PMRA Update
Vegetative Filter Strips

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Health Canada
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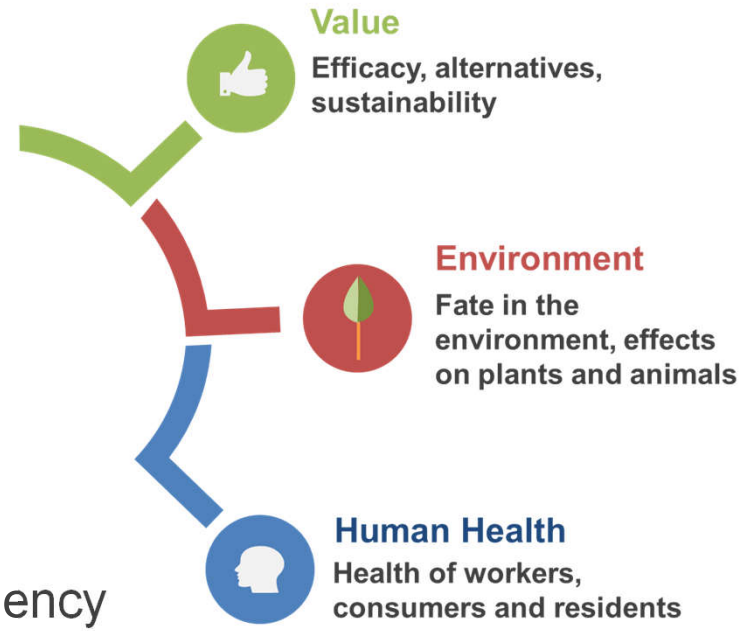
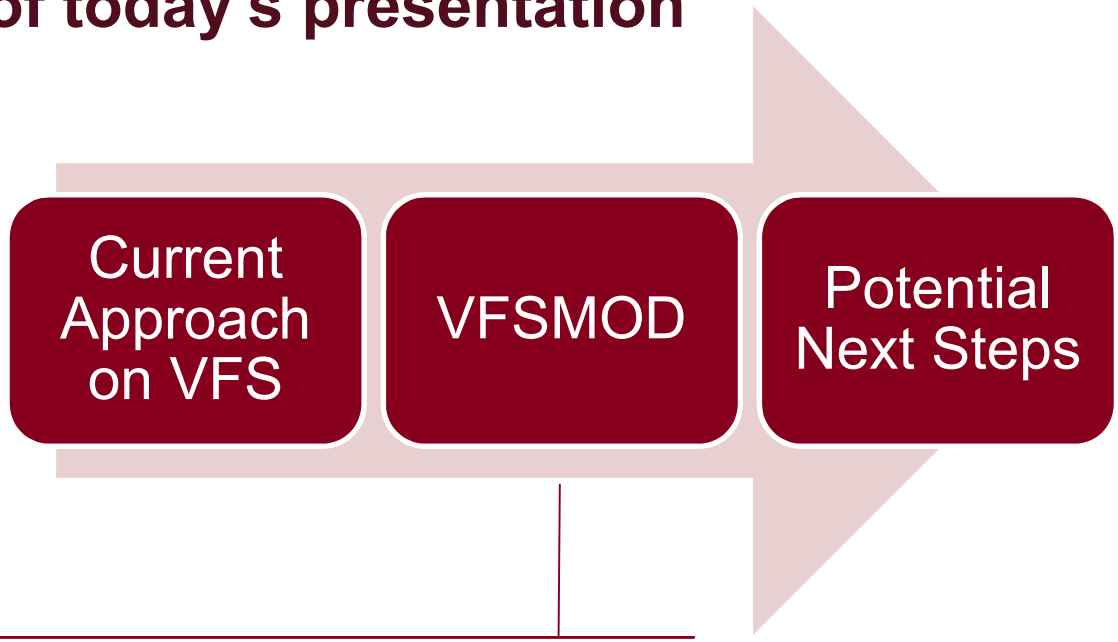
Santé Canada Health Canada

Canada



- Pest Management Regulatory Agency
- Branch of Health Canada
- Regulates pesticide use in Canada
- Under the authority of the Pest Control Products Act
- Approx. 450 employees (~330 scientists)
- **No research**

Outline of today's presentation



During the first VFS workshop, PMRA agreed to explore how VFSMOD could be used in the regulatory context.

Current Approach on VFS

- VFS are mentioned on the label of all pesticides used in the field.
- VFS may be recommended as a best practice to reduce runoff (non enforceable) or may be mandatory (enforceable).
- Few pesticides have a mandatory VFS (n < 10).
- At this time, PMRA requires a mandatory VFS for persistent and highly sorptive pesticides when risk to aquatic non-target organisms from runoff has been identified and there is supporting information to demonstrate that a VFS would effectively mitigate the risks.
- The width of the mandatory VFS is 10 metres, perpendicular to the bank of any down-gradient surface water aquatic habitat.
- The 10m width was determined first for permethrin and was carried over to other pesticides on a case-by case basis.

The rationale behind the 10m width is provided in the re-evaluation decision document for permethrin (RVD2019-11, pages 18 - 19):

A detailed analysis of the literature by Health Canada (see below) provides clear evidence that a 10 m VFS is expected to provide adequate risk mitigation for aquatic organisms from bound pesticides (such as permethrin) in runoff across Canada.

Robinson *et al.* (1996) examined 13 natural rainfall events that ranged from low to very high intensity. High levels of pesticide would be expected to be carried to aquatic habitats during very high rainfall events, categorized in this study as rainfall amounts of 18 to 72 mm within no set timeframe. The study determined that during these high intensity rainfall events, 3, 6 and 9 m VFSs retained approximately 50, 75 and >95%, respectively, of soil in the resulting runoff from a 7% slope. Assuming soil and pesticide (permethrin) losses are proportional, a 50 to 75% reduction (from 3 and 6 m VFSs) in the aquatic EECs from runoff would still result in exceedance of the level of concern for aquatic organisms; however, the level of concern would not be exceeded for aquatic organisms using a 9 m VFS.

Although there was >95% retention of soil in this study using a 9 m VFS, rainfall intensity and duration, soil characteristics and increased slope could result in decreased retention under the variety of Canadian conditions. Therefore, a 10-m VFS is expected to be protective of sensitive aquatic species.

Abu-Zreig *et al.* (2004) studied soil retention of various width VFS (2, 5, 10, and 15 m) and different slopes (2.3 and 5%) in Guelph, Ontario. The authors concluded that the width of the VFS was the predominant factor affecting soil deposition, at least up to 10 m. Syversen (2005) studied soil retention in 5 m and 10 m wide VFS in southern Norway and found that the 10 m wide VFS retained significantly more soil than the 5-m wide VFS. Both of these studies conclude that a VFS with a width of 10 m trapped significantly more soil than VFSs of smaller widths. Health Canada is aware of only two studies that studied the effects of VFS on permethrin concentrations in runoff. One of those studies (Moore *et al.* 2014) examined much larger VFS sizes (16 and 47 m). The other, Schmitt *et al.* (1999), found that permethrin concentrations were reduced in runoff by 36% using a 7.5 m wide VFS and by 66% using a 15 m wide VFS on slopes of 6 to 7%.

Best Practice

Under ENVIRONMENTAL PRECAUTIONS:

To reduce runoff from treated areas into aquatic habitats avoid application to areas with a moderate to steep slope, compacted soil, or clay.

Avoid application when heavy rain is forecast.

Contamination of aquatic areas as a result of runoff may be reduced by including a vegetative filter strip between the treated area and the edge of the water body.

Mandatory

Under ENVIRONMENTAL PRECAUTIONS:

To reduce runoff from treated areas into aquatic habitats, avoid application to areas with a moderate to steep slope, compacted soil, or clay.

Avoid application when heavy rain is forecast.

To reduce risk to aquatic organisms from run-off, a vegetative filter strip of at least 10 metres wide between the field edge and adjacent, downhill aquatic habitats must be observed, as specified under DIRECTIONS FOR USE.

Under DIRECTIONS FOR USE:

A Vegetative Filter Strip (VFS) of at least 10 metres wide must be constructed and maintained. The VFS is required between the field edge and adjacent, downhill aquatic habitats to reduce risk to aquatic organisms from run-off. Aquatic habitats include, but are not limited to, lakes, reservoirs, rivers, permanent streams, marshes or natural ponds, and estuaries.

The VFS is to be composed of grasses and may also include shrubs, trees, or other vegetation. Additional guidance can be found on the PMRA Environmental Risk Mitigation webpages.

Both VFS and spray drift buffer zones must be observed.

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Vegetative Filter Strips

Vegetative filter strips are a tool to protect surface waters from pesticide runoff. Learn about the construction, maintenance and use of vegetative filter strips, and the difference between a vegetative filter strip and spray buffer zones.

Vegetative Filter Strips vs. Spray Buffer Zones

A vegetative filter strip and a spray buffer zone are different ways to protect the environment. However, they are complimentary to one another and can be used together to protect non-target habitats.

Vegetative Filter Strips

A vegetative filter strip is a permanently vegetated strip of land. It sits between an agricultural field and downslope surface waters. Vegetative filter strips reduce the amount of pesticide entering surface waters from runoff by slowing runoff water and filtering out pesticides carried with the runoff. Certain pesticide labels will require a vegetative filter strip, other labels will recommend a vegetative filter strip as a best management practice. Read the label for specific instructions on vegetative filter strips.

Spray Buffer Zones

Spray buffer zones are required at the time of application between the area being treated and the closest downwind edge of a sensitive aquatic or terrestrial habitat. Spray buffer zones reduce the amount of spray drift that enters non-target habitats. The size of the spray buffer zone depends on the product used and the crop. Read the pesticide label for the specific spray buffer zone size.

Always read the pesticide label before handling.

Construction and Maintenance of Vegetated Filter Strips

Vegetative Filter Strip Construction

- A vegetative filter strip is constructed along the downslope edge of an agricultural field where it meets a surface water body.
- It must be at least 10 m wide from edge of field to the surface water body (see diagram on back).
- It must be composed of grasses, but may also contain other vegetation (shrubs, trees, etc.).
- Vegetation should be:
  - perennial
  - long-lived
  - hardy
  - stiff stemmed
  - deep rooted
  - native (when possible).

Vegetative Filter Strip Maintenance

- The strip should be mowed occasionally, with grass being at least 15 cm high to maintain effectiveness.
- Avoid soil compaction, do not drive heavy machinery over strip.
- The filter strip should be checked regularly for bare spots, especially after heavy rainfall, irrigation and snowmelt. Damaged areas should be repaired.
- Built up soil should be removed from the strip.

For more information

Environmental Risk Mitigation: https://www.canada.ca/en/health-canada/services/consumer-product-safety/pesticides-pest-management/growers-commercial-users/environmental-risk-mitigation.html.

OR search for PMRA pesticide environmental risk mitigation using your preferred search engine.

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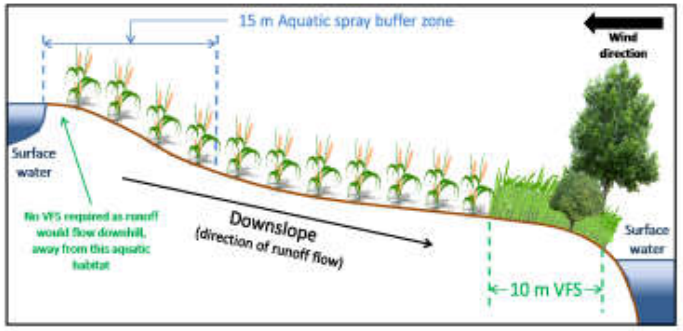
Examples of Vegetative Filter Strip and Spray Buffer Zone Use

In these examples, it is assumed that the pesticide being applied requires a spray buffer zone of 15 m to protect sensitive aquatic habitats and a mandatory vegetative filter strip. The spray buffer zone is only required at the time of application between the area being treated and the closest downwind edge of a sensitive habitat.

Diagram 1 – wind direction is blowing to the left:

- A 15m aquatic spray buffer zone is at the top of the hill, protecting the aquatic habitat to the left of the field.
- A spray buffer zone would not be required on the right hand side as the wind is blowing to the left.
- A 10 m wide vegetative filter strip is needed on the downslope edge of the field next to the water body.



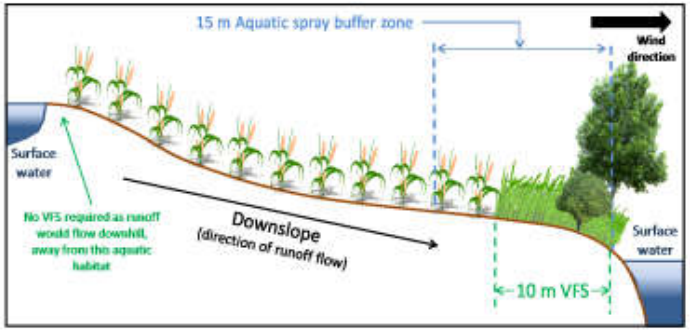


Diagram 2 – the wind direction is blowing to the right:

- A 15 m aquatic spray buffer zone is on the right hand side, protecting the aquatic habitat to the right of the field.
- A 10 m vegetative filter strip is needed on the downslope edge of the field next to the water body.
- In this example, as the 10m vegetative filter strip is within the 15m aquatic spray buffer zone, only 5m of the crop would need to be left unsprayed to comply with the requirement for a 15 m spray buffer zone.

The current PMRA recommendation is that terrestrial buffer zones do not apply to vegetated filter strips unless there is a pre-existing sensitive terrestrial habitat within them. However, care must be taken when applying herbicides to adjacent fields.

To Find the Most Current Labels: http://pr-rp.hc-sc.gc.ca/ls-re/index-eng.php
OR Search the words **PMRA Label Search** using you preferred search engine
Download the app: https://www.canada.ca/en/health-canada/services/consumer-product-safety/pesticides-pest-management/registrants-applicants/tools/pesticide-label-search.html
The FREE Pesticide Labels App is available for iOS, Android & the Amazon App Store for Blackberry or scan the QR code from your device.

Available at amazon — GET IT ON Google play — Download on the App Store

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- A VFS is a permanently vegetated strip of land constructed along the downslope edge of a field, where it meets the water body
- Not the same as a buffer zone

Examples of Vegetative Filter Strip and Spray Buffer Zone Use

In these examples, it is assumed that the pesticide being applied requires a spray buffer zone of 15 m to protect sensitive aquatic habitats and a mandatory vegetative filter strip. The spray buffer zone is only required at the time of application between the area being treated and the closest downwind edge of a sensitive habitat.

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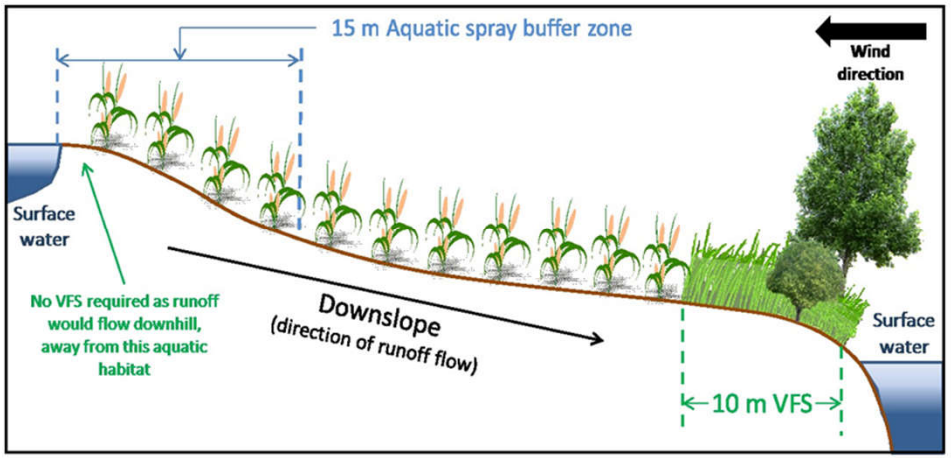

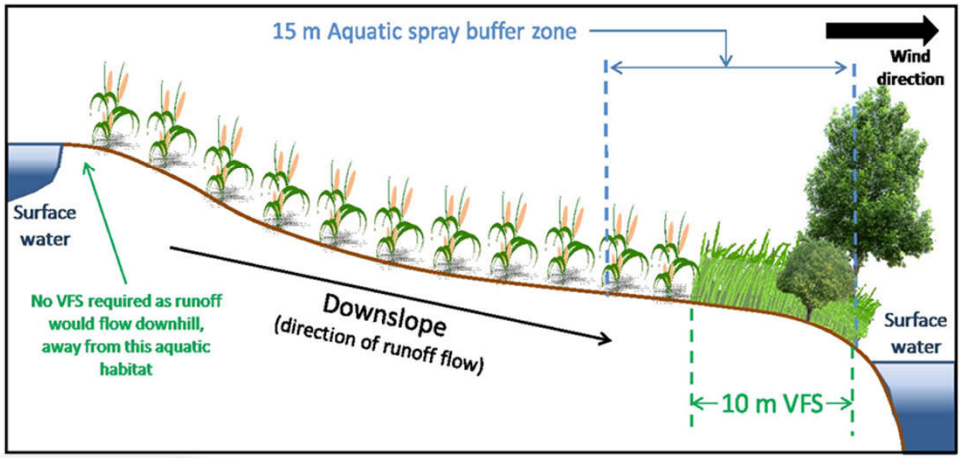

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The current PMRA recommendation is that terrestrial buffer zones do not apply to vegetated filter strips unless there is a pre-existing sensitive terrestrial habitat within them. However, care must be taken when applying herbicides to adjacent fields.

- While VFS are permanent, the location of buffer zones depend on wind direction
- Aquatic buffer zones and VFS are not additive
- Terrestrial buffer zones do not apply to VFS

Construction and Maintenance of Vegetated Filter Strips

Vegetative Filter Strip Construction

- A vegetative filter strip is constructed along the downslope edge of an agricultural field where it meets a surface water body.
- It must be at least 10 m wide from edge of field to the surface water body (see diagram on back).
- It must be composed of grasses, but may also contain other vegetation (shrubs, trees, etc.).
- Vegetation should be:
  - perennial
  - long-lived
  - hardy
  - stiff stemmed
  - deep rooted
  - native (when possible).

Vegetative Filter Strip Maintenance

- The strip should be mowed occasionally, with grass being at least 15 cm high to maintain effectiveness.
- Avoid soil compaction, do not drive heavy machinery over strip.
- The filter strip should be checked regularly for bare spots, especially after heavy rainfall, irrigation and snowmelt. Damaged areas should be repaired.
- Built up soil should be removed from the strip.

- Simple advice on design and maintenance

Health Canada

Vegetative Filter Strips for the Protection of Surface Waters from Pesticide Runoff

Canada

Ross Breckels, Tim MacDonald, and Mélanie Whiteside

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Email: ross.breckels@canada.ca

Introduction

Issue: The health of aquatic habitats is declining. Water monitoring data suggests that concentrations of certain pesticides in surface waters present concerns to aquatic organisms.

Risk assessments conducted by Health Canada consider spray drift and runoff as typical routes of entry into surface waters.

Spray buffer zones are a widely used mitigation measure to reduce drift; pesticide labels include few mitigation measures to reduce runoff.

New mitigation measure: Health Canada has implemented mandatory vegetative filter strips (VFS) for pesticides meeting specific criteria in an effort to further protect aquatic habitats from pesticide runoff.

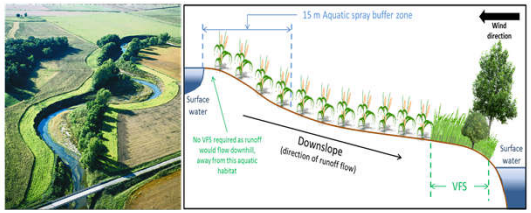
Vegetative Filter Strips

What: Permanent strip of dense perennial vegetation. Grass is required, but the strip may also contain other vegetation, such as shrubs and trees.

Where: Situated on the downslope edge of a field, plantation, woodlot, etc., along a surface water body.

Why: Reduces the amount of pesticide entering surface waters by slowing runoff water to allow suspended soil particles with bound pesticides to settle in the grass before reaching the water body.

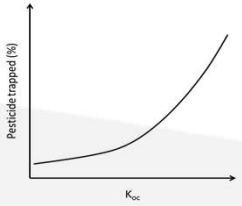
When: A requirement on the label of certain pesticides.



Pesticide Properties

Properties that make a pesticide a suitable candidate for a VFS include:

- High toxicity to aquatic organisms,
- Persistent,
- Low solubility, and
- High binding potential (K_{OC}).



Trapping Mechanisms

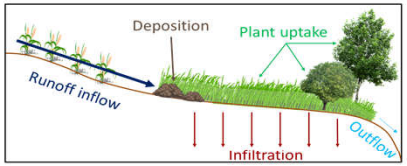
Strongly sorbed pesticides

Adsorption and deposition: Runoff is slowed by dense, mesh-like vegetation. When water travels at lower velocity, soil (and sorbed pesticides) settle out of suspension and are deposited in the VFS (i.e., the strip acts as a "filter").

Weakly sorbed pesticides

Infiltration: Runoff water penetrates and is retained in the soil. Influenced by plant roots and soil texture (coarser textures leads to higher rates of infiltration).

Plant uptake: Runoff water is taken up by plants, where pesticides can accumulate, be converted to volatile forms, or broken down by enzymes.



Design & Construction Considerations

Many factors affect the efficacy of a VFS.

Some site-specific factors cannot be controlled, such as

- Climate (precipitation), size and slope of adjacent area, soil characteristics, distance to groundwater, etc.

Other factors we can control, such as:

- Type of vegetation and width (perpendicular to the bank) of the strip.

Vegetation

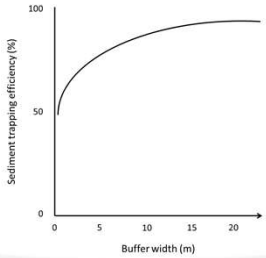
Type: A VFS should predominantly consist of grasses, but may also include other vegetation, such as shrubs and trees. Pre-existing sensitive habitat in the VFS can be preserved (i.e., do not cut down mature trees, incorporate them into the VFS).

Species: Optimal vegetation for a VFS is site-specific. Sturdy, tall, perennial grass with deep roots should be used. Natives should be used, when possible.

Age: Mature vegetation can be more effective.

Width

The wider the VFS, the more effective it will be. There is a trade-off between finding the optimal VFS width that ensures effective protection of aquatic habitats while maximizing arable land.



PMRA Recommendation

The PMRA requires mandatory VFSs for certain pesticides (high K_{OC}, low solubility, persistent) when a risk to aquatic non-target organisms from runoff has been identified and there is supporting information to demonstrate that a VFS would effectively mitigate the risks.

The width of the mandatory VFS is 10 m, perpendicular to the bank of any down-gradient surface water aquatic habitat (such as lakes, rivers, sloughs, ponds, prairie potholes, creeks, marshes, streams, reservoirs, wetlands, and estuarine/marine habitats), and extend for the whole length of the water body in the area to which the pesticide is being applied.

Other Jurisdictions

The required use of a VFS for pesticide mitigation is inconsistent around the world. Not all jurisdictions have adopted the use of VFS, the terminology is not always the same, and the recommended width also varies across jurisdictions. The 10 m width currently recommended by PMRA falls within other legislations.

Country	Legislations for pesticide use near surface water	Comments
PMRA, Canada	10 m VFS	Mandatory for certain pesticides only
PEI, Canada	15 m buffer zone (VFS)	Blanket statement for all contaminants
USA	3 m (10 ft) VFS (60 ft proposal)	On pesticide labels
Austria	1 to 3 m VFS	On pesticide labels
Denmark	2 to 10 m crop free zone*	Application restrictions
France	5 to 20 m VFS	On pesticide labels
Holland	0.25 m to 9 m crop free zone*	Application restrictions
Hungary	5 m VFS	Unclear
Italy	5 m VFS/riparian strip along rivers, streams and ditches	Less if water quality is sufficient'(3 m) to high (0 m)
Poland	20 m VFS; 5 m VFS along roads	Unclear
Slovakia	12 m VFS	Unclear
UK	2 m crop free zone*	Application restrictions
Sweden	6 m crop free zone proposal*	Would be on pesticide labels

*Assumed crop-free zone would be vegetated to some degree. Germany legislated 1 to 3 m spray free zone, unclear as to whether crops are allowed.

Future Directions

Work is underway to incorporate VFS modelling into risk assessments using VFSMOD. In the short term, modelling could help support the implementation of a 10 m VFS for highly sorptive pesticides without the need for field trials. The effectiveness of VFS for soluble pesticides could also be further explored with VFS modelling. Longer term directions include finding ways to incorporate site specific considerations to determine optimal VFS width.

TRAPPING MECHANISMS

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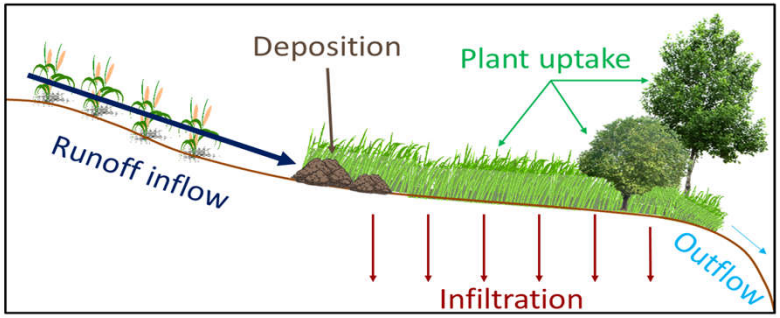

- Different mechanisms for sorptive vs. soluble pesticides
- Our current policy focuses only on highly sorptive pesticides

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- 10 m width falls within other national legislations
- Provincial requirements may differ from label requirements

FUTURE DIRECTIONS

Work is underway to incorporate VFS modelling into risk assessments using VFSMOD. In the short term, modelling could help support the implementation of a 10 m VFS for highly sorptive pesticides without the need for field trials. The effectiveness of VFS for soluble pesticides could also be further explored with VFS modelling. Longer term directions include finding ways to incorporate site specific considerations to determine optimal VFS width.

Modelling can be used to

- Confirm effectiveness without field data
- Explore effectiveness for soluble compounds
- Consider site specific parameters

Explorations with VFSMOD

Details in PMRA presentation by J. Westgate

Objective 1: Connect VFSMOD with PWC

Objective 2: Relevance of the 10m width

- For highly sorptive compounds that have a mandatory 10m VFS, does the modelling predict concentrations below the toxicity threshold with the VFS?
- Would a VFS < 10 metres also be effective?
- What about soluble compounds?
- How does the modelled reduction in exposure with a VFS compare with data from our literature search?

Objective 3: Sensitivity analysis

- What are the important factors to consider when modelling, but also when thinking about field implementation?

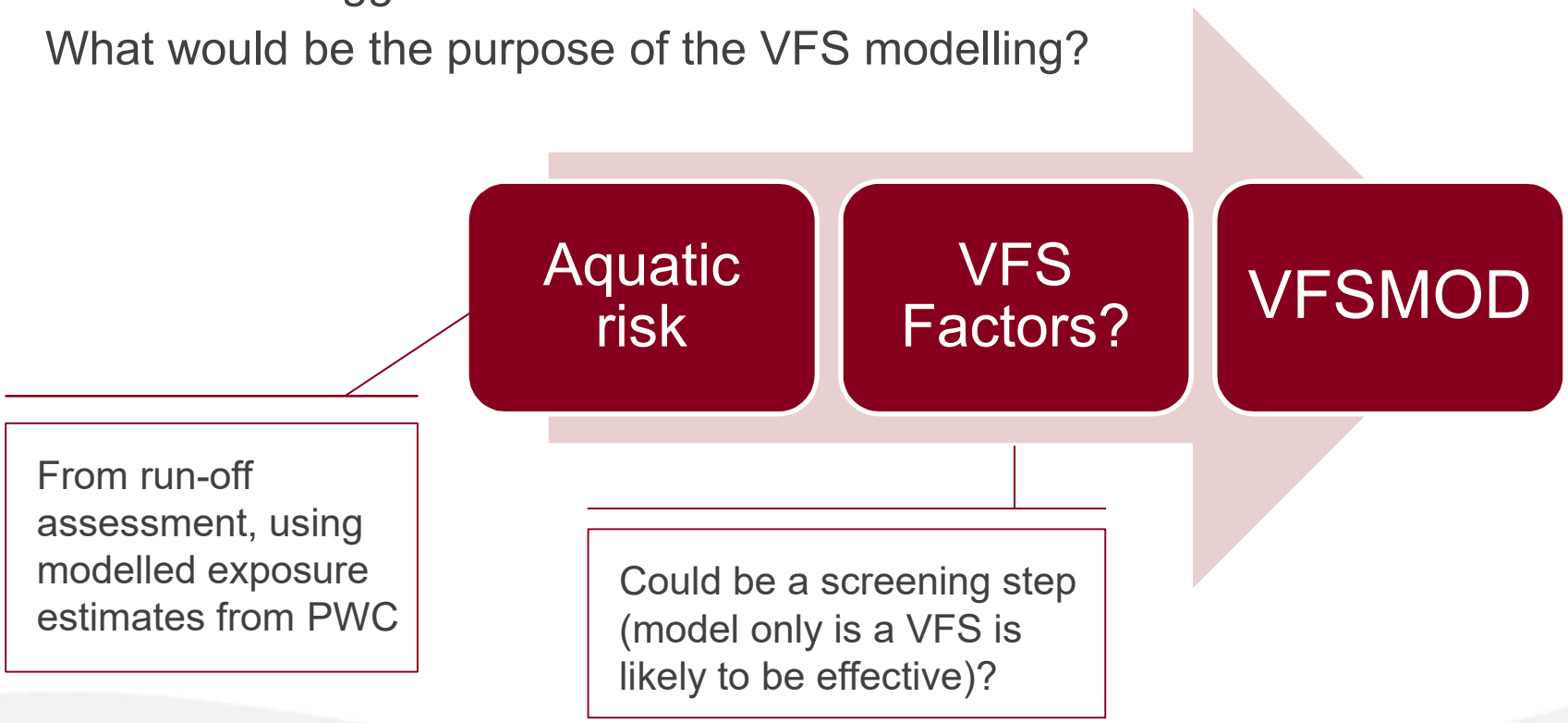
Ideas for a Regulatory Framework

Risk Assessment

Where in the process would VFS modelling be used?

What would trigger it?

What would be the purpose of the VFS modelling?

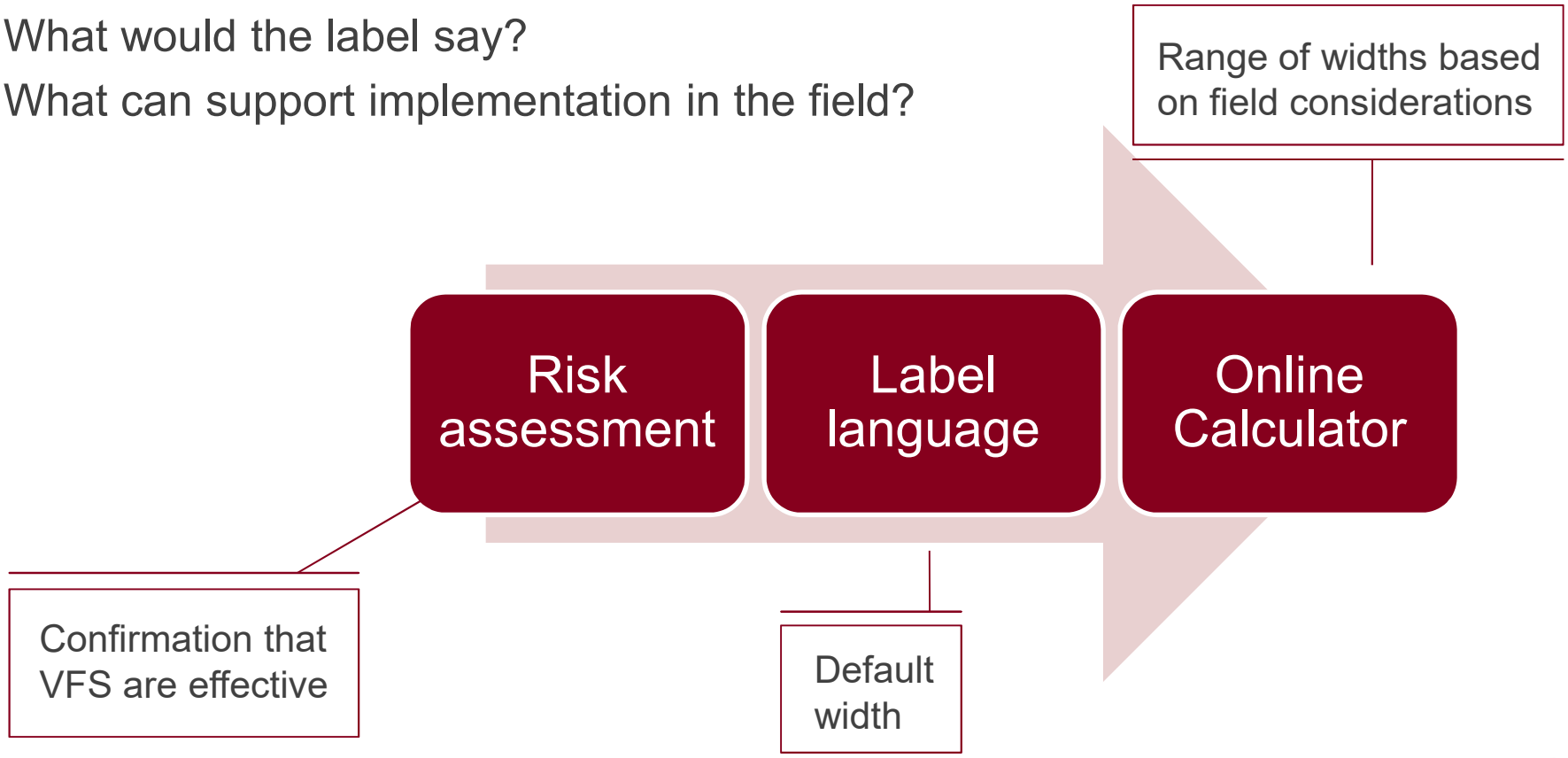


Ideas for a Regulatory Framework

Risk Mitigation

What would the label say?

What can support implementation in the field?



PMRA Workshop Outcomes

Address outstanding questions on modelling

- Confidence in the model?
- How do we ensure version control?
- Simpler model for regulatory purposes?
- How can we promote harmonization in North America?

Determine best direction for a draft regulatory framework for PMRA

- Solidify approach
- Gather information on field implementation
- Get feedback from end users
- Identify gaps
- Find opportunities for collaboration

Looking forward to working with all of you!