Spray Drift Risk Assessment and Regulation at the APVMA

OECD RRSG Seminar
Spray Drift Regulation
24 Feb 2009
Presenter: David Loschke

The Australian Pesticides and Veterinary Medicines Authority is Australia’s national regulator of pesticides

The APVMA is responsible for 3 main risk areas of pesticide use

It must –

• Protect human health
• Protect the health of the environment
• Protect Australia’s international trade
Spray drift can affect all three risk areas

APVMA and Spray Drift

- On 15 July 2008, the APVMA published on its website a policy overview paper entitled – APVMA OPERATING PRINCIPLES IN RELATION TO SPRAY DRIFT RISK

- The website also contains information about how protective no-spray zones are set and about how the APVMA estimates potential drift by using standard application scenarios

Australian Pesticides and Veterinary Medicines Authority
APVMA Spray Drift Risk Assessment

- The APVMA uses both computer modelling and field data sets to estimate drift deposition
- Currently, 19 standard spray drift risk assessment scenarios are available on the APVMA website
- Spray drift risk is assessed near the upper estimate of risk for equipment and methods typical of Australian industry

Examples of typical drift deposition profiles

![Graph showing fraction of applied rate vs. metres downwind for different drift scenarios]
Risk Management Approach

- Risk is managed by means of instructions and restrictions placed on product labels
- State and Territory authorities enforce mandatory label instructions as law
- If a method of application (for example aerial) has not been assessed for risk, that method is forbidden on the label

Principal Label Restrictions

Mandatory label statements include:

- Required use of largest spray droplet size compatible with efficacy – specified as a standard spectrum – currently within ASAE S572
- Limits on wind speed during spraying
- Imposition of protective downwind no-spray zones (buffer zones) when necessary
Mandatory No-Spray Zones

Mandatory no-spray zones (buffer zones) exist only in the downwind direction at the time of spray application

- Labels might have a different no-spray zone for each of the three major risk categories
- The size of a no-spray zone is based on estimated spray drift deposition linked to an acceptable risk-threshold based on scientific studies
Beyond Label Restrictions

Label restrictions based on current typical practice will form a relatively stable reference point over time.

- As industry practices improve with new drift reducing technologies (DRT), those who take up aspects of DRT can be rewarded through a special mechanism
- The mechanism will be based on methods used in Europe and Canada

Australian Pesticides and Veterinary Medicines Authority

Beyond Label Restrictions

Label mandatory no-spray zones can be reduced by factors tied to the measured benefit of particular DRTs

- An easily updated reference document referred to on each label will explain the reduction factor for each type of DRT
- Australia will use existing data for these factors as much as possible

Australian Pesticides and Veterinary Medicines Authority
Systematic Label Reviews

Targeted label revisions of older products for spray drift risk have recently begun

- A large number of old products need to be reviewed – perhaps more than 2,000
- This massive task is expected to require four to five years

Example Wind Speed Restriction Statement

**DO NOT** apply when wind speed is less than 3 or more than 20 kilometres per hour at the application site.
Example Droplet Size Restriction Statement

DO NOT apply with smaller than COARSE spray droplets according to ASAE S572 definition for standard nozzles.

Example Human Health No-Spray Zone Restriction Statement

DO NOT apply when there are people, structures that people occupy or parks and recreation areas within XXX metres downwind from the application area.
Bystander Spray Drift Exposure Model

To determine the size of a human health no-spray zone as in the previous slide, the APVMA uses an exposure model that considers a small unclothed child playing on drift affected turf:

- The model combines standard drift scenarios with a toddler turf exposure model developed by the US EPA.
- The model delivers total dose in mg/kg/day for both oral and dermal exposure as well as the sum of the two.
- The size of the play area, its distance from the application area and other features can be set as input parameters.

Bystander Spray Drift Exposure Model

- The model integrates each deposition curve across the play area.
- The width of the play area and its distance from the application area can be varied.
- Input of the environmental half-life of the pesticide on foliage and time intervals between applications allow repeat applications to be taken into account.

Australian Pesticides and Veterinary Medicines Authority
Drift onto play area

Area where pesticide is applied

wind direction

play area for child

Drift onto play area

Area where pesticide is applied

wind direction

play area for child

Aerial Fine
Aerial Medium
Aerial Coarse
Ground HiFine
Ground LoFine
Ground HiCrase
Ground LoCrase
Airblast Sparse
Airblast Dense
Airblast Vineyard
Airblast Normal
Drift onto play area

Area where pesticide is applied

wind direction

A Question to Consider - Which Health Standard Should be Used as a Threshold?

- ARfD ?
- ADI ?
- Tailored standard based on appropriate short-term repeat dose study NOEL ?

Australian Pesticides and Veterinary Medicines Authority
thank you
Modelling Drift and Droplet Size for Aerial Application

Dr Andrew Hewitt
Lincoln Ventures, Lincoln University, New Zealand
University of Queensland, Australia

Summary

- Current models: drift and droplet size
- Predictive models versus curve-fits for field data
- Gaps and ongoing modelling work
Aerial Drift Models

- More effort has probably gone into modelling aerial spraying than any other application platform
- Several decades of work, millions of dollars by USDA Forest Service, NASA, US Army, Spray Drift Task Force, EPA and others – mostly focussed on a single platform, AGDISP

AGDISP

- Lagrangian modelling – higher level of complexity than simpler Gaussian approaches
- Tracks every droplet released from every nozzle on an aircraft through emission to transport to deposition within or beyond the target crop or forest
- Validated with thousands of field studies for diverse applications
- Extensively published
AgDRIFT

- The AGDISP code has found a home in many subsequent models, perhaps the most famous of which is AgDRIFT.
- AgDRIFT is a regulatory-focussed model with three tiers for spray drift exposure risk assessment of pesticide application based on SDTF field study validation of AGDISP. Developed jointly by SDTF, EPA and USDA – download from www.agdrift.com

AgDRIFT

- Most users will input reasonable worst-case application conditions and use the toolboxes to assess spray drift mitigation options such as droplet size (e.g. “Coarse spray”), wind speed and perhaps boom length to manage drift.
- Includes aquatic and terrestrial “no spray” buffer zone toolboxes as well as more specialised features such as stream assessments, multiple application assessments, etc.
Example of Toolbox Calculation Showing 100 m No-Spray Zone Recommendation

Future Work in NZ and N. America

- Improvements to the accountancy for spray within the canopy
- Alternative far-field drift calculations to reduce the 4 X difference between SDTF field studies and model data at such larger distances (e.g. using CALPUFF modelling) and variability/uncertainty analysis for meteorological conditions. The current steady-state modelling approach wrongly assumes constant wind speed and direction in the field
- CFD Modelling considerations
**Droplet Size Data Needs**

- Important for product performance, drift management and spray efficacy
- Primary input for drift and application modeling, e.g. using AGDISP/AgDRIFT
- Specified on increasing number of pesticide labels

**Aerial Droplet Size Modelling**

- Nozzle catalogue ground droplet size data are not applicable to aerial scenarios due to air shear effects
- Aerial sprays tend to be more concentrated than ground sprays due to their lower water volume rates. This produces further changes in droplet size relative to ground conditions
Droplet Size Models

- SDTF – “DropKick” model within AgDRIFT
- Jones Air Australian nozzle angle model – in “JARBA” system
- Rotary atomiser models (ASC, Micronair, Unimiser)

Many Models Included in AGDISP/AgDRIFT
Atomization Models

- Wind tunnel data being used to develop range of atomization models compatible with other droplet size data from SDTF already in AgDRIFT
- Extensive rotary atomizer and active tank mix/ adjuvant modeling

Example of Droplet Size Calculator

<table>
<thead>
<tr>
<th>Nozzle Calculator for 2,4-D</th>
<th>Input data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Speed (knots)</td>
<td>120</td>
</tr>
<tr>
<td>Product</td>
<td>Water</td>
</tr>
<tr>
<td>Nozzle Type</td>
<td>40° Flat Fan</td>
</tr>
<tr>
<td>Orifice Size</td>
<td>10</td>
</tr>
<tr>
<td>Pressure (bar)</td>
<td>4</td>
</tr>
<tr>
<td>Nozzle Angle</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Predicted droplet size</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>D[v,0.1]</td>
<td>192</td>
</tr>
<tr>
<td>VMD</td>
<td>426</td>
</tr>
<tr>
<td>D[v,0.9]</td>
<td>737</td>
</tr>
<tr>
<td>Fines (&lt;150µm)</td>
<td>7.4%</td>
</tr>
<tr>
<td>Spray Quality</td>
<td>Coarse</td>
</tr>
</tbody>
</table>
Micronair AU5000 Atomiser

Ongoing Droplet Size Modelling

- Need to develop additional models for many application, adjuvant and tank mix types
- Increasingly important to facilitate compliance with pesticide label droplet size requirements
International Collaborations

- Modelling collaborations between researchers in several countries, e.g. current joint work by LVL (NZ), ILVO and CUL (Belgium), TAG Silsoe (UK), UQ (Australia), AAFC (Canada), USDA (US) and others
- We would like to collaborate with others as well on important drift and application technology research

For Further Information

- A.hewitt@uq.edu.au
- Andrew.hewitt@lvl.co.nz