Cost	$1.50 per bottle

Wine Value	less Vineyard Costs Saved	less Winemaking Cost	less Bottling Cost
$8 x 1,000 x 8	- $9,300 x 25%	- $2 x 0.75 x 1,000 x 8	- $1.5 x 1,000 x 8
= $64,000	- $2,325	– $12,000	– $12,000
= $37,675/ha			

Scenario 3: Vine loss to a contract grower.

- Total crop loss in affected area.
- Total vine loss in affected area. Vines are mature.
- Claimant calculates cost of fruit not available for sale for four years (replanting must wait for the following winter) less cost of harvesting not incurred for four years (assume net $8,075 per hectare as calculated above), plus cost of buying and planting replacement vines.

Parameters	
Crop Value	$8,075 per ha
Years of Crop Loss	4
Replacement Vine Cost	$4.50 per vine
Vine Density	2667 per ha
Vine Removal Cost	$5000 per ha
Vine Replanting Cost	$9150 per ha
Vine Training Cost	$2500 per ha

Cost of Crop Loss and Vine Replacement				
Crop Value	plus Removal Cost	plus Vine Purchase Cost	plus Replanting Cost	plus Training Cost
$8,075 x 4	+ 5,000	+ $4.50 x 2,667	+ $9,150	+ $2,500
= $32,300	+ $5,000	+$12,000	+ $9,150	+ $2,500
= $60,950/ha over 4 years				

4. The Legal Perspective

4.1 Acts of Parliament

There is a range of enacted laws relevant to herbicide spray and minimisation of spray drift. It includes:

- **The Hazardous Substances and New Organisms Act 1996 (HSNO)** - was enacted to replace several older pieces of legislation and controls all hazardous substances and new organisms in one Act. It is administered by the Environmental Risk Management Authority (ERMA). It covers registration and control of hazardous substances, enables the creation of a New Zealand Standard and requires Approved Handler training for handlers of specified hazardous substances.

  The Act allows Tolerable Exposure Limits (TELs) and Environmental Exposure Limits (EELs) to be set for different chemicals. Where limits are set, applicators have a legal responsibility not to exceed them outside the spray area. Current EELs can be found at: http://www.ermanz.govt.nz/hs/compliance/eels.html.

- **Resource Management Act 1991 (RMA)** – promotes the sustainable management of natural and physical resources. Under the Act, city, regional and district councils can generate rules appropriate to their area in regional and district plans for the safe application of agrichemicals. They can issue abatement notices and impose instant fines for contravention of the rules. Because these rules are made specific to each city, region or district they can and do vary around the country. Applicators need to be fully aware of the rules that apply in their region. Check your local council website.

- **Agricultural Compounds and Veterinary Medicines Act 1997 (ACVM)** – deals with the risks associated with agrichemical use to trade, animal welfare, agricultural biosecurity and food residue standards; and consumer information about agricultural compounds.

- **Health and Safety in Employment Act 1992** – deals with workplace issues relating to hazardous substances.

4.2 NZ Standard

NZS 8409:2004 Management of Agrichemicals is the current code of practice for the safe handling and application of all agricultural chemicals. It provides an approved means of compliance with the requirements of the HSNO Act and associated regulations, and may also satisfy the requirements of the RMA. It is approved by ERMA (Environmental Risk Management Authority) and administered by the New Zealand Agrichemical Education Trust which also manages GROWSAFE® training courses for agrichemical applicators.

Chapter 5.3 of the standard details responsibilities of applicators with respect to spray drift. Appendix B covers legislation and agrichemical use in great detail. Appendix G provides details of drift hazards and avoidance. Appendix N, particularly N2.2 and N3 covers spray damage complaints.

4.3 Local Authority District Plans

In addition to statutory requirements, there are a range of local authority requirements to be met. These are prepared under the RMA and may include the relevant Regional Council Air Quality Plan and District Council Plan.

4.4 Civil Liability

Any person or organisation involved in the transport, storage, application or disposal of agrichemicals is liable under common law for negligence if he fails to take all reasonable care to protect people or the environment.

4.5 Criminal Liability

Each of the acts listed above have sections setting out the conditions of offences. These are referenced in Section 1.4 of NZS 8409:2004.

5. Major Types of Herbicide Associated with Grape Vine Injury

The herbicides most likely to cause drift injury to grape vines fall into 3 broad types: glyphosate, sulfonylurea and growth regulator. The table below lists information about their impact, specifically on grape vines.

Table 2
Types of Herbicide and their Impact on Grape Vines

Herbicide Type (trade name example*)	Chemical group	Active Ingredient	Typical Injury Range	Typical Injury Severity	Typical Recovery
Glyphosate (e.g. Roundup)	n-phosphono methyl glycine	-glyphosate	Localised in direct relationship to wind drift with a rapidly decreasing gradient of injury.	Significant vine injury and crop loss first year with potential crop loss 2nd year.	Affected vines most often recover fully by 2nd or 3rd year.
Sulfonylurea (e.g. Escort)	sulfonylurea	- chlorimuron - chlorsulfuron - flazasulfuron - halosulfuron-methyl -iodosulfuron-methyl -metsulfuron--methyl ester - metsulfuron-methyl - nicosulfuron - primisulfuron - thifensulfuron - methyl - tribenuron-methyl	Intermediate in direct relationship to wind drift with a slowly decreasing gradient of injury.	Vines have extreme sensitivity. Complete localized crop loss possible. Significant risk of vine loss close to the source.	Variable according to dose and proximity to source. Vines recover completely from moderate exposure. Severe contamination can compromise vine performance permanently.
Growth Regulator (e.g. 2,4-D)	- phenoxy acetic acid - phenoxy butyric acid - penzoic acid - substituted pyridine	-2,4-D amine - 2,4-D ethylhexyl ester - aminopyralid Ester - clopyralid - dicamba - MCPA - MCPB - picloram	Greatest spread of visible effect.	Significant single season crop loss possible. Symptoms often look worse than the economic damage.	Vines most often recover fully in the 2nd year.

*All active ingredients listed here are generic. There are numerous products with these active ingredients available in New Zealand.

5.1. Glyphosate

- Damage - is mostly localized when Glyphosate is used on its own. Can occasionally be severe to the point of non recovery of the vine. Early to mid season contamination can cause crop loss. Late season contamination may reduce the quality of the fruit and increase the risk of residues in the wine. In the following season, crop levels may be reduced.

- Occurrence – most often when applied to pasture, cropland, wasteland or burms in the immediate vicinity of vineyards. The risk is associated with direct contamination by wind drift. When Glyphosate is used in combination with sulfonylurea herbicides, there is an exponential increase in damage to vineyards exposed to drift.

- Symptoms (Glyphosate only) - These vary according to age of the vine, time of application and dose of herbicide. Glyphosate injury can be mistaken for sulfonylurea injury and vice versa. Symptoms often reappear in the second year but with lower severity.
  - Growing tips yellow and then die approximately 2 weeks after application.
  - Multiple lateral shoots emerge giving the vine a stunted and bushy appearance.
  - Young shoot growth is stunted – internodes are shortened.
  - Partially formed leaves become cupped, significantly textured, arrow shaped, and upward curled.
  - Vines may defoliate but will usually regrow.

5.2. Sulfonylurea

- Damage - When used on its own, or in combination with glyphosate, can occur at significant distances from the target. Can be both in the direct drift zone, and as a result of katabatic or anabatic movement of drift particles. These herbicides do not have a vapour active phase but the tolerance of grape vines is so low that minute quantities (as low as 4 grams active ingredient/ha), have been known to cause significant injury. Severe contamination will result in vine loss. Moderate contamination early in the season can cause complete crop loss followed by crop reduction in the following season due to poor growth of fruiting wood. Late season contamination may increase the risk of residues in the wine. In the following season, crop levels can be reduced.

- Occurrence - Commonly used in agricultural situations where quick action and short persistence is required. Widely used in forestry, amenity, and farm woody weed control. Sulfonylurea herbicides are best used for control of woody weeds in spring when they are actively growing. This brings their use in direct conflict with viticulture, as this is the time when vines are also at their most susceptible.

- Symptoms - vary according to age of the vine, time of application and dose of herbicide. Sulfonylurea injury can be mistaken for glyphosate injury and vice versa. Symptoms may reappear in second year but with lower severity.
  - Shoot tips abort rapidly.
  - Young shoot growth is severely stunted or curled.
  - Partially formed leaves become malformed and crinkly with interveinal chlorosis.
  - Vines often defoliate or abort young shoots.
  - Vines generally regrow in the same year (moderate to slight contamination).

5.3. Growth regulator

Growth regulators can cause spectacular damage in vineyards. Ester formulations are more widely used than amines due to lower cost and greater effectiveness. These formulations may occasionally vaporize and drift great distances in a completely unpredictable manner. However, under New Zealand conditions aerosol drift appears to be the principal cause of damage at distance.

- Damage - can occur locally, at a significant distance in the direct drift zone or (rarely) at very great distance (10 or more km) through drift of aerosols or the vaporised active ingredient. Vines are rarely killed by growth regulators, but early season contamination can have disastrous effects on crop levels. Vines generally recover and will crop at normal levels in the following season.

- Occurrence - commonly used in arable cropping and pasture for a wide range of broadleaf weeds. Like the sulfonylureas, they are best used in spring when weeds are actively growing, and vines are at their most susceptible.

- Symptoms
  - Initially shoot internodes elongate rapidly.
  - Shoot tips stop growing but laterals emerge.
  - Partially formed leaves become very characteristically fan shaped or strap like with ‘fingers’ of fine growth at the leaf margins.
  - Interveinal chlorosis is rare but leaves become mottled.
  - Leaves may cup in either direction.
  - Vines rarely defoliate and rarely die.
  - Affect on fruit is variable depending on formulation, dose and time of injury

6. Factors Affecting Spray Drift and Best Practice Application

The objective of any spray activity should be to ensure maximum retention of the spray on the target.

A full understanding of safe agrichemical application can only be gained by:

- **Reading and following label instructions.**
- **Reading and following NZ8409:2004, the New Zealand Standard on management of agrichemicals.**
- **Checking the relevant rules with your local council.**

Many factors affect the amount of off-target spray drift. They are detailed in a range of documents including NZS 8409:2004 Management of Agrichemicals Appendix G, and summarised in Table 3 below:

Table 3
Drift Factors and Best Practice Recommendation

Drift Factor	Best Practice Recommendation	Notes
Human Factor The most important factor in minimising spray drift is the skill, knowledge and initiative of the applicator. Spray application is fundamentally a straightforward activity, but managing to minimise spray drift demands attention to detail in all aspects of the application, ability to identify risks, and the power to stop the operation if conditions demand.	GROWSAFE® and Approved Handler Trained. Sufficient experience with these herbicide types to competently judge application conditions. Authority to postpone or cease spraying.	
Buffer Zone At seasonal margins (see Table 4) grape vine sensitivity exists and is unpredictable.	Should be considered when using herbicides with known sensitivity for grapes.	
Spray Droplet Size Spray drift is reduced with increased droplet size, as wind will carry large droplets a shorter distance than small ones. Droplet size can be increased by reducing spray pressure, increasing nozzle orifice size, and adding a drift reduction adjuvant.	Use nozzle size and pressure settings to achieve >250 microns VMD. (Volume Mean Diameter)	

Nozzle Type and Angle When orifice and spray angle are compared at constant pressure, nozzles with larger spray orifices and smaller spray angles create larger droplets.	Use nozzles types with orifice and spray angle to achieve >250 microns VMD.	
Wind Speed Wind carries spray droplets, aerosols and vapour. The higher the wind speed, the greater will the potential loss of herbicide from the target and the further away from the target it can drift. Conditions that appear calm are high risk as the air is always moving. Drift in these conditions is unpredictable.	Spray in winds with constant and predictable velocity >1 m/s and <3 m/s. Always measure with a calibrated anemometer.	Stop spraying if wind speed rises above 6 m/s.
Wind Direction There will always be drift and it will always be downwind.	Spray when wind direction is constantly and predictably away from sensitive off-target areas.	
Temperature Inversion Inversion occurs where cool; apparently still air near the ground is trapped below a layer of warmer air. There is little vertical mixing of the layers of air. Aerosols and vapours may fall very slowly or be suspended. When the cool air warms it rises and can carry drift large distances in unpredictable directions.	Test for inversion with cold smoke. Postpone spraying until wind speed reaches at least 1 m/s.	Only cold smoke will reliably indicate temperature inversion. Hot smoke may penetrate the inversion layer.
Humidity and Temperature Lower relative humidity and higher temperatures cause more rapid evaporation of spray droplets between spray nozzle and target. Evaporation reduces droplet size and increases the potential for spray droplets to drift as aerosols. High temperature also increases the vaporisation of volatile herbicides, and the associated risk of vapour drift.	Specific information on safe limits is not available. Literature suggests a maximum of 30^0 C.	
Release Height above the Target Small droplets have low inertial energy. The closer their release to the target, the more likely they will reach it. Spray drift will generally be greater the higher the boom or release point, and therefore greater from aerial	For ground application use boom height <1m above the target. For air application	Wind velocity often increases with height above ground. The lower the spray droplets

application than from ground application.	FLY LOW FLY SLOW.	are released, the lower the wind drift is likely to be.
Herbicide Volatility A volatile herbicide is one that changes from a solid or liquid into a gaseous state. All herbicides can drift as spray droplets but ester formulations of growth regulators can also cause damage from drift of vapour. Vapour drift may occur over greater distances and a longer time than droplet drift. This means an unfavourable wind shift subsequent to spraying may drift vapour from a volatile spray formulation onto a susceptible crop, even if the spray droplets have fallen on the target.	Use amine formulations over ester formulations where possible. Postpone spraying of growth regulator herbicides unless all best practice conditions exist.	Vapour drift is rarely identified in New Zealand.
Drift Reduction Agents There are a range of additives available that reduce the number of small droplets and increase the number of larger droplets. Always read the herbicide label and use an agent specified by the manufacturer.	Use drift reduction agents when spraying at the margins of an exclusion zone.	**Do not use drift reduction agents to compensate for poor application conditions. Postpone spraying instead.**

7. Grape Vine Sensitivity

Grapes are a sensitive crop. They are significantly more sensitive to the herbicides discussed in section 5 than many other crops. This sensitivity varies markedly with the growth stage of the vine. At no time in their growth cycle are grapes completely resistant to these herbicides, but there are safer times of year to spray the herbicides that cause the damage.

The following table shows seasonal sensitivity to the three key herbicide groups. Where two different herbicide types are sprayed in tank mix, the greater sensitivity applies.

Table 4
Grape Vine Seasonal Sensitivity to Key Herbicide Groups

Herbicide Type	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Glyphosate	Moderately Sensitive		Safest					Most Sensitive				
Sulfonylurea	Moderately Sensitive			Safest				Most Sensitive				
Growth Regulator	Moderately Sensitive			Safest				Most Sensitive				

The safest time of application is in the light zone, but only when grape vines are not actively growing. Active growth is from first movement of bud scales until termination of shoot tip.

The most sensitive time is in the dark zone, from bud movement to shoot tip termination.

The growth stages in Table 4 are based on the growth stages in Marlborough. They occur earlier in the North Island and later further south. As part of your spray plan preparation, consult vineyards near the target area to confirm the growth stage of their vines.

The zones are different across herbicide types because grape sensitivity varies with the herbicide type and the season.

Be aware that the directions for use on chemical labels are written to ensure the most efficacious use of the herbicide. For example, recommendations on timing of application can place the user at the greatest risk of causing damage to grape vines.

8. Actions for Parties Affected by Spray Injury

Time is of the Essence. For example sulfonylurea injury normally takes one to two weeks to manifest, but environmental degradation of the active ingredient is rapid. Metsulfuron methyl has a half life of one to five weeks in the soil, at normal (acid) soil pH, temperature and moisture. Breakdown in foliage may be even more rapid. As a general rule of thumb, the herbicide and its breakdown products may not be detectable after six weeks from the time of first symptom expression.

These are the steps to take when you see spray activity of concern:

8.1. Take photographs of the activity.

(See 8.7 below for instructions on taking photographs.)

8.2. Complete the relevant details of the Spray Drift Injury Data Form

(See Table 5 below)

8.3. Ask the spray operator what they are spraying.

These are the steps to take when you see spray damage in your vineyard:

8.4. Collect initial samples of damage.

On first recognition of herbicide injury symptoms identify area of injury and any gradients of degree of injury. Then collect at least two duplicate 1 kg samples of injured foliage. Label and consign these immediately to freezer storage. **Do not remove from freezer until just before sending them to a lab for analysis.** (See 8.7 below for instructions on collecting samples.)

8.5. Engage and instruct a competent viticulture consultant.

Choose a consultant with experience in spray drift injury. There is a list of Viticulturalists on the NZW website http://wineinf.nzwine.com/links.asp

Here are suggested instructions for your consultant:

- Identify the cause of the injury.
- Identify the source of the injury.
- Quantify the extent of the injury.
- Estimate the loss.
- Advise on remedial action in the vineyard.
- Advise on best options for recourse.
- Assist with negotiations or briefing of legal counsel.

8.6. Inform the appropriate authorities.

- **Your local Council** – call your local council pollution hotline. Also inform them in writing and request their assistance. They are obliged under section 15 of the RMA to investigate and you can demand a visit. Be aware that your local council may have a dual role. They may have engaged a liable spray contractor, and under the RMA they may also be the prosecuting body.

- **NZ Winegrowers** - Please e-mail info@nzwine.com and request a Spray Injury Register form (see Table 6). This national register will be used to minimise future incidence of spray drift injury. NZ Winegrowers are not able to assist with individual cases, but collection of data on spray drift incidents will assist their advocacy role.

8.7. Collect Evidence

Here is some advice on evidence collection. Below in Table 5 is a form to use for collecting relevant information about the injury.

Remember time is of the essence.

- **Map the affected area.**
  - Include a north indicator.
  - Mark the drift injury area and the path of the drift.
  - Mark the wind direction at the time of the drift if you know it.
  - Indicate property boundaries, roads, buildings and shelter belts.
  - Note sampling locations and sample numbers.
  - Mark any other relevant features.

- **Take digital photographs.**
  - Use your camera's date/time facility if it has one.
  - Show the big picture with overall shots of the scene.
  - Take at least three shots of the injury; in close-up, in the context of the plant and in the context of the block.
  - Take shots of uninjured vines as a comparison.
  - Check that your images are in focus, especially close-up images.
  - Number each image and reference the image against the sample number as appropriate.

- **Choose sample sites.**
  - Take individual samples from as representative an area as possible. Sample apparently unaffected areas, representative areas and worst affected areas.
  - Sample from the least affected areas first and the most affected areas last.
  - If you suspect the damage is not yet fully manifest, sample in a grid in the entire block, noting the extent of injury at each sample site.

- **Collect samples.**
  - Use disposable gloves – a new pair for each sample.

- Use a fresh container for each sample. Best practice is to wrap samples in aluminium foil prior to bagging.
- Always collect duplicate samples. Keep the duplicate for the other party.
- Place each sample in the smallest possible container, exclude as much air as possible and seal it with tape or some other tamper-evident seal.
- Number the sealed sample. Record that number in your diary with date, extent of injury and exact location (row and bay number) in the vineyard. Finally record the sample number on your map before moving on to the next sample site.
- Protect the sample from light and keep secure at all times.
- Take photographs of the samples and sample sites as they are collected.
- If the samples can be sent to the lab on the day of collection, consign them immediately. You may request that they be frozen pending instruction. If they can't be despatched immediately then consign to freezer storage. Once frozen the samples maintain their integrity until defrosted.
- Collect water samples from irrigation dams and rain water tanks where applicable.

Table 5
Spray Drift Injury Data Form

Personal :				
Name				
Postal Address				
Phone		Mobile		
E-mail Address				
Event: General description of Injury				
Injury location - Map Ref				
No. Hectares Affected		No. Vines Affected		
Vine Variety		Vine Age		
Vine Variety		Vine Age		
Vine Variety		Vine Age		
Vine Variety		Vine Age		
Vine Variety		Vine Age		
Vine Variety		Vine Age		
Date injury discovered				
Discovered by whom				
Event Details – if known				
Date of Spray Event				
Time of Spray Event				
Agent Active Ingredient				
Indentified by?				
Org Name				
Contact Name				
Postal Address				
Phone		Mobile		
E-mail Address				
Spray Source	Contacted?	Yes	No	
Org Name				
Contact Name				
Postal Address				
Phone		Mobile		
E-mail Address				
Description of attempted prevention (warning etc.)				
Date of prevention attempt				
Estimated Value of Loss				
Weather (if known)	**Before Event**	**Day of Event**	**Day After Event**	
Temperature				
Humidity				
Wind Speed				
Wind Direction				

Cloud Cover			
Rainfall last 24 hours			
Rainfall last 48 hours			
Nearest Climatological Station			
Nearest Met Station			
Other Parties Affected:			
Name			
Postal Address			
Phone		Mobile	
E-mail Address			
Name			
Postal Address			
Phone		Mobile	
E-mail Address			
Witnesses:			
Name			
Postal Address			
Phone		Mobile	
E-mail Address			
Name			
Postal Address			
Phone		Mobile	
E-mail Address			
Advisers:			
Viticulture Consultant	Contacted?	Yes	No
Org Name			
Contact Name			
Postal Address			
Phone		Mobile	
E-mail Address			
Local Council	Contacted?	Yes	No
Org name			
Contact Name			
Postal Address			
Phone		Mobile	
E-mail Address			
Police	Contacted?	Yes	No
Org Name			
Contact Name			
Postal Address			
Phone		Mobile	
E-mail Address			
Barrister/Solicitor	Contacted?	Yes	No
Org Name			
Contact Name			
Postal Address			
Phone		Mobile	
E-mail Address			

Table 6
Spray Injury Register Form

Please append map, sample diary, spray diary, vineyard diary, laboratory reports, photographs, videos etc if available.

Personal :				
Vineyard/Winery Name				
Contact Name				
Postal Address				
Phone		Mobile		
E-mail Address				
Event:				
General description of Injury				
Injury location - Map Ref				
No. Hectares Affected		No. Vines Affected		
Date injury discovered				
Estimated Value of Loss				
Event Details – if known:				
Date of Spray Event				
Time of Spray Event				
Agent Active Ingredient				
Spray Source – if known:	Contacted?	Yes		No
Org Name				
Contact Name				
Postal Address				
Phone		Mobile		
E-mail Address				

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