

Exposure of workers, residents and bystanders to vapour of plant protection products after application

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Outline of presentation



- Introduction

- Methods
 - Scenarios
 - Models
 - Application of model and scenario

- Results for example assessments

- Conclusions

- New regulation for plant protection products (1107/2009)
- Protection of humans and environment
- EU-BROWSE project for development and improvement of models and scenarios
- Vapour exposure of worker, resident and bystander for example compounds

The EU BROWSE project



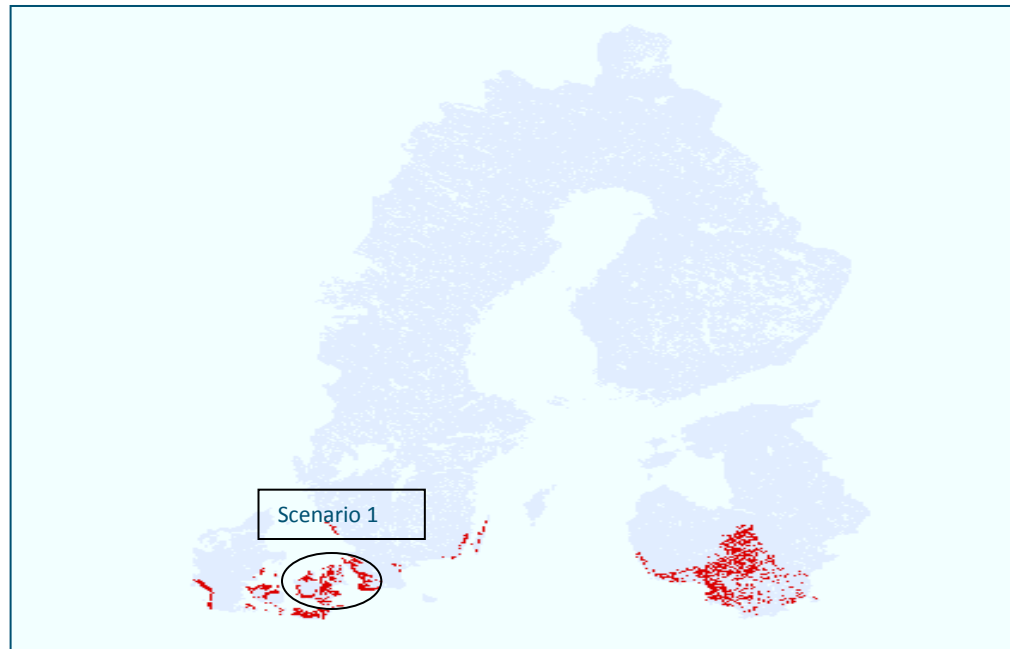
The BROWSE project team

- Vapour pressure main driver of volatilisation of plant protection products from crops
- Vapour pressure increases with temperature
- Tiered approach: first tier conservative, only volatilisation considered as dissipation process on crop
- For scenarios in each EU zone locations need to be identified with relatively high annual average temperatures

- Target is location with 90th percentile of average temperature during growing season (1 April – 31 October)
- Target temperature and countries in EU zones with potential sites

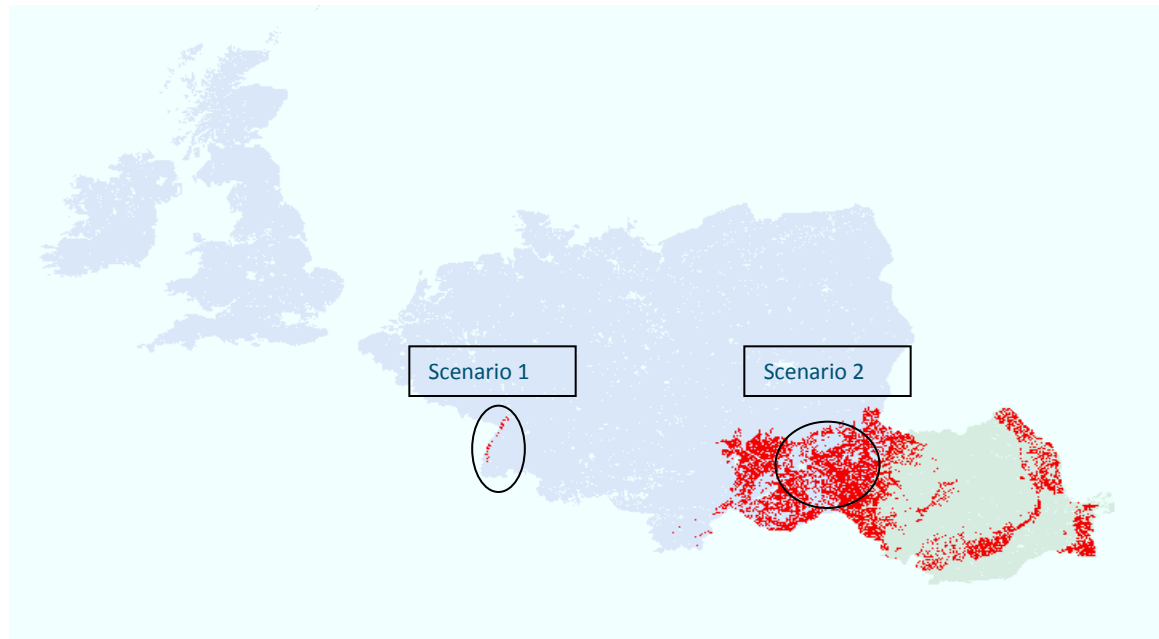
EU Zone	Average Temperature (°C)	Countries with potential sites
Southern	21	Greece, Italy and Spain
Central	16	Hungary, Romania, Germany
Northern	12	Denmark, Lithuania

- Potential sites in Northern Zone



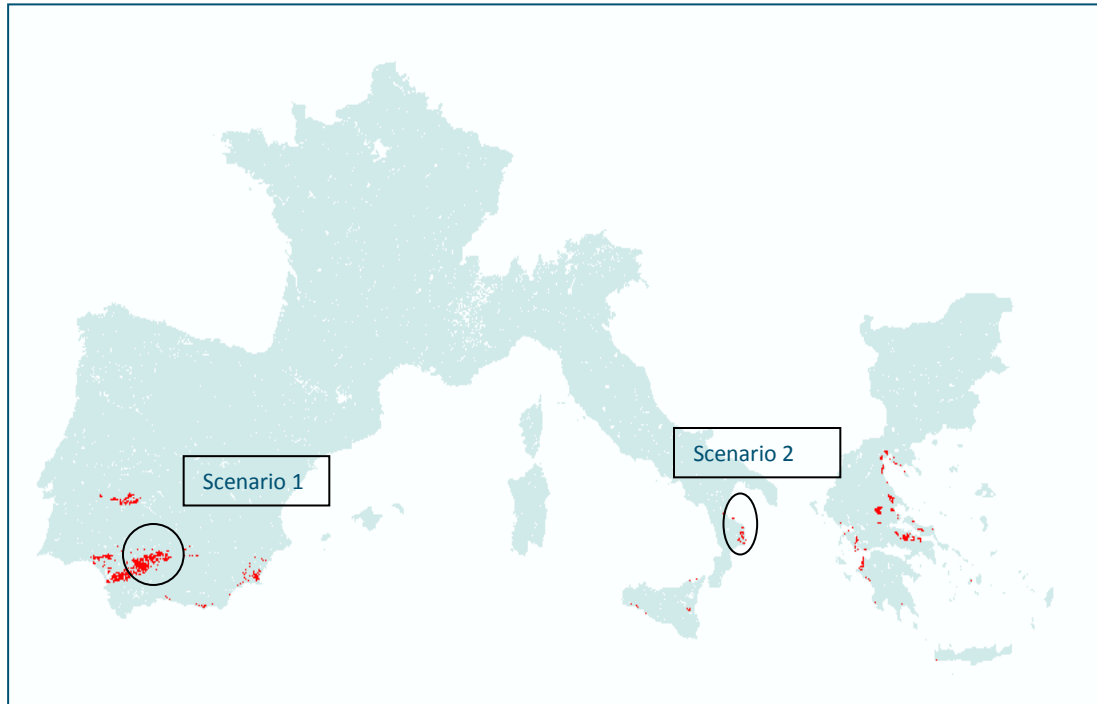
Arable land in Northern EU zone with average air temperature close to 90th percentile of the average air temperature

■ Sites in Central Zone



Arable land in Central EU zone with average air temperature close to 90th percentile of the average air temperature

■ Sites in Southern Zone



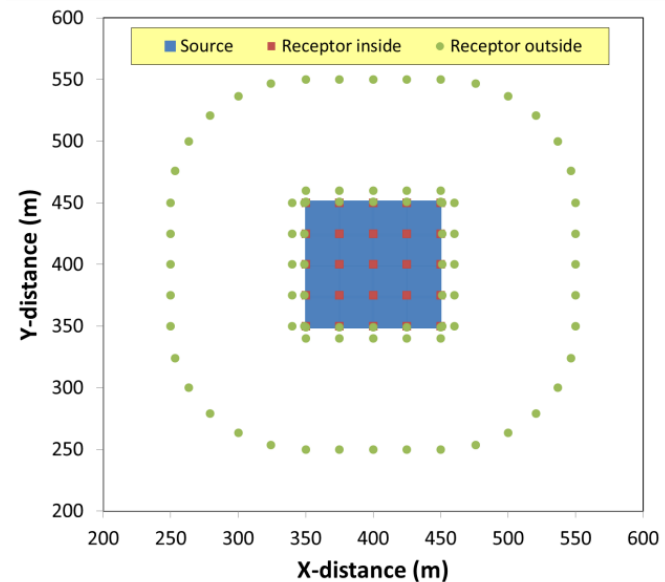
Arable land in Southern EU zone with average air temperature close to 90th percentile of the average air temperature

First tier - scenario data



- Meteorological data collected for sites in Denmark, Germany, Hungary, Spain and Italy for period 2005-2009

- Field of 200 by 200 m
- Complete soil coverage by crop, crop height 0.1 m



- Receptors at 2, 10 and 50 m from treated field; receptor height at 1.4 m (adult); worker in the centre of the field

- Emission from treated crop calculated by PEARL; atmospheric dispersion and deposition calculated by OPS.
- Procedure:

Input data (scenario, application, substance)



Output (targets as defined by BROWSE)

Example assessments



- Application every 2 weeks; only volatilisation considered as dissipation process on plants
- Compound with low vapour pressure of 0.020 mPa and compound with high vapour pressure of 2 mPa
- Target output for resident and bystander: 90th percentile of a) maximum 24-h average concentration in air and b) 7-d average concentration in air
- For the exposure of workers the concentrations are calculated for the period from 8.00 to 18.00 h.

Results example assessments

- The 90th percentiles of the maximum 24-h average concentration in air for exposure of residents (R) and bystanders (B) at 2 m and that of the maximum 10-h average concentration in air for workers (W). Single application, exposure height 1.4 m.

Substance Name	Target Group	Maximum 24h average concentration ($\mu\text{g}/\text{m}^3$)		
		Denmark	Hungary	Spain
LVP	R, B	0.25	0.53	1.08
HVP	R, B	9.35	15.8	12.9
HVP	W	9.63	19.3	20.9

- Concentrations for residents and bystanders in air were mostly highest in Spanish scenario and lowest in Danish scenario.

Results example assessments

- The 90th percentile 7- day average concentration in air for exposure of residents (R), bystanders (B) and workers (W). Single application, exposure height 1.4 m. Exposure period for R&B 24 h per day, for W 10 h per day.

Substance Name	Target Group	7-d Average concentration ($\mu\text{g}/\text{m}^3$)		
		Denmark	Hungary	Spain
LVP	R, B	0.15	0.35	0.77
HVP	R, B	2.18	2.89	2.32
HVP	W	2.07	3.08	3.04

- Again, concentrations for residents and bystanders in air were highest in Spanish/Hungarian scenario and lowest in Danish scenario.

Example assessments (2)



- Application every 2 weeks
- Dissipation processes considered are volatilisation and photo-transformation
- Same compounds; compound with low vapour pressure of 0.020 mPa and compound with high vapour pressure of 2 mPa
- Half-life photo-transformation 3 days
- Same target output for residents, bystander and worker

Results example assessments

- The 90th percentile of the maximum 24-h average concentrations in air for exposure of residents (R) and bystanders (B) at 2 m and the maximum 10-h average concentration in air for workers (W). Single application, exposure height 1.4 m.

Substance Name	Target Group	Concentration ($\mu\text{g}/\text{m}^3$) Only volatilisation			Concentration ($\mu\text{g}/\text{m}^3$) Volatilisation and photo-transformation		
		Denmark	Hungary	Spain	Denmark	Hungary	Spain
LVP	R, B	0.25	0.53	1.08	0.18	0.46	0.86
HVP	R, B	9.35	15.8	12.9	8.67	15.1	11.8
HVP	W	9.63	19.3	20.9	9.50	18.5	20.1

- Short-term concentrations in air somewhat lower when photo-transformation is taken into account.

Results example assessments

- The 90th percentile 7-day average concentration in air for exposure of residents (R) and bystanders (B) at 2 m and the 7-day average concentration in air for workers (W). Single application, exposure height 1.4 m.

Substance Name	Target Group	Concentration ($\mu\text{g}/\text{m}^3$) Only volatilisation			Concentration ($\mu\text{g}/\text{m}^3$) Volatilisation and photo-transformation		
		Denmark	Hungary	Spain	Denmark	Hungary	Spain
LVP	R, B	0.15	0.35	0.77	0.10	0.23	0.45
HVP	R, B	2.18	2.89	2.32	1.93	2.69	2.08
HVP	W	2.07	3.08	3.04	1.88	2.92	2.91

- Longer-term concentrations in air lower when photo-transformation is taken into account. Decrease stronger for compounds with low volatility.

Conclusions



- In the proposed first tier scenarios for vapour exposure, the lowest target vapour concentrations were calculated for the Danish scenario and the highest concentrations for the Spanish/Hungarian scenario.
- Vapour exposure concentrations for workers are calculated to be somewhat higher than those for residents and bystanders
- Competing processes, such as photo-transformation may result in a substantial reduction of vapour concentrations.

- The vapour pressure has a large effect on the vapour concentrations in air, so attention should be paid to the reliability of the value introduced in the model.

- Competing processes could be considered in a higher tier.

- Other options for refinement are:
 - crop specific data
 - realistic timing of application events

Acknowledgement



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Thanks for your attention

