The impact of volatilisation on the environmental distribution
and off-crop deposition of pesticides

After application (Volatilisation)

During application

Volatilisation: LRT

Airborne

Volatilisation: SRT

(Drift: SRT)
Volutilisation experiments

Volatilisation with the example of Fenpropimorph

<table>
<thead>
<tr>
<th>Property</th>
<th>Fenpropimorph</th>
</tr>
</thead>
<tbody>
<tr>
<td>IUPAC-name</td>
<td>(1cis-4)[1-4(tert-butyl)-phenyl]-2-methyl[3-4]-2,6-dimethylmorpholin</td>
</tr>
<tr>
<td>Smar formula</td>
<td>C22H33NOS</td>
</tr>
<tr>
<td>Molecular mass [g mol⁻¹]</td>
<td>305.5</td>
</tr>
<tr>
<td>Vapor pressure [Pa]</td>
<td>3.5 × 10⁻⁵</td>
</tr>
<tr>
<td>Water sol. [mg L⁻¹]</td>
<td>4.5</td>
</tr>
<tr>
<td>Henry’s law constant</td>
<td>1.0 × 10⁻⁷</td>
</tr>
<tr>
<td>Log Pow</td>
<td>4.1</td>
</tr>
<tr>
<td>C-Labeling position</td>
<td>[U-14C]Benzimidazol</td>
</tr>
<tr>
<td>Specific radioactivity [kBq mg⁻¹]</td>
<td>30–75</td>
</tr>
<tr>
<td>Formulation type</td>
<td>EC</td>
</tr>
<tr>
<td>A1 amount [g ha⁻¹]</td>
<td>750</td>
</tr>
</tbody>
</table>
Measured (__) and simulated (--) air temperature (a), humidity (b), wind velocity (c) and irradiation (d) during the experimental period of 4 days.

Kinetics of volatile radioactivity after application of 14C-fenpropimorph to barley/soil.
Directly measured volatilisation versus vapour pressure
(From plants during 24 h in wind tunnels)

Short range transport (< 1 km)

Entrance triggers for SRT Exposure Assessment
Proposed by FOCUS - AIR:

10^{-5} \text{ Pa for volatilisation from plant (20^\circ C)}

10^{-4} \text{ Pa for volatilisation from soil (20^\circ C)}
Deposition after volatilisation - Function of vapour pressure:

Vapour pressure classes and corresponding 1-m distance deposition (90th percentile)

Implemented in EVA 2.0

Kubiak, 2006

EVA 2.0:

Calculated deposition versus observed in field trials

Kubiak, 2006
Relevance of deposition after volatilisation
Rautmann tables in comparison with EVA 2.0 calculations

Downwind distance from the treated crop [m]

- Aerial drift deposition (Rautmann)
- Deposition after volatilisation (Pa > 5x10^-2)
- Deposition after volatilisation (Pa 5x10^-2 to 10^-4)
- Deposition after volatilisation (Pa 10^-4 to 10^-5)

Kubiak, 2006

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Terrestrial Exposure Assessment proposed by FOCUS

- Spry drift and volatilisation negligible: no
  - Can a pesticide reach the atmosphere considering the application conditions?
    - Yes

- Volatilisation negligible: trigger not exceeded
  - Trigger for volatilisation: $V_p = 10^{-5}$ Pa (plant), $10^{-4}$ Pa (soil) at 20°C

- Exposure by volatilisation negligible compared to other routes (eg drift): no
  - Are mitigation measures required to reduce exposure to non-target organisms at 1 m (field crop) or 3 m (others) distance?
    - No

- Authorisation possible: yes
  - Tier 1 Entry
  - Trigger

Kubiak, 2006

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Experiments to determine deposition (PEC) following volatilisation and/or mitigation measures

Add a term of deposition after volatilisation into the relevant RA procedures

PEC acceptable?

yes

no

Fitting into current exposure assessment

Add a term of deposition after volatilisation into the relevant RA procedures

Experiments to determine deposition (PEC) following volatilisation and/or mitigation measures

PEC acceptable?

yes

no

Fitting into current exposure assessment

Authorisation possible

Authorisation questionable

Kubiak, 2006

Model calculations of off-site deposition (PEC) originating from volatilisation
Option: refine calculation using data from confined experiments

Are mitigation measures needed according to FOCUS Surface Water Step 4?

Spray drift and volatilisation negligible

Can a pesticide reach the atmosphere considering the application conditions?

yes

no

volatilisation negligible

Trigger for volatilisation:

\[ V_p = 10^{-5}\ \text{Pa (plant)}, 10^{-4}\ \text{Pa (soil)} \] at 20°C

Trigger not exceeded

Exposure by volatilisation negligible compared to other routes (e.g. drift, run-off, drainage)

Are mitigation measures needed according to FOCUS Surface Water Step 4?

yes

no

Authorisation possible

Aquatic exposure assessment proposed by FOCUS

Kubiak, 2006
Model calculation of offsite deposition (PECsw) originating from Volatilisation. Option: refine calculation using data from confined experiments.

- Add a term of deposition after volatilisation to FOCUS SW step 4.
- Experiments to determine PECsw following volatilisation and/or mitigation measures.

Authorisation possible if tier 2 is acceptable, otherwise questionable.

Authorisation possible if tier 3 is acceptable, otherwise questionable.

Kubiak, 2006

Long range transport (> 1000 km)
Long Range Transport

FOCUS AIR Proposal:

**Trigger:** Half life in air: 2 d

to identify substances NOT of potential concern for LRT

Exceedance of the trigger indicates not a risk but the need of further evaluation on a case by case basis considering:

- Substance amount entering the atmosphere
- Likely behaviour of the substance as it is transported in and deposited from air (use of models)
- Potential impact on and behaviour in remote environments
- Monitoring data

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Conclusions

**Long Range Transport:**

Trigger is the DT-50 of 2 days in air

Exceedance of the trigger indicates the need for further evaluation on a case by case basis

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**Short Range Transport:**

VP triggers of $10^{-5}$ Pa for plants and $10^{-4}$ Pa for soils.

Exposure assessment schemes for aquatic and terrestrial TER calculation.

The empirical model EVA 2.0 is proposed for a SRT - RA
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Thank you for your attention