No Spray Buffer Zones

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The Centre for Pesticide Application and Safety

Lincoln University
Te Whare Wānaka o Aoraki

LINCOLN VENTURES LIMITED

Spray Drift in Australia

- Several high-profile alleged spray drift incidents continue to increase pressure on APVMA and DEWHA to restrict spray applications in Australia: Barrier Reef (QLD), 2-headed fish (QLD), herbicide damage to ornamental trees (QLD), cotton damage from phenoxy herbicides allegedly 10-30km away (QLD, NSW), etc

Sensitive Areas

- Increasingly, people are choosing to live and visit areas adjacent to pesticide use, and regulators and planners are having to consider appropriate ways to prevent spray drift exposure
- Non-target sensitive crops – especially for herbicide exposure
- Aquatic ecosystems

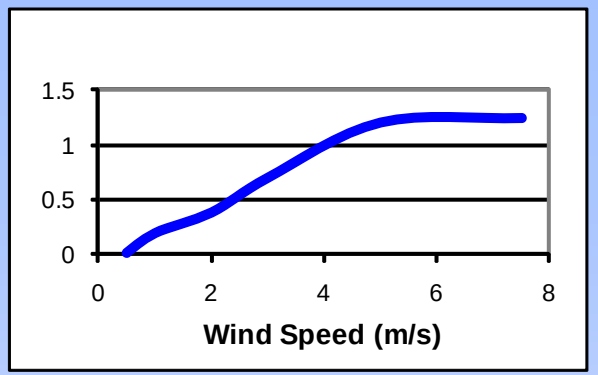
Drift Management

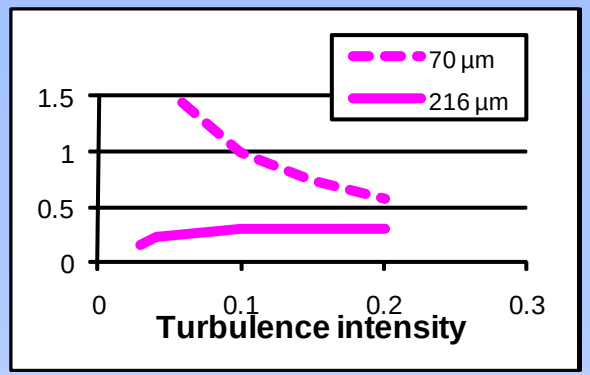
- Education/ training
- Technological improvements
- Regulation

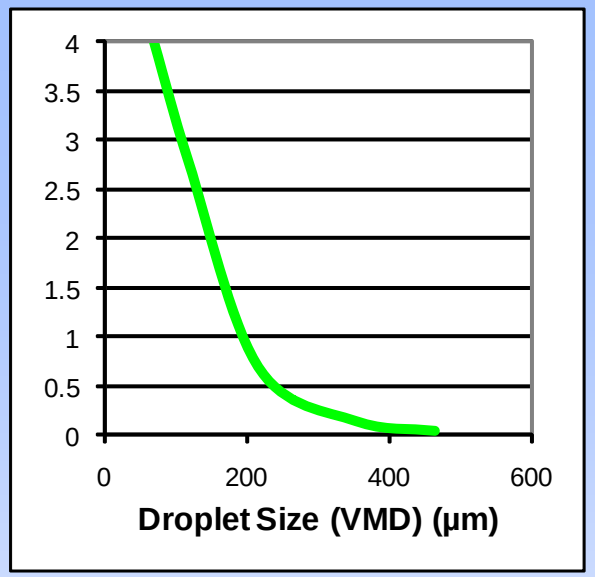
- All require appropriate resources, tools, models etc.

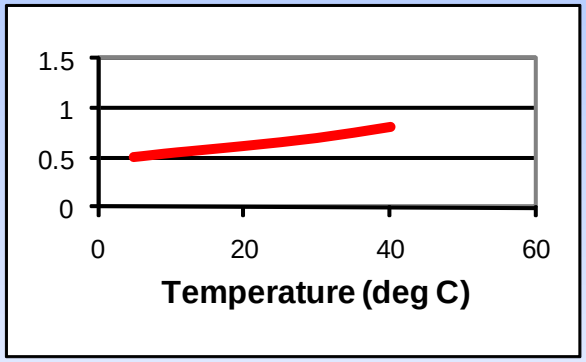
The Main Factors Affecting Drift

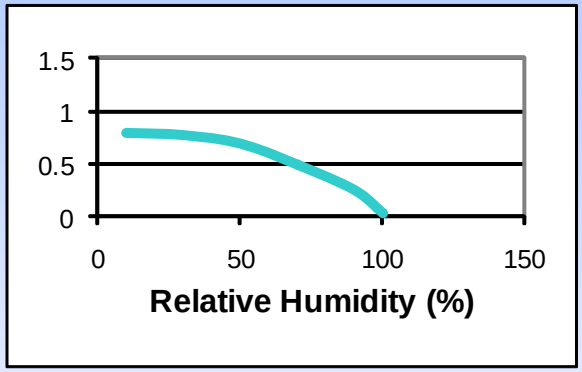
- Droplet size – small droplets go where the wind takes them
- Wind speed – higher horizontal and vertical wind speeds carry sprays greater distances
- Boom height – greater heights allow droplets to remain airborne longer
- Temperature and Relative Humidity – affect evaporation rates for water carrier

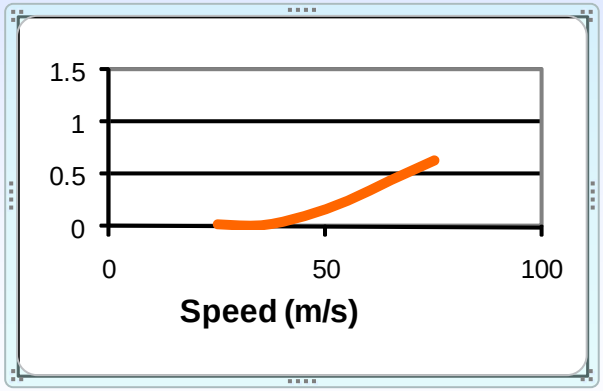


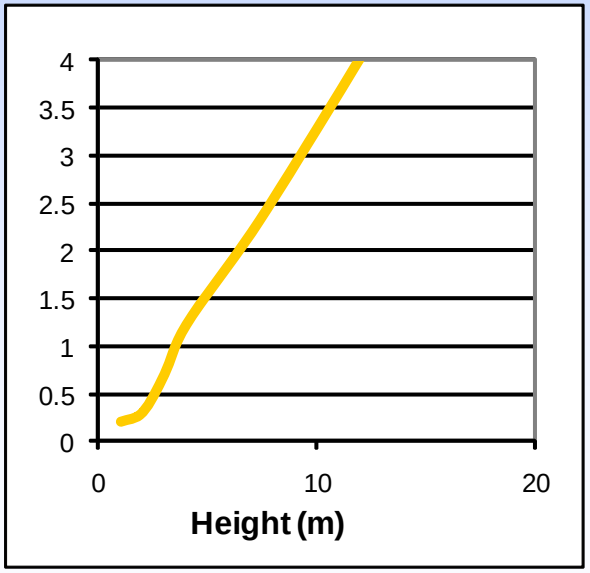










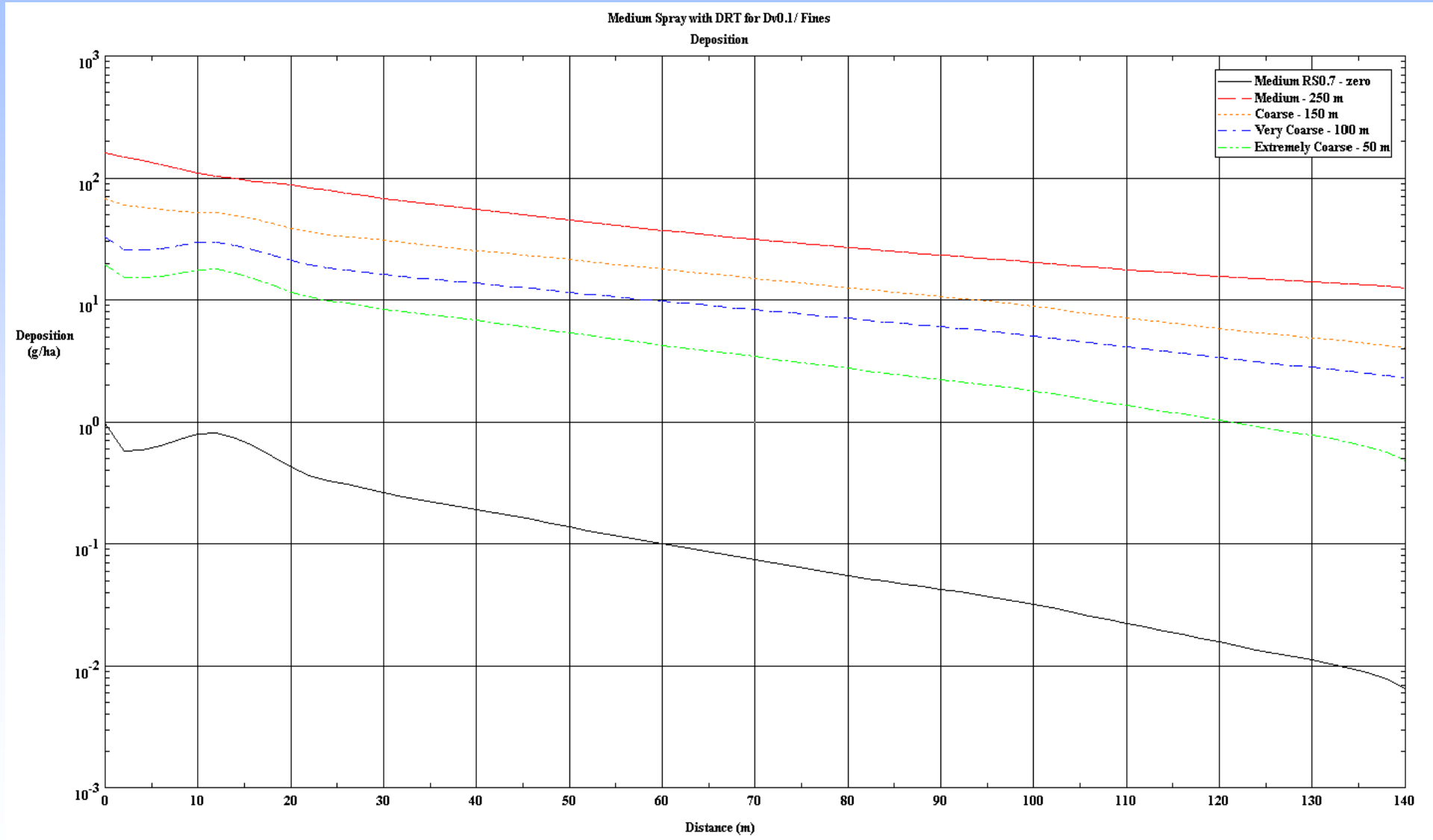


AgDRIFT Sensitivity analysis - effect of application parameters on spray drift deposition

Drift Management

- Select nozzles and adjuvants that reduce “fines” in sprays (most sprays include many fines – e.g. “Coarse” can include up to 9% fines below 100 um – meaning 9L/ha of a 100L/ha could drift)
- Shield the spray from the wind using shrouds, cones, shields, air-assistance
- Reduce boom height
- Do not spray when wind blows toward sensitive areas

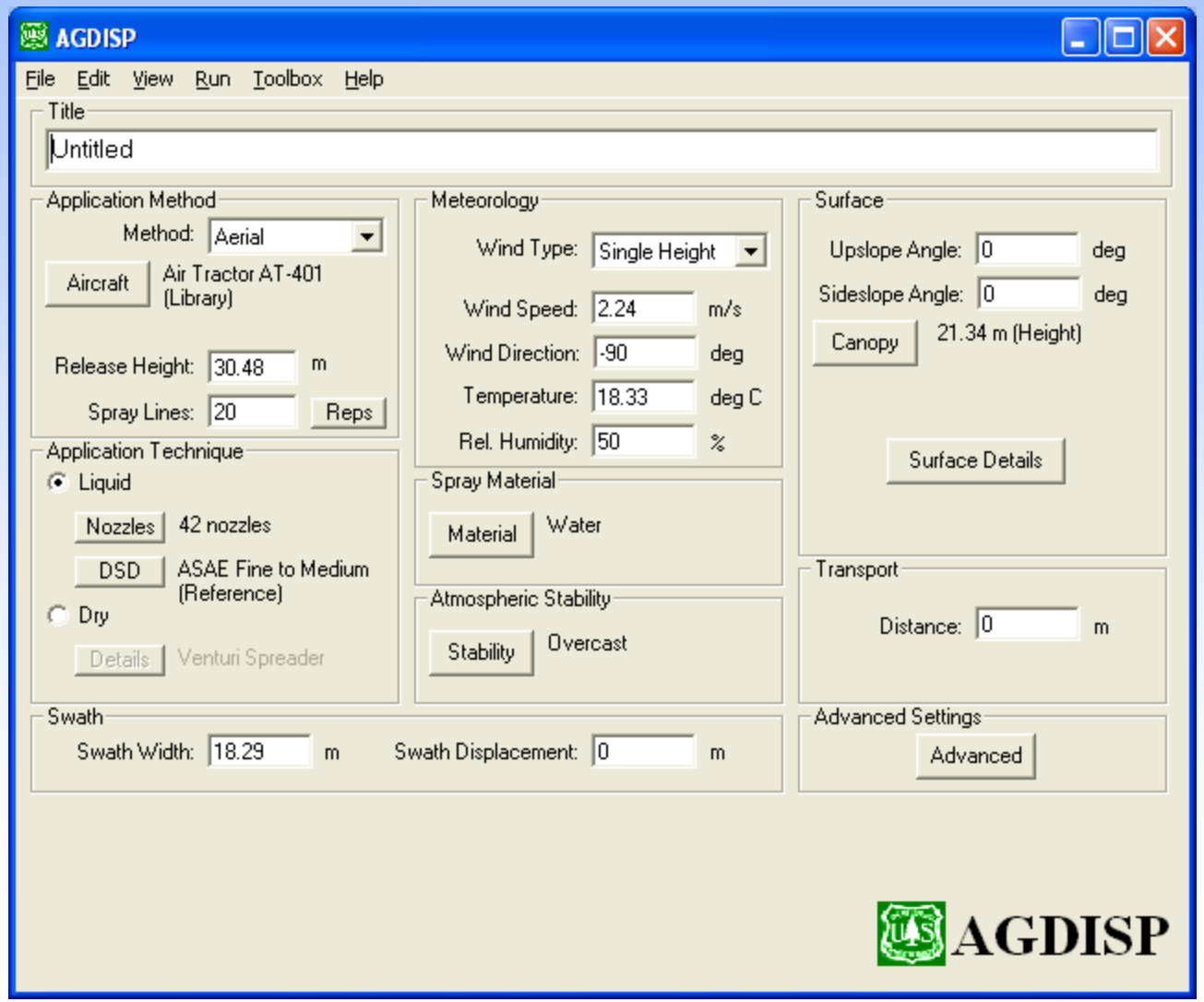
Droplet Size as a DRT



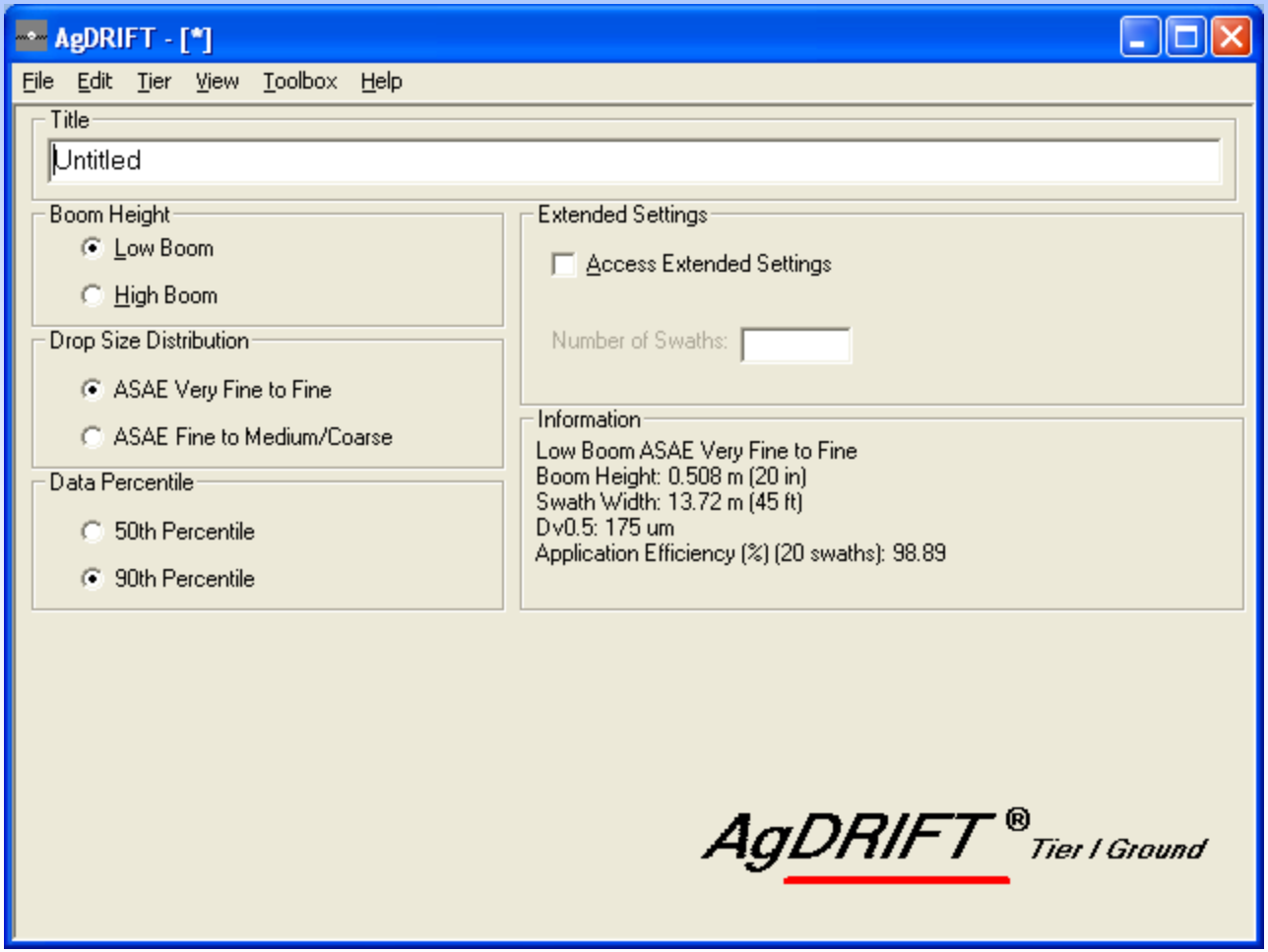
How Does APVMA Assess Spray Drift Exposure to Set Regulations?

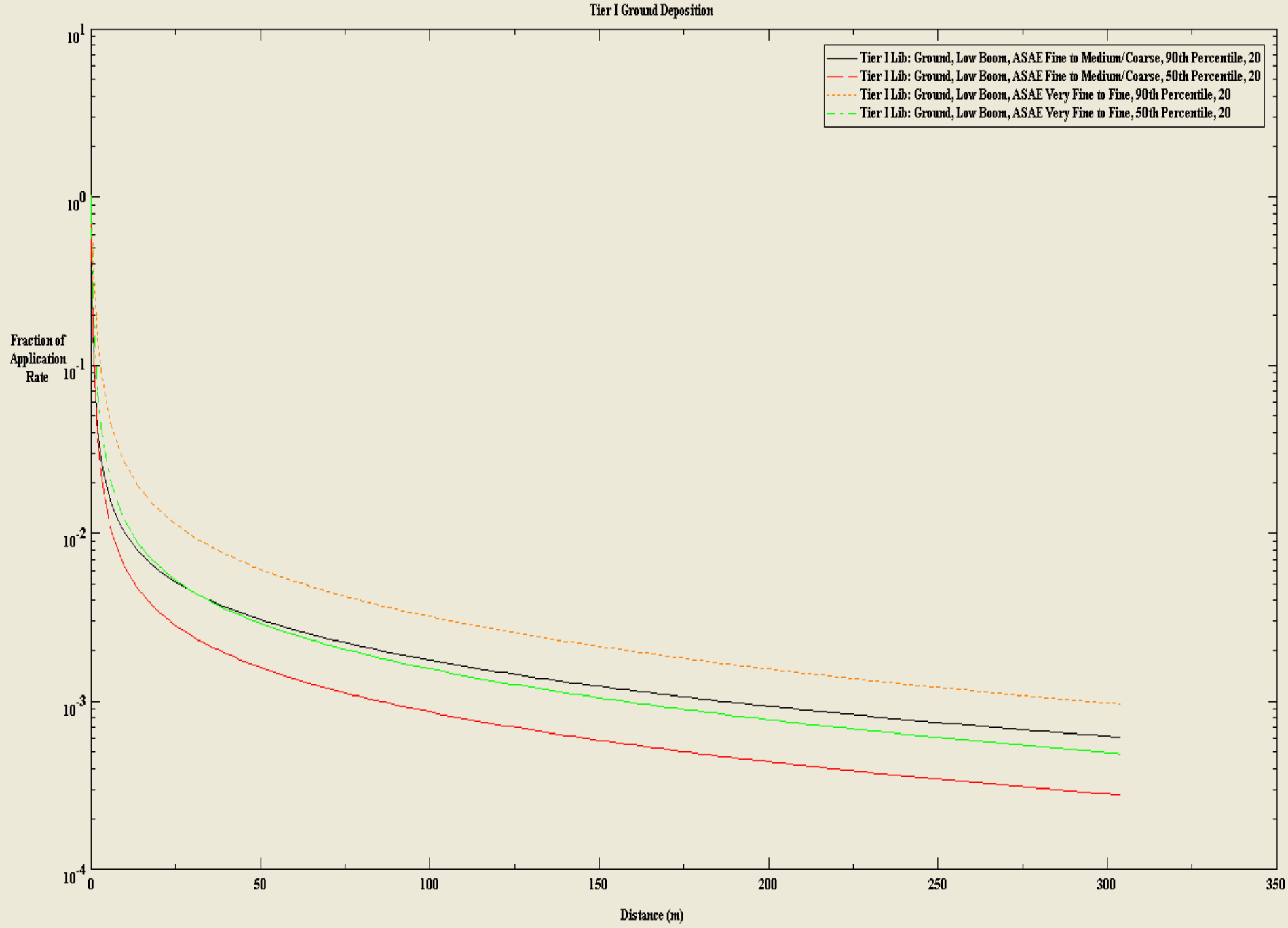
- Over the last few years, there have been rapid changes in regulations for pesticide drift management in Australia, driven by APVMA using the AgDRIFT and AGDISP models to assess exposure risk
- The models assess the drift levels downwind of applications and the toolboxes allow the distance at which drift is below the level of concern for each pesticide to be assessed – this the becomes the no spray buffer zone

AGDISP

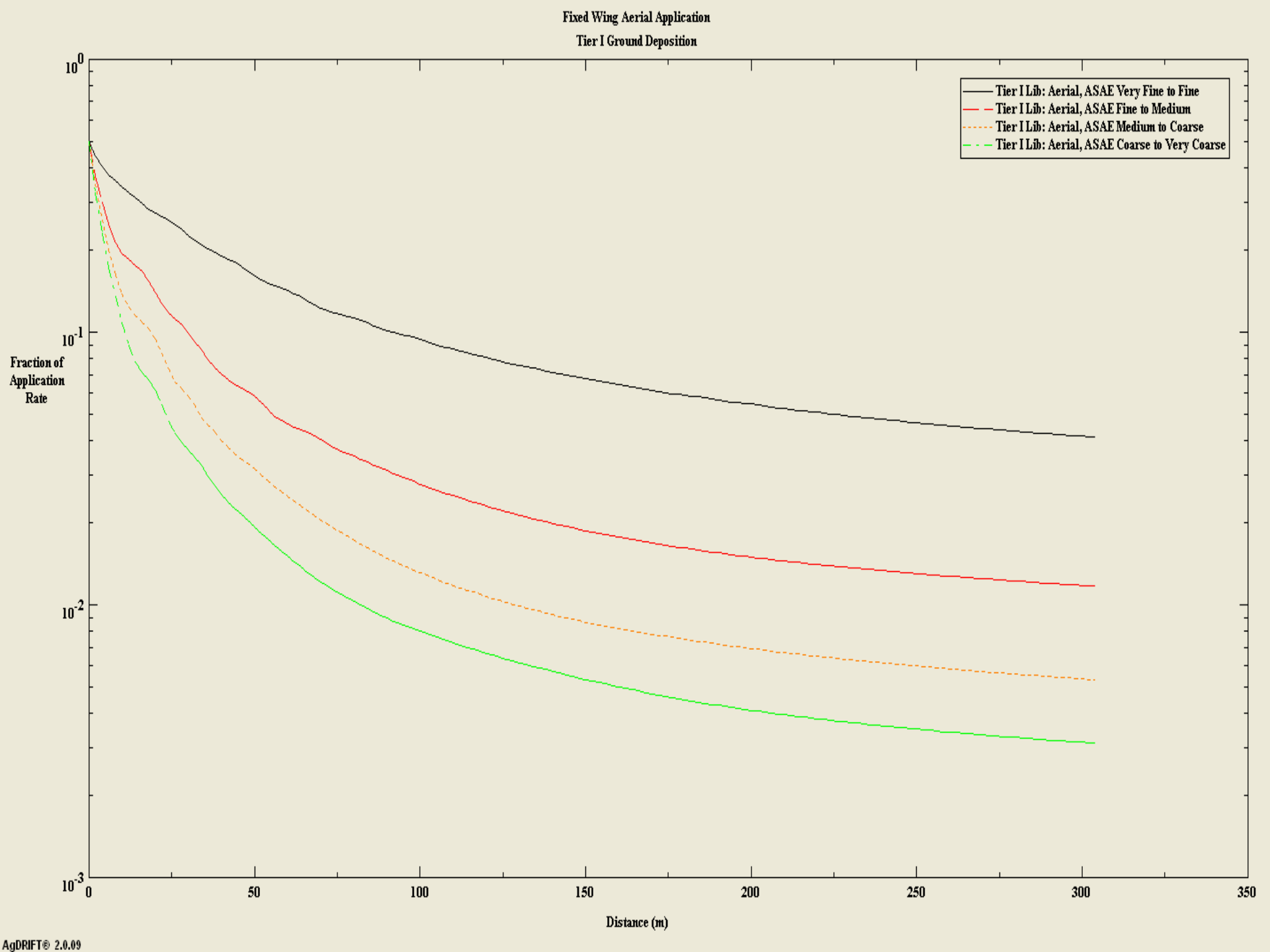

AGDISP
File Edit View Run Toolbox Help
Title
Untitled
Application Method
Method: Aerial
Aircraft
Air Tractor AT-401 (Library)
Release Height: 30.48 m
Spray Lines: 20
Reps
Application Technique
Liquid
Nozzles
42 nozzles
DSD
ASAE Fine to Medium (Reference)
Dry
Details
Venturi Spreader
Meteorology
Wind Type: Single Height
Wind Speed: 2.24 m/s
Wind Direction: -90 deg
Temperature: 18.33 deg C
Rel. Humidity: 50 %
Spray Material
Material
Water
Atmospheric Stability
Stability
Overcast
Surface
Upslope Angle: 0 deg
Sideslope Angle: 0 deg
Canopy
21.34 m (Height)
Surface Details
Transport
Distance: 0 m
Swath
Swath Width: 18.29 m
Swath Displacement: 0 m
Advanced Settings
Advanced
AGDISP

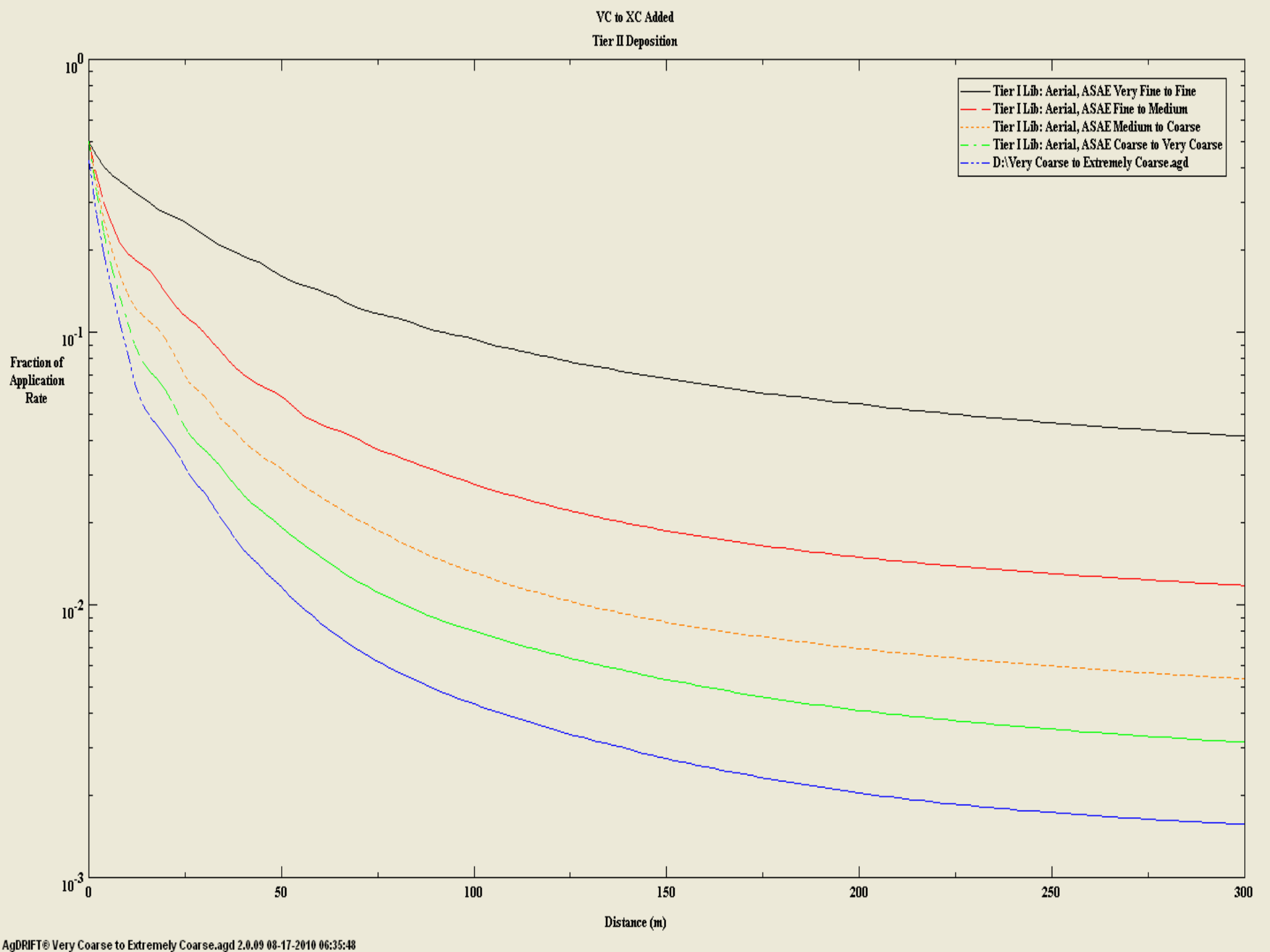
AgDRIFT Ground



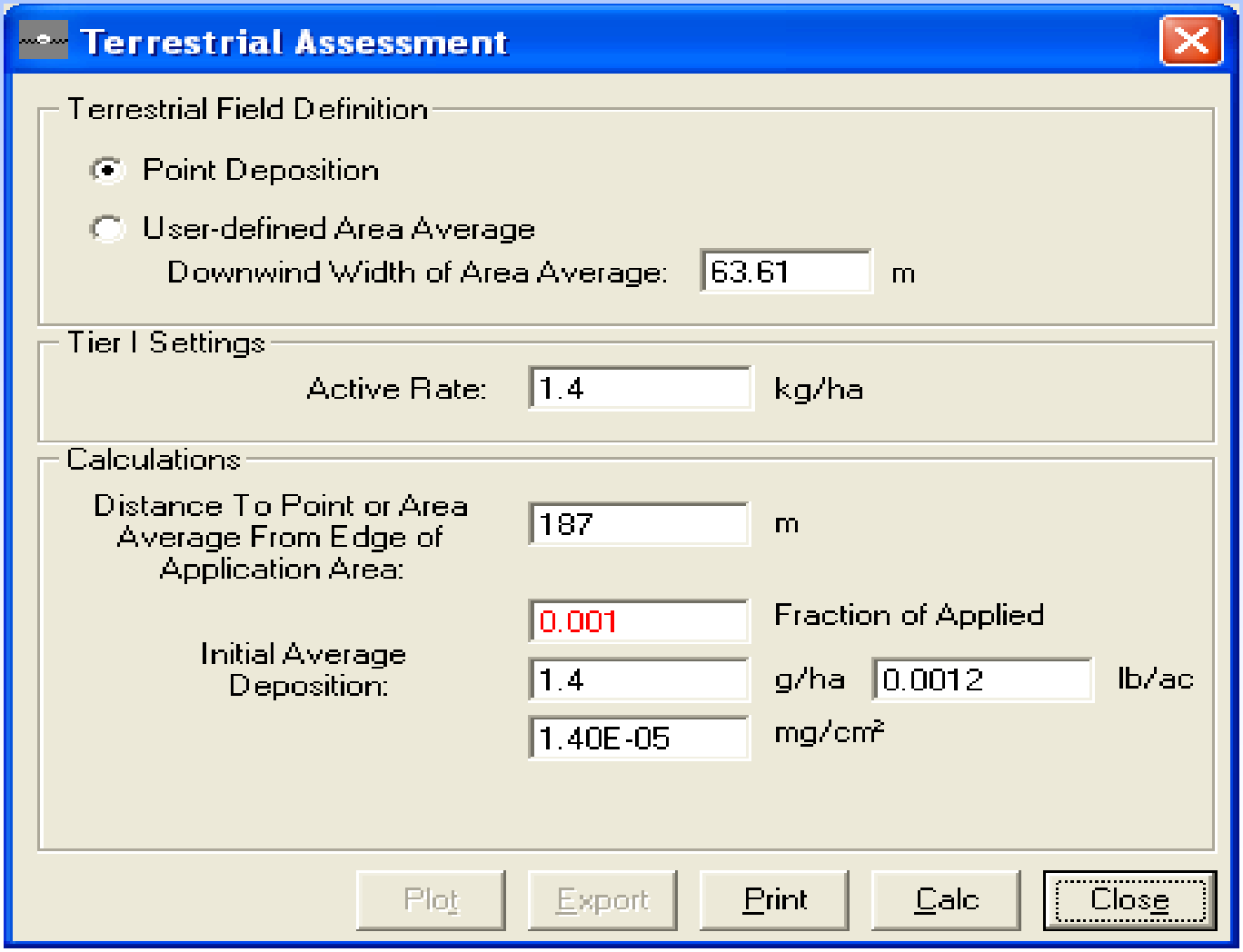


AgDRIFT® 2.0.09


Fixed Wing Aerial Application
Tier I Ground Deposition
Tier I Lib: Aerial, ASAE Very Fine to Fine
Tier I Lib: Aerial, ASAE Fine to Medium
Tier I Lib: Aerial, ASAE Medium to Coarse
Tier I Lib: Aerial, ASAE Coarse to Very Coarse
Fraction of Application Rate
10^{0}
10^{-1}
10^{-2}
10^{-3}
0
50
100
150
200
250
300
350
Distance (m)
AgDRIFT® 2.0.09


VC to XC Added
Tier II Deposition
Tier I Lib: Aerial, ASAE Very Fine to Fine
Tier I Lib: Aerial, ASAE Fine to Medium
Tier I Lib: Aerial, ASAE Medium to Coarse
Tier I Lib: Aerial, ASAE Coarse to Very Coarse
D:\Very Coarse to Extremely Coarse.agd
Fraction of Application Rate
10^{0}
10^{-1}
10^{-2}
10^{-3}
0
50
100
150
200
250
300
Distance (m)
AgDRIFT® Very Coarse to Extremely Coarse.agd 2.0.09 08-17-2010 06:35:48

Toolboxes Determine the Buffers



Interim Ground Drift Model (GRDC-supported)

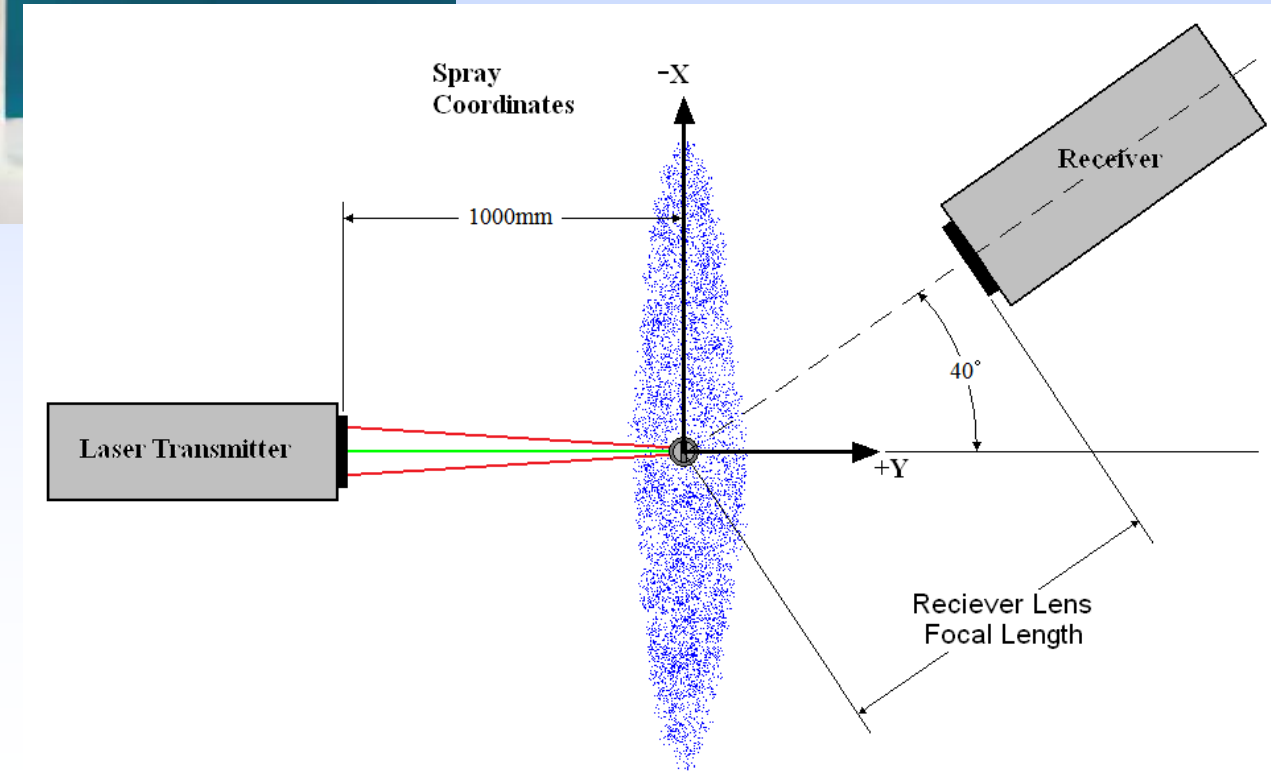
- Added options for coarser sprays than the M/C boundary in AgDRIFT
- Looked mainly at Canadian data (Tom Wolf)
- Assessed other options to propose to APVMA under its new DRT scheme – initial case for shrouds and cones using Canadian data followed up by testing newer ones in wind tunnel and field

Fully-Predictive Models

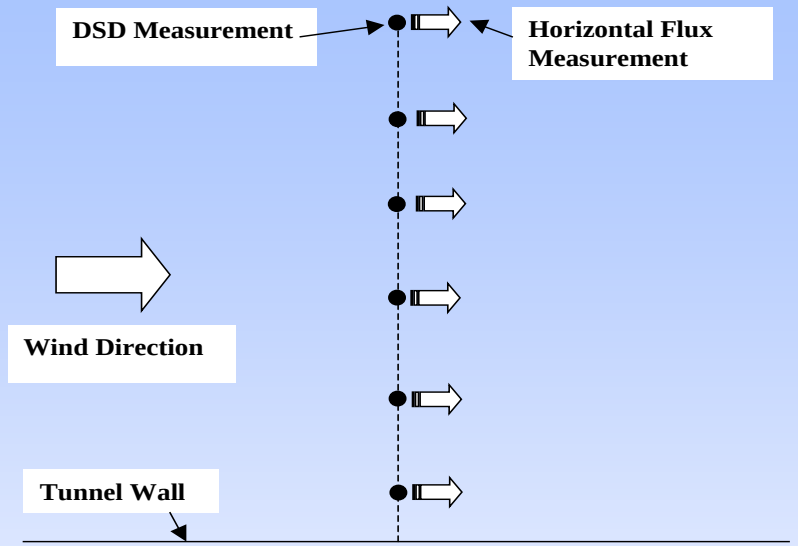
- NZ project supporting development of new models for ground-applied sprays. Developing sampling techniques as part of a new model that can accommodate conventional and drift reduction technology (DRT) systems (called AgDRT) (DRTs: shields, shrouds, electrostatics, air-assistance, adjuvants, etc)

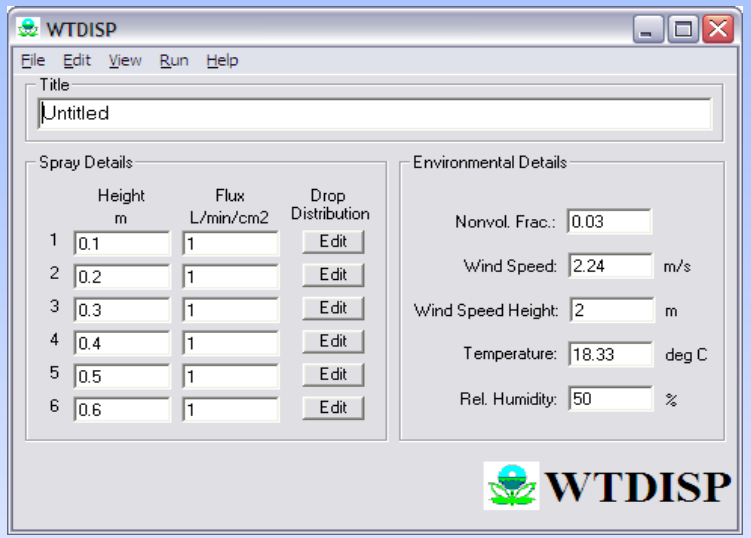
Lasers

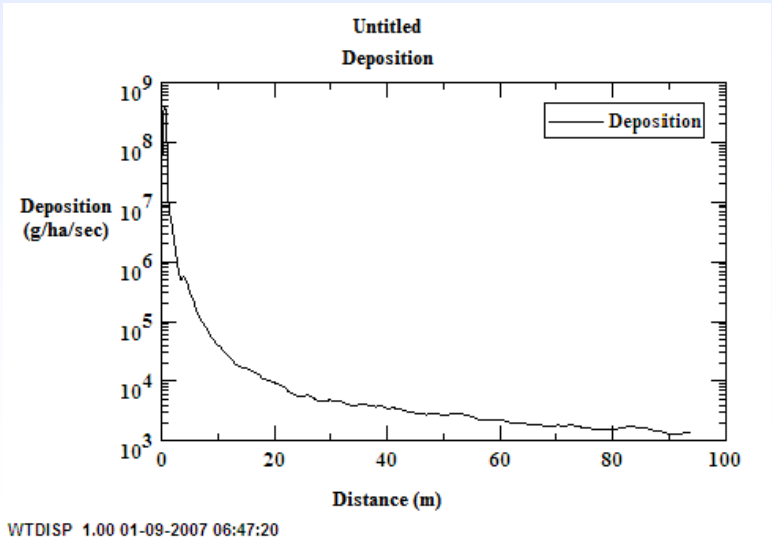

Artium
Technologies Inc.


Spray
Coordinates
-X
1000mm
Receiver
40°
Laser Transmitter
+Y
Reciever Lens
Focal Length

WTDISP







AGDISP

Back to the Interim Ground Model

- AgDRIFT Ground currently only offers:
  2 droplet size categories (largest is M/C 340um)
  2 boom heights (50 and 127 cm)
  2 percentiles (50 and 90^{th} -APVMA picks 90^{th})
- We have added 2 more droplet size options – VC and XC
  Making the case for allowing 50^{th} percentile

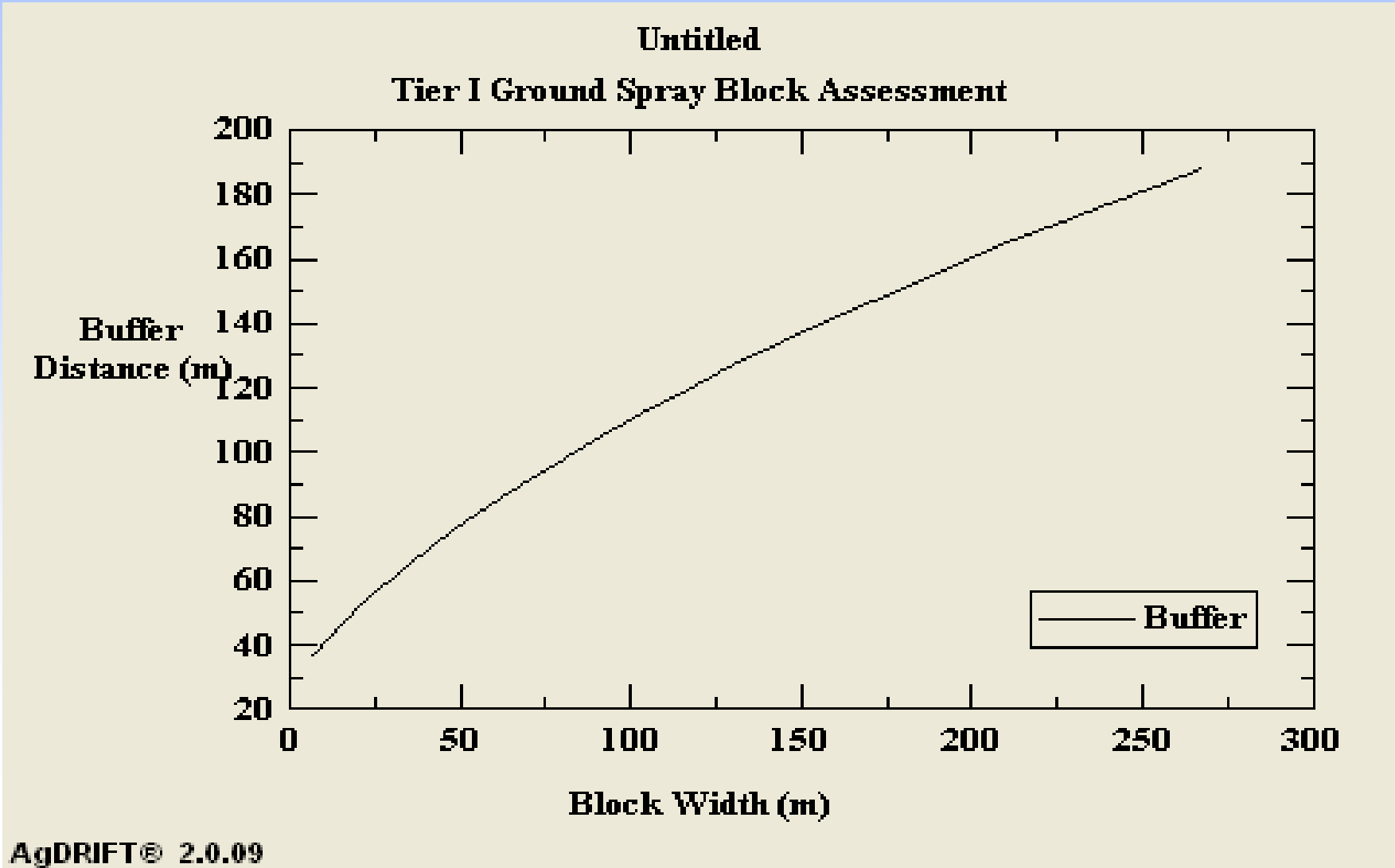
Interim Ground Drift Model

Level of concern		0.001	(fraction of applied)
Buffer distance to achieve LOC (m)			
	50 Percentile	90 percentile	
F-Low	276	>300	
M-Low	74	201	
VC-Low	26	108	
VC-High	52	116	
XC-High	42	104	
AgDRIFT	86	188	(F to M/C, Low boom)
Number of swaths =		15	

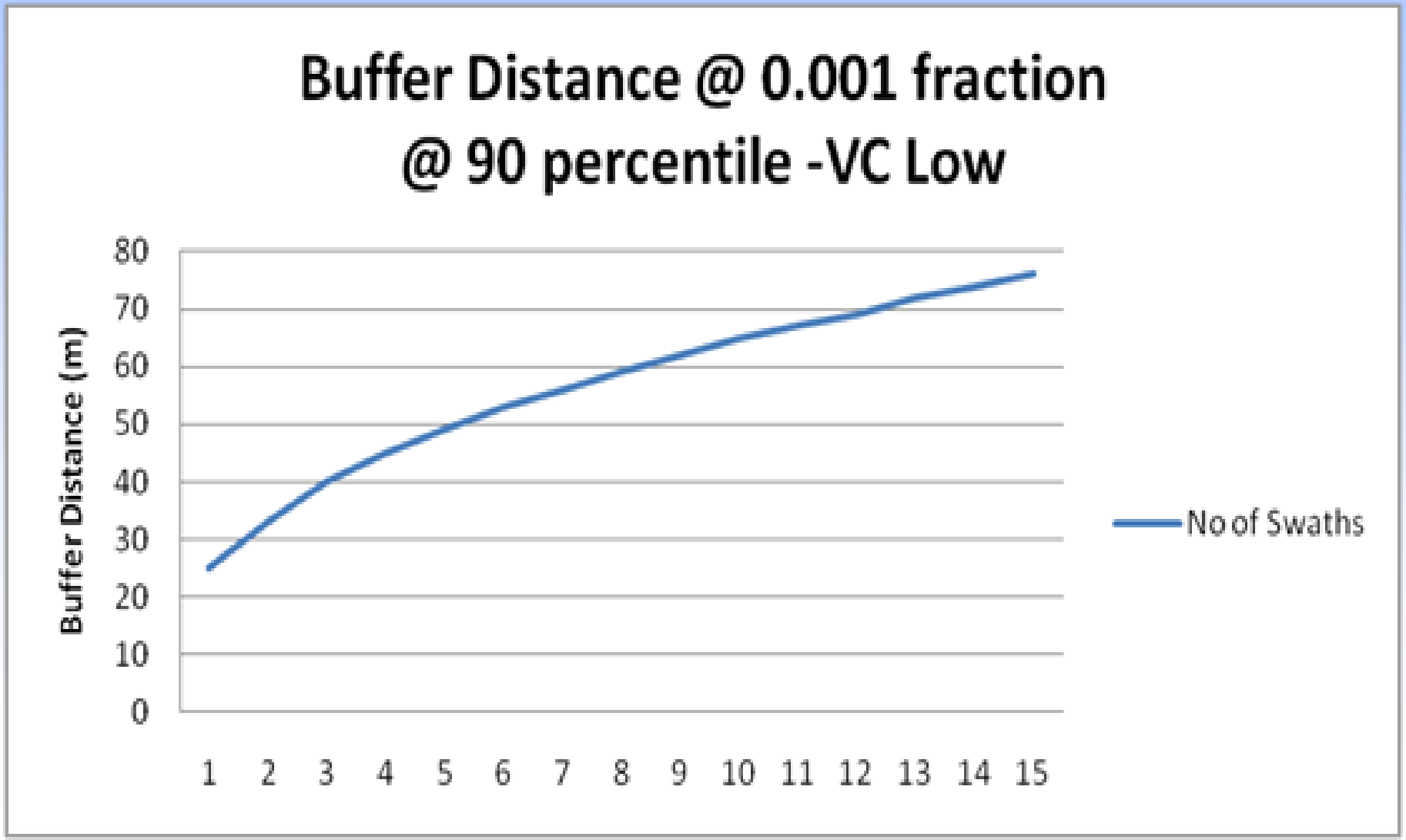
Buffer Zone Reduction Options

- Coarser sprays
- ?Narrower application areas (fewer swaths than the model default field width of ~300m)
- ?Boom height (fully-predictive models)
- ?Lower application rate than APVMA assumption of maximum label rate
- DRTs (APVMA welcomes data to support)
- ?Vegetative barriers

AgDRIFT Coarsest Spray 90th Percentile Low Boom



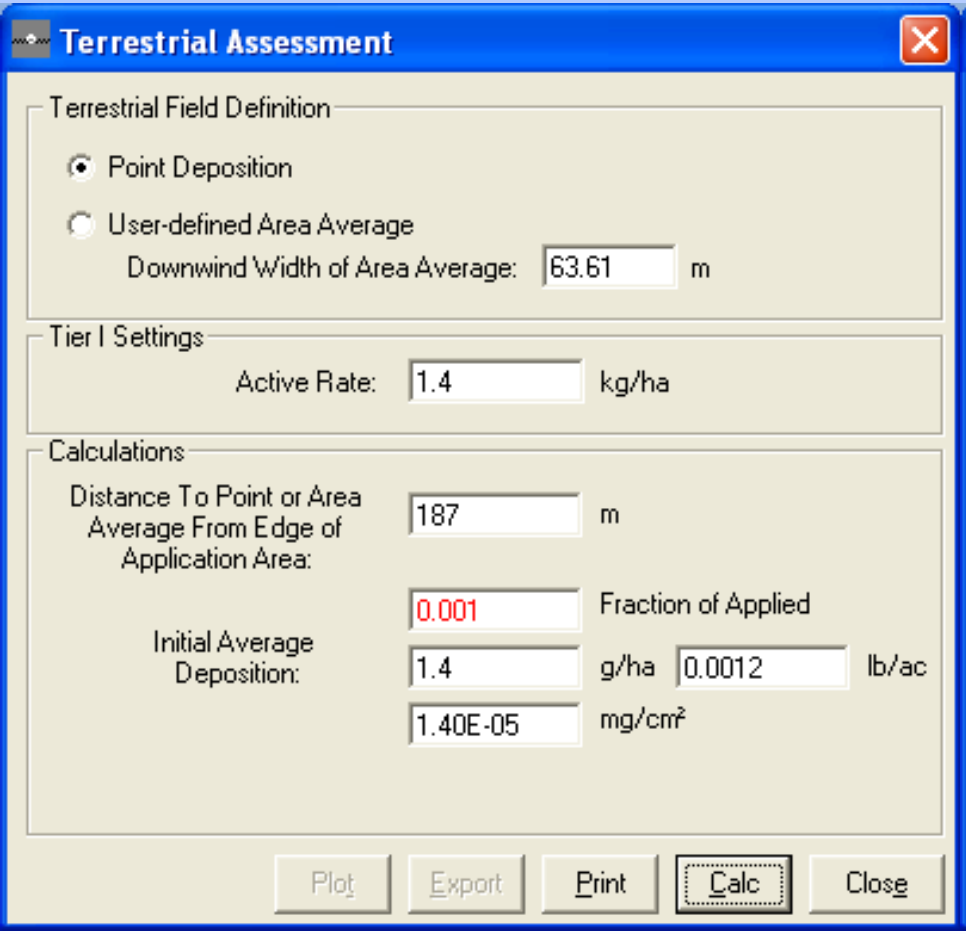
Interim Ground Model: Number of Swaths

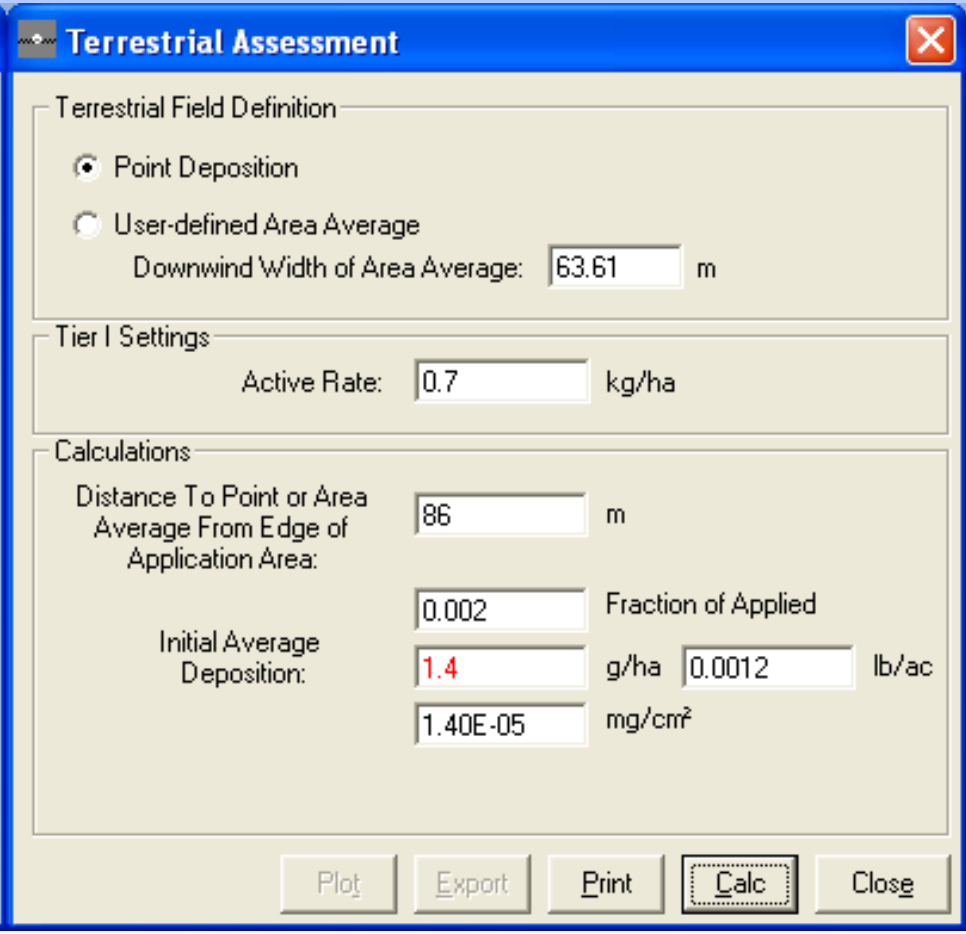


Application Rate (A.I. Rate)

- In AgDRIFT Ground, the shortest no spray buffer zone we can get for 2,4-D if the applied rate is 1.4kg/ha would be 190m
- If we apply 2,4-D at half that rate (i.e. 0.7kg/ha), then the no spray zone is less than half the full rate case – i.e. 90m

Example of 2,4-D Rate Reduction from 1.4 to 0.7kg/ha Giving Half the Buffer for LOC=1.4g/ha





DRTs

- Most DRTs can be easily tested in wind tunnels (e.g. nozzles, adjuvants, PWM, etc)
- A few DRTs may require field testing (e.g. entire sprayers)
- Bridging European data to Australian conditions for buffer zone reduction

Canadian Studies with Shrouds and Cones

- Drift reduction between 25-83% for shrouds and 15% for cones
- Old data – we have tested some newer systems which perform even better

Canadian Glyphosate Label

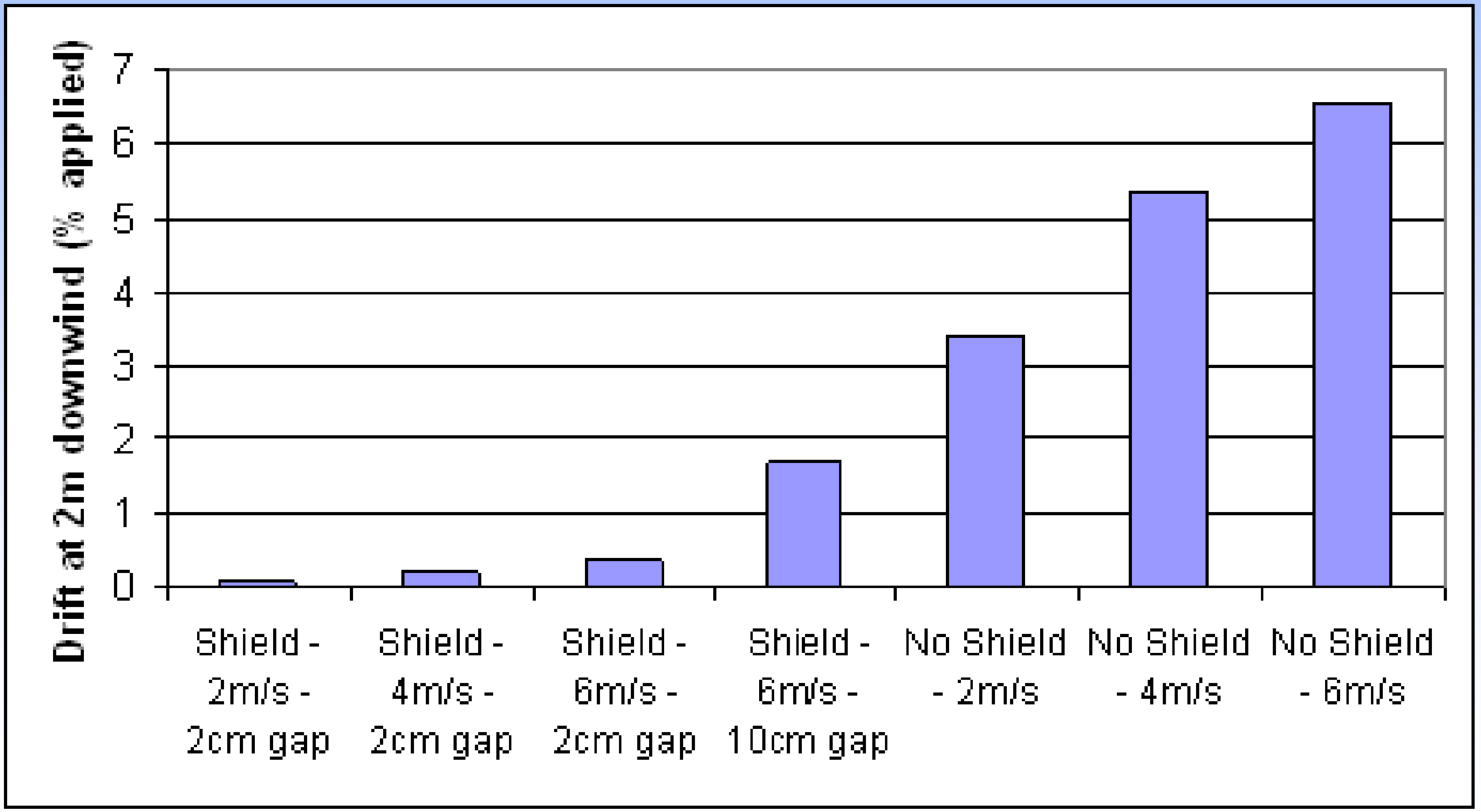
iii) Buffer Zones

The buffer zones specified in the table below are required between the point of direct application and the closest downwind edge of sensitive terrestrial habitats (such as grasslands, forested areas, shelter belts, woodlots, hedgerows, pastures, rangelands and shrublands), and sensitive aquatic habitats (such as lakes, rivers, sloughs, ponds, prairie potholes, creeks, marshes, streams, reservoirs, and wetlands). Do not contaminate these habitats when cleaning and rinsing spray equipment or containers.

Method of Application	**Buffer Zones (metres) required for protection of:**	
	Aquatic Habitat	**Terrestrial Habitat**
Field sprayer*	15	15
Aerial (preharvest only)	25	55

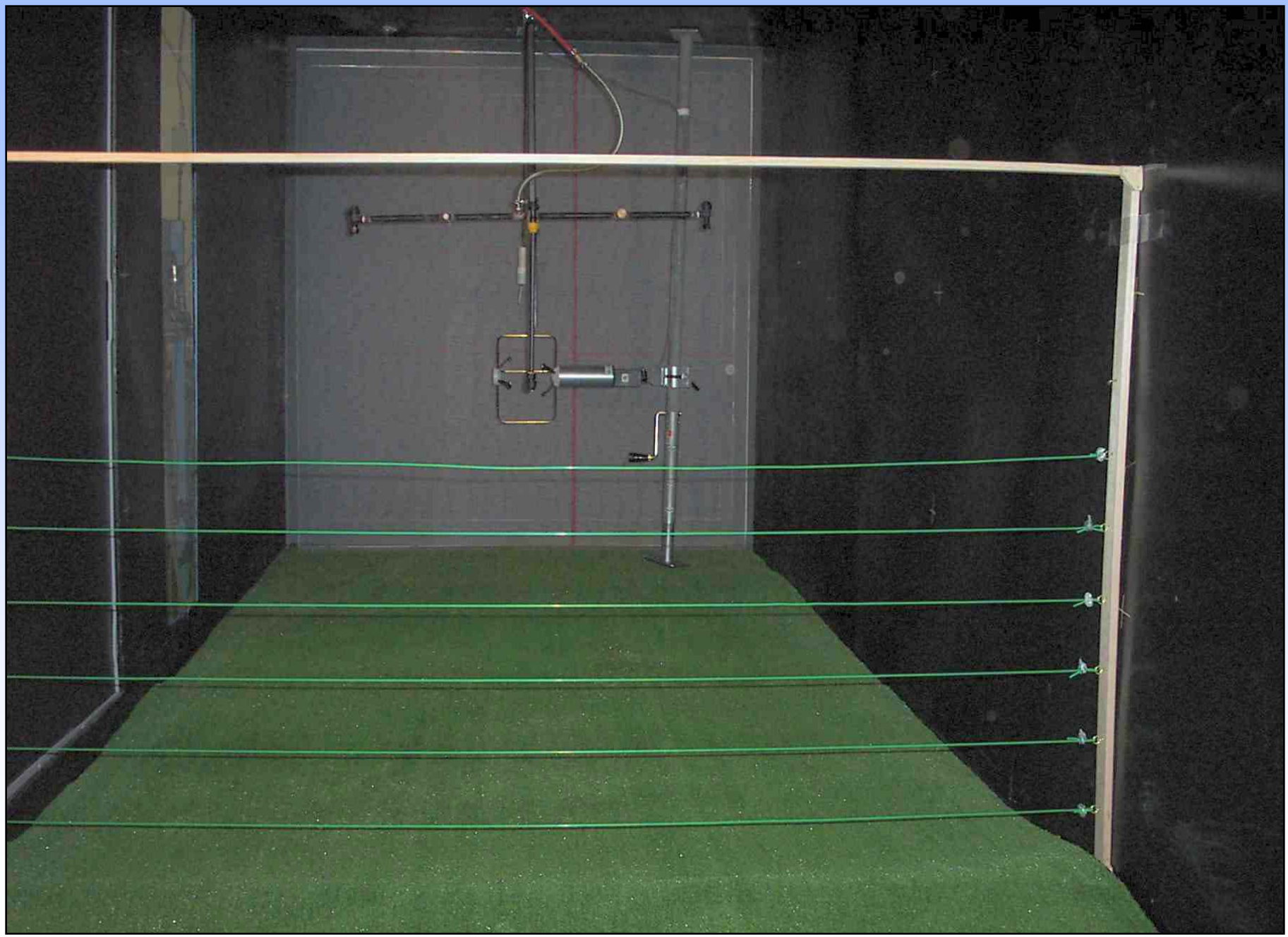
*For field sprayers, buffer zones can be reduced by 70% when using shrouds or 30% when using cones. When a tank mixture is used, consult the labels of the tank-mix partners and observe the largest (most restrictive) buffer zone of the products involved in the tank mixtures.

Wind Tunnel Shielded Sprayer Study

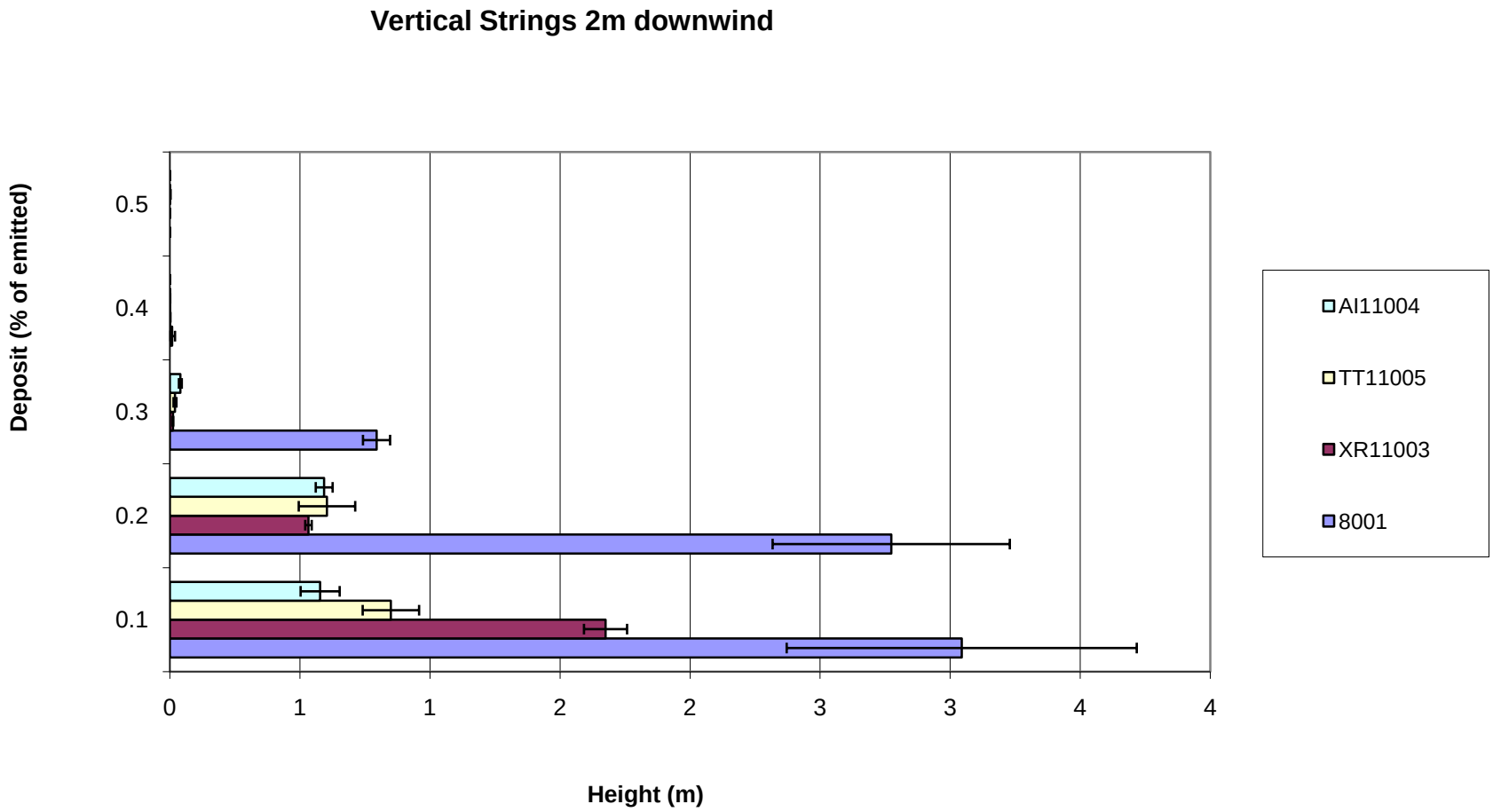


Bridging International Data to Australian Conditions

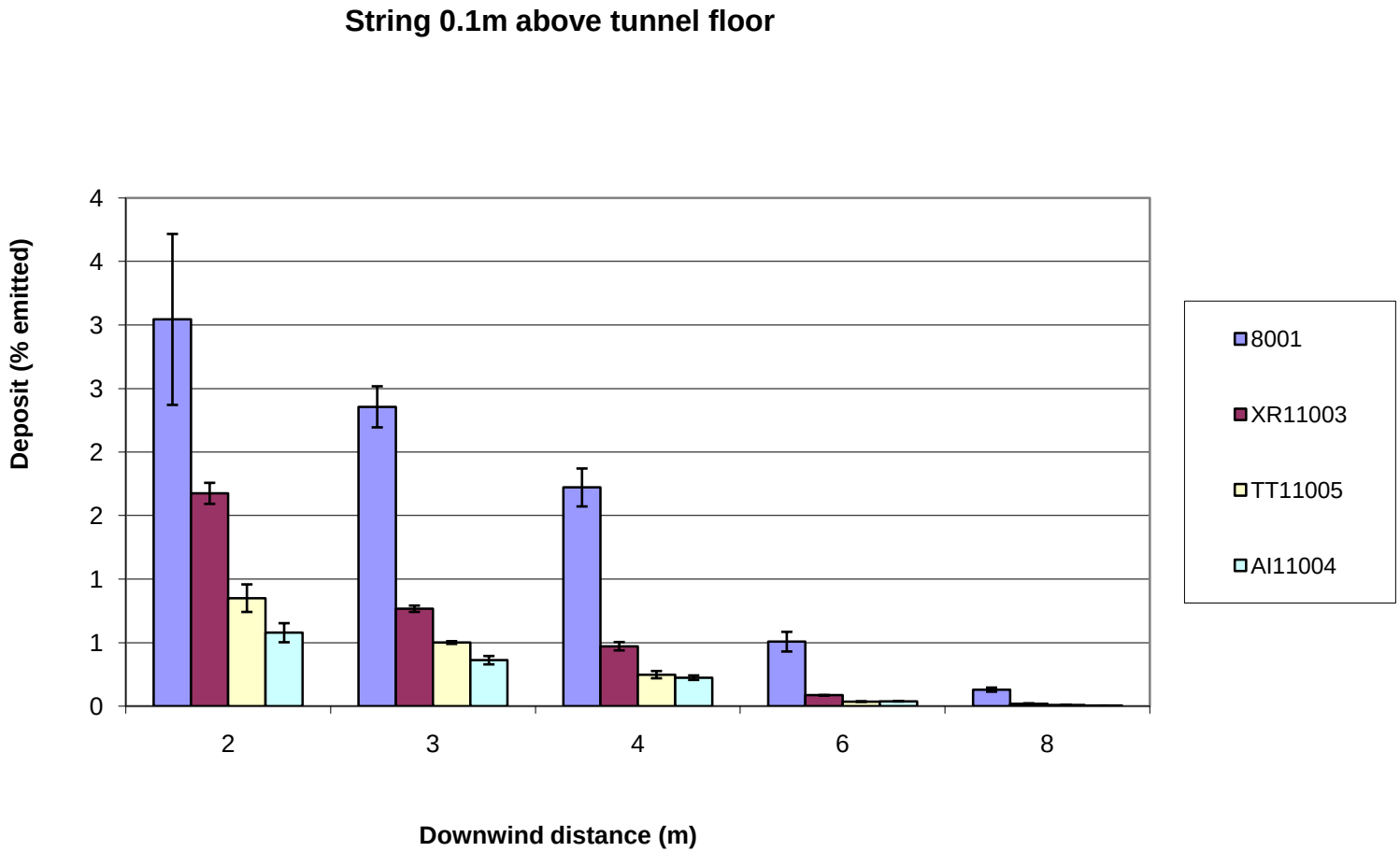
- Tested Australian tank mixes in wind tunnel using same nozzles as in Canadian studies
- Measured droplet size with lasers
- Drift potential calculated from deposition measurements on monofilament collectors



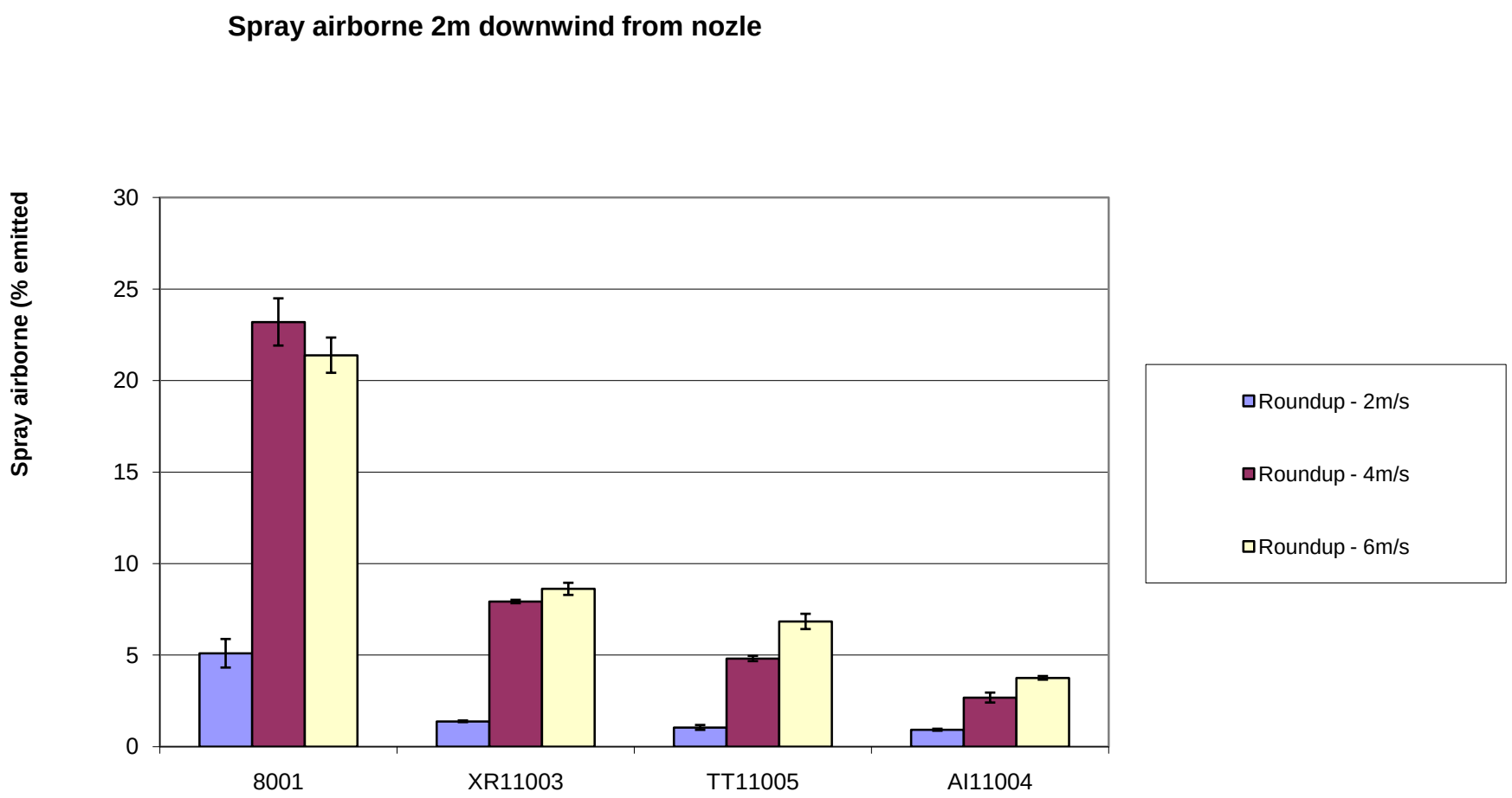
Airborne Drift at 2m



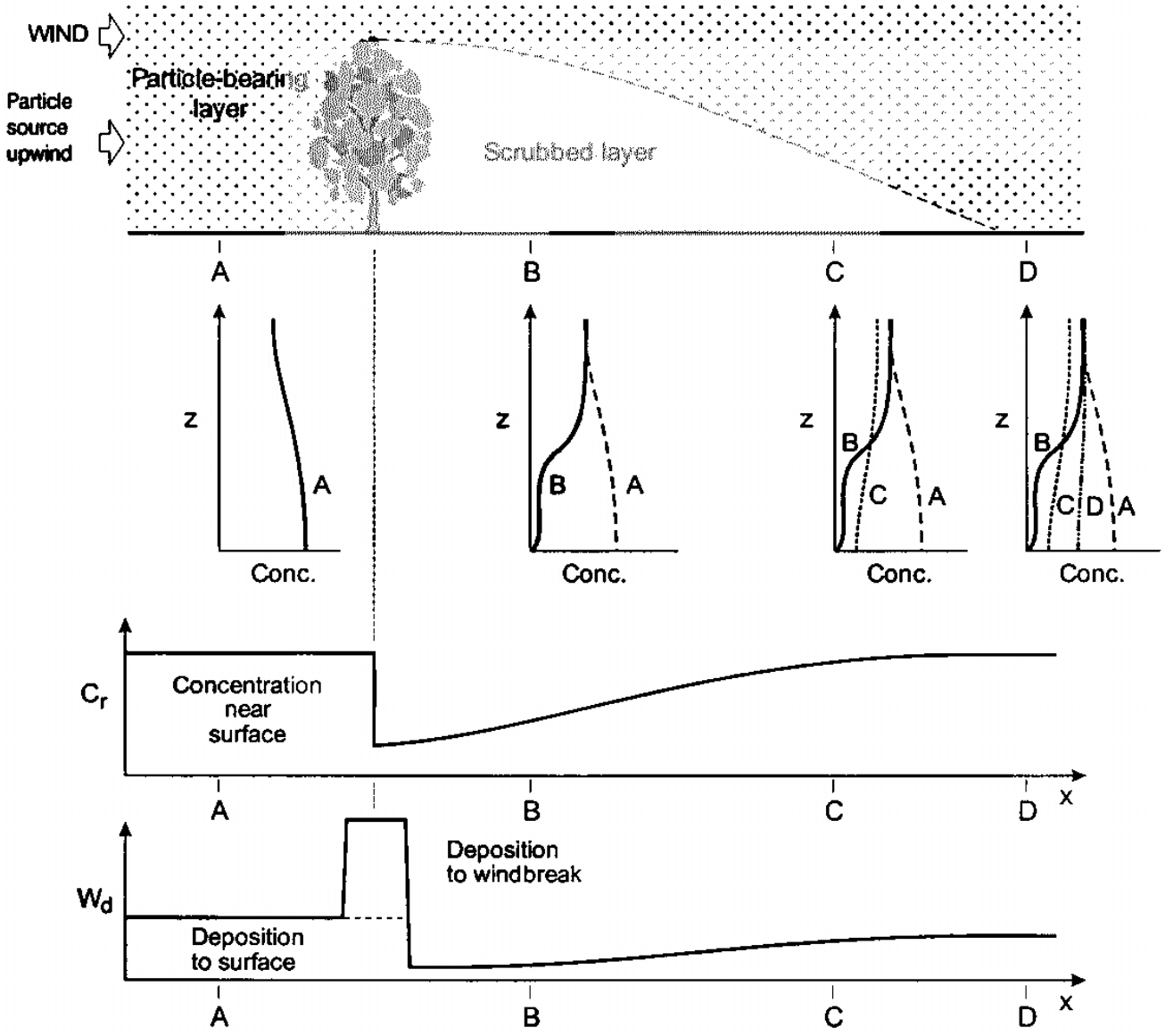
Deposition Downwind of Nozzle



Effect of Wind Speed on Drift

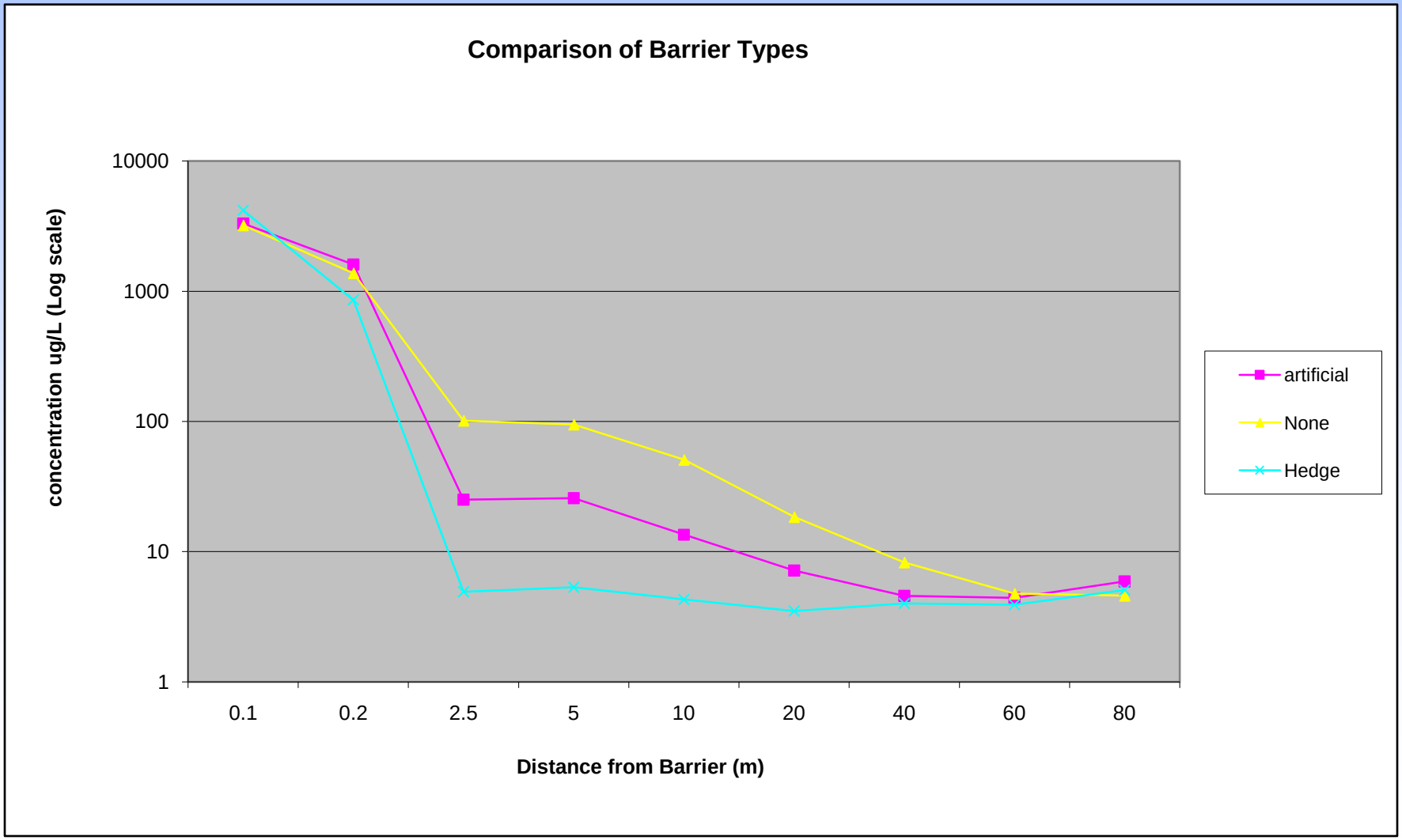


Hedges and The Rural/Urban Interface

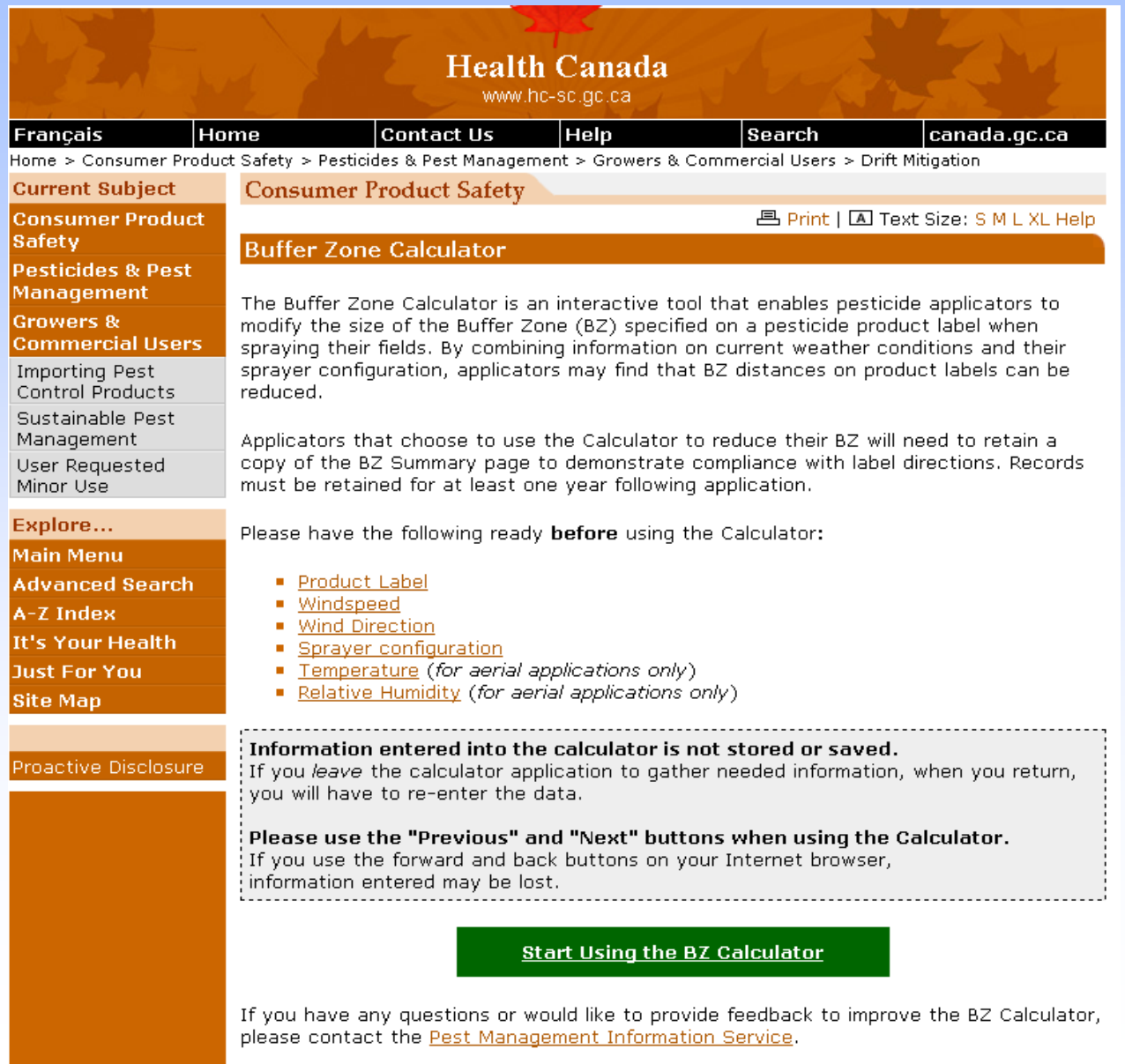

WIND
Particle source upwind
Particle-bearing layer
Scrubbed layer
A
B
C
D
z
Conc.
C_r
Concentration near surface
x
W_d
Deposition to windbreak
Deposition to surface

Vineyard Buffer Study

Different sprayers; different barriers



Canadian Buffer Zone Calculator



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Home > Consumer Product Safety > Pesticides & Pest Management > Growers & Commercial Users > Drift Mitigation

Current Subject
- Consumer Product Safety
- Pesticides & Pest Management
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- User Requested Minor Use

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Buffer Zone Calculator

The Buffer Zone Calculator is an interactive tool that enables pesticide applicators to modify the size of the Buffer Zone (BZ) specified on a pesticide product label when spraying their fields. By combining information on current weather conditions and their sprayer configuration, applicators may find that BZ distances on product labels can be reduced.

Applicators that choose to use the Calculator to reduce their BZ will need to retain a copy of the BZ Summary page to demonstrate compliance with label directions. Records must be retained for at least one year following application.

Please have the following ready **before** using the Calculator:

- Product Label
- Windspeed
- Wind Direction
- Sprayer configuration
- Temperature (*for aerial applications only*)
- Relative Humidity (*for aerial applications only*)

Information entered into the calculator is not stored or saved.
If you *leave* the calculator application to gather needed information, when you return, you will have to re-enter the data.

Please use the "Previous" and "Next" buttons when using the Calculator.
If you use the forward and back buttons on your Internet browser, information entered may be lost.

Start Using the BZ Calculator

If you have any questions or would like to provide feedback to improve the BZ Calculator, please contact the Pest Management Information Service.

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Main Menu
Advanced Search
A-Z Index
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Site-Specific Buffer Zone Calculator

Profile

Date: * 2010-06-16

Applicator and Business Name: * Agri-Sprayers Inc.

Applicator Certification No.: 10011101

Land Description: * Kuchnicki Acres, R.R. #1 Renfrew

Crop and Growth Stage: Corn, 3rd Tiller

Product Name: * Killemdead Herbicide

PCP Registration No.: * 10001

Application Technique: * Field Sprayer

Habitats for Buffer Zone Protection

Select all sensitive habitat types that are either within, or adjacent to your planned spray area. *

- [x] Freshwater body < 1 m deep (e.g. small pond, creek, seasonal wetland, etc.)
- [x] Freshwater body > 1 m deep (e.g., large pond, lake, river, slough, permanent wetland, etc.)
- [ ] Marine water body < 1 m deep
- [ ] Marine water body > 1 m deep
- [x] Terrestrial vegetation (e.g., shelterbelt, windbreak, forest, grasslands, etc.)

Meteorological Conditions (Field Sprayer)

Application Start Time: 08:00

Windspeed (km/h): * 1-8

Wind direction: * North West - 315°

next

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Main Menu
Advanced Search
A-Z Index
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Field Sprayer Module

Buffer Zone on Label

Freshwater habitat < 1 m deep: *	60
Freshwater habitat > 1 m deep: *	20
Terrestrial habitat: *	25

Sprayer Configuration

Equipment type: *	Standard boom sprayer	
Spray Quality on Label: *	Medium	
Spray Quality at Application: *	Coarse	
Boom height (m): *	0.5	
Product application rate:	1.5 L/ha	
Carrier (water) volume (L/ha):	200 L/ha	
Nozzle:	Turbo TeeJet TT11002	
Nozzle flow rate (L/minute):	0.4	
Boom pressure:	40	psi
Tractor speed:	10	km/h

next

Current Subject
About Health Canada
Accountability, Performance & Financial Reporting
Activities & Responsibilities
Branches & Agencies
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Media Room
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Legislation & Guidelines
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Main Menu
Advanced Search
A-Z Index
It's Your Health
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Your Results

Site-Specific Sprayer Buffer Zones

Freshwater habitat < 1 m deep: 6

Freshwater habitat > 1 m deep: 2

Terrestrial habitat: 3

Revise your information

Print or Save your Results

These are the buffer zones that can now be used according to the application conditions you have specified in this calculator. Buffer zones are for habitats downwind of your spraying area only. You **must** retain a copy of this output for your files for at least one year from the time of application.

Help on accessing alternative formats, such as Portable Document Format (PDF), Microsoft Word and PowerPoint (PPT) files, can be obtained in the alternate format help section.

(PDF Version - 3 K)

Revise your information

Page 1

Profile

Date: 2010-06-16
Applicator and Business Name: Agri-Sprayers Inc.
Land Description: Kuchnicki Acres, R.R. #1 Renfrew ON, Lot#3
Crop and growth stage: Corn, 3rd Tiller
Product Name: Killemdead Herbicide
PCP Registration No.: 10001
Application Technique: field

Record of Site-Specific Buffer Zone Modifications

Applicator and Business Name	Agri-Sprayers Inc.		
Land Description	Kuchnicki Acres, R.R. #1 Renfrew ON, Lot#3		
Crop and growth stage	Corn, 3rd Tiller		
Product Name	Killemdead Herbicide	**Registration No.**	10001
Application Date	2010-06-16	**Application Technique**	field
Application notes:			

Buffer Zones from Product Label

Freshwater body	less than 1 m deep	60 m	greater than 1 m deep	20 m
Marine water body	less than 1 m deep		greater than 1 m deep	
Terrestrial area		25 m		

Spayer Configuration

Equipment/Sprayer type	Standard	**Nozzle type**	Turbo TeeJet TT11002
Nozzle deflection (aerial only)		**Carrier (water) volume**	200 L/ha L/ha
Product application rate	1.5 L/ha L/ha or g/ha		
ASAE Spray Quality			
On Product Label:	Medium	**At Application:**	Coarse
Boom pressure	40 psi	**Boom height**	0.5 m
Tractor speed or Air speed	10 km/h		

Meteorological Conditions

Start time	08:00	**Wind speed**	1-8 km/h	**Direction**	North West
Temperature (aerial only)			**Relative humidity (aerial only)**		

Your Modified Site-Specific Buffer Zones

Freshwater body	less than 1 m deep	6 m	greater than 1 m deep	2 m
Marine water body	less than 1 m deep		greater than 1 m deep	
Terrestrial area		3 m		

2010-06-08 - 11:10

Conclusions

- Drift management can be achieved through: Appropriate nozzle/ adjuvant selection and use (fewer fines)
  Lower boom heights
  Avoiding high wind speeds toward sensitive areas
  DRTs such as shielded sprayers
  Avoiding local surface temperature inversions
  Vegetative barriers
  Spraying narrower blocks
  (Possibly lower dosage rates)
  (Safer spraying, certification, calibration, national sprayer testing scheme proposal)

Conclusions

- For risk assessors, new modeling approaches are considering DRTs as well as conventional application systems and we are developing techniques that will be set as standards for any qualified researcher to then collect data to populate the AgDRT libraries
- In the interim, field curve-fits will offer more options for Australian ground applications

Conclusions

- Nozzles and adjuvants should be developed for compatibility to offer drift management without compromise on spray pattern (e.g. spray angle), coverage and efficacy
- We need more models for predicting droplet size and tools for validating/ controlling droplet size in the field in real time (e.g. working with UC Davis on sensor systems)

Conclusions

- Considering proposal for Canadian-type buffer zone reduction scheme for Australia and collaboration across several countries (US, NZ, AU and CA)