

Evaluating changes in PT 18 (insecticide) emission calculations: Comparison of the 2008 and 2024 Emission Scenario Documents

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Introduction

Environmental risk assessment (ERA) of insecticides under the Biocidal Products Regulation (BPR) requires calculation of local emissions into the environment, allowing subsequent Predicted Environmental Concentration (PEC) derivation and risk characterisation. Calculations are performed in accordance with the Product-Type 18 (PT 18) (insecticides) Emission Scenario Document (ESD). Since the publication of the original PT 18 ESD in 2008 [1], there have been substantial developments in data availability and modelling approaches. The updated (December 2024) PT 18 ESD [2] introduces significant methodological revisions aimed at improving realism, transparency and regulatory harmonisation of insecticide ERA across Europe. Consequently, differences in the equations and resulting outputs of emission calculations exist between the original and updated ESD. This study investigated such differences in emission calculations between the 2008 and 2024 versions of the PT18 ESD, using prallethrin as a representative active substance.

Method

Active substance (prallethrin) data

Environmental fate and ecotoxicology data for prallethrin were sourced from the prallethrin PT 18 Competent Authority Report (April 2024) [3], available on the 'Information on biocides' ECHA database [4].

Emission scenarios

Indoor and outdoor environmental emission scenarios from the 2008 ESD were directly compared against their 2024 equivalent, using identical product specific inputs and default inputs for all other fields as appropriate, and the percentage differences between resulting 2008 and 2024 ESD emission values calculated (Table 1).

Risk characterisation

PEC calculation and risk characterisation was performed in the EUSES 2.2.0 software, based on the active substance properties data and calculated environmental emission values, and tabulated for comparison (Table 2).

Table 1: Summary of set input values used for direct comparison of the 2008 and 2024 versions of the PT 18 ESD and the percentage differences between the resulting output values.

Indoor						Outdoor						
	Mixing / loading step Quantity of product used per preparation	Input			Output Local emission to STP (kg/day)	% diff. in 2024 ESD compared to 2008 ESD		Mixing / loading step Quantity of product used per preparation	Input			Output Rural: Direct emission to soil (mg/kg wwt) / Urban: Local emission to STP (kg/day)
		Application step	Simultaneity (application frequency)	Local emission to STP (kg/day)					Application step	Simultaneity (application frequency)	Local emission to STP (kg/day)	
Indoor spraying (barrier, surface)	15 g	1.00E-03	3.0E-03 kg/m ²	Weekly (0.0275 / 0.0285)	Non-prof: ↑5% Prof: ↑30%							
Indoor spraying (RTU aerosol, space spray)	N/A	1.00E-03	3.0E-05 kg/m ³	Daily (0.055 / 0.2)	Non-prof: ↓52% Prof: ↓28%							
Indoor diffusers (electric)	N/A	0.01	20 g (200-hr total use duration)	Daily: 0.055 / 8.0E-03	↑408%							
Indoor diffusers (passive)	N/A	0.01	20 g (200-hr total use duration)	Daily: 0.055 / 0.024	↑1422%							
Indoor gel application (preventative)	N/A	1.00E-03	3 g/point	Daily (0.055 / 0.2)	Non-prof: ↓49% Prof: ↓37%							
Indoor gel application (curative)	N/A	1.00E-03	3 g/point	Daily (0.055 / 0.2)	Non-prof: ↓83% Prof: ↓79%							
Powders by dusting (void/crack and crevice)	20 g	0.01	0.01 kg/m ²	Daily (0.055 / 0.2)	Non-prof: ↑3301% Prof: ↑4521%							
Powders by dusting (broadcast)	20 g	0.01	0.01 kg/m ²	Daily (0.055 / 0.2)	Prof (large): ↓61% Prof (medium): ↓87%							
Injection	15 g	1.00E-03	1 g / drilling 1 drilling / m	Monthly (0.0139 / 6.58E-03)	Prof: ↓97%							
Outdoor spray, flying insects	15 g	1.00E-04	2.0E-03 kg/m ²	Monthly (0.0139 / 6.58E-03)	Rural – Non-prof: ↓61% Rural – Prof: ↓38% Urban: ↓54%							
Outdoor spray, crawling insects - Foundations and soil around building; Treated area	15 g	1.00E-04	2.0E-03 kg/m ²	Monthly (0.0139 / 6.58E-03)	Rural – Non-prof: ↓60% Rural – Prof: ↓61% Urban – Non-prof: ↓53% Urban – Prof: ↓61%							
Outdoor spray, crawling insects - crawling space; Treated area	15 g	1.00E-04	2.0E-03 kg/m ²	Monthly (0.0139 / 6.58E-03)	Rural – Non-prof: ↓62% Urban – Non-prof: ↓46%							
Outdoor wasp nest spraying	N/A	1.00E-04	3.00E-03 kg/nest	N/A	↓99%							
Outdoor spot application (ant nest treatment, gel/powder)	N/A	1.00E-04	7.50E-04 kg (1 application; 4 sites)	N/A	↓99%							
Outdoor spot application (ant nest treatment, bait)	N/A	1.00E-04	7.50E-04 kg (1 application; 4 sites)	N/A	↓99%							

Non-prof: Non-professional use (standard house / residential treatment); Prof: Professional use (standard house & large building / residential & non-residential treatment)

* The 2008 emission scenario for 'powders by dusting' specifies default treatment areas for 'standard houses' and 'large buildings', whereas the 2024 ESD specifies defaults for small, medium and large treatment areas in residential and non-residential buildings. For direct comparison between the 2008 and 2024 ESDs, the appropriate default treatment based on the intended use was selected (i.e. 'small' for 'crack and crevice' use and 'medium' for residential buildings and 'large' for non-residential buildings for broadcast use).

^ The 2008 emission scenario for 'Outdoor spray, crawling insects - crawling space' does not have default 'area treated per day' inputs, thus only non-prof included for comparison.

Table 2: Summary of risk characterisation (PEC/PNEC values) resulting from environmental emissions calculated using the 2008 and 2024 versions of the PT 18 emission scenario documents.

		PEC/PNEC _{STP}		PEC/PNEC _{water}		PEC/PNEC _{sed}		PEC/PNEC _{soil}		PEC _{GW} (µg/L)	
		2008 ESD	2024 ESD	2008 ESD	2024 ESD	2008 ESD	2024 ESD	2008 ESD	2024 ESD	2008 ESD	2024 ESD
Indoor spraying (barrier, surface)	Non-prof	2.94E-03	3.08E-03	0.70	0.74	0.71	0.74	0.07	0.07	7.77E-04	8.14E-04
	Prof	3.95E-03	5.12E-03	0.94	1.22	0.94	1.23	0.09	0.12	1.04E-03	1.35E-03
Indoor spraying (RTU aerosol, space spray)	Non-prof	3.16E-03	1.52E-03	0.76	0.36	0.76	0.36	0.07	0.03	8.37E-04	4.01E-04
	Prof	4.38E-03	3.14E-03	1.04	0.75	1.05	0.75	0.10	0.07	1.16E-03	8.28E-04
Indoor diffusers (electric)	Non-prof	2.91E-04	1.48E-03	0.07	0.35	0.07	0.35	0.01	0.04	1.21E-04	8.37E-04
	Prof	8.74E-04	0.013	0.21	3.18	0.21	3.19	0.02	0.36	3.64E-04	7.56E-03
Indoor diffusers (passive)	Non-prof	2.10E-03	1.07E-03	0.50	0.26	0.50	0.26	0.05	0.02	5.55E-04	2.82E-04
	Prof	2.84E-03	1.77E-03	0.68	0.42	0.68	0.42	0.06	0.04	7.49E-04	4.67E-04
Indoor gel application (preventative)	Non-prof	6.30E-03	1.07E-03	1.51	0.26	1.51	0.26	0.14	0.02	1.66E-03	2.82E-04
	Prof	8.55E-03	1.77E-03	2.03	0.42	2.04	0.42	0.19	0.04	2.25E-03	4.67E-04
Indoor gel application (curative)	Non-prof	1.21E-03	0.04	0.29	9.86	0.29	10	0.03	0.93	3.32E-04	0.011
	Prof	1.48E-03	0.07	0.36	16.46	0.36	16.32	0.05	1.55	1.65E-03	0.018
Powders by dusting (void/crack and crevice)	Non-prof	0.66	0.65	154	154	157	155	15	15	0.173	0.171
	Prof (large)	7.97	3.07	1908	738	1909	736	179	68.87	2.104	0.811
Powders by dusting (broadcast)	Prof (medium)	1.07	1.07	262	262	257	257	23.84	23.84	0.283	0.283
	Prof (medium)	2.40E-03	7.84E-05	0.57	0.02	0.57	0.02	0.05	1.8E-03	6.33E-04	2.07E-05
Injection	Non-prof	-	-	-	-	-	-	0.60	0.23	0.039	5.91E-06
	Prof	-	-	-	-	-	-	0.62	0.38	0.040	9.69E-06
Outdoor spray, flying insects (rural)	Non-prof	3.05E-03	1.39E-03	0.73	0.33	0.73	0.33	0.07	0.03	8.04E-04	3.67E-04
Outdoor spray, flying insects (urban)	Prof	-	-	-	-	-	-	0.27	0.11	0.018	2.77E-06
Outdoor spray, crawling insects - Foundations and soil around building (rural)	Non-prof	-	-	-	-	-	-	0.28	0.11	0.018	2.77E-06
	Prof	-	-	-	-	-	-	0.28	0.11	0.018	2.77E-06
Outdoor spray, crawling insects - Foundations and soil around building (urban)	Non-prof	8.74E-04	4.07E-04	0.21	0.10	0.21	0.10	0.02	0.01	2.31E-04	1.07E-04
	Prof	1.39E-03	5.44E-04	0.33	0.13	0.33	0.13	0.03	0.01	3.66E-04	1.44E-04
Outdoor spray, crawling insects - Crawling space (rural)	Non-prof	-	-	-	-	-	-	0.21	0.08	0.014	2.00E-06
	Prof	-	-	-	-	-	-	0.21	0.08	0.014	2.00E-06
Outdoor spray, crawling insects - Crawling space (urban)	Non-prof	3.39E-03	1.83E-03	0.81	0.44	0.81	0.44	0.08	0.04	8.94E-04	4.84E-04
	Prof	-	-	-	-	-	-	0.36	2.95E-03	0.023	7.52E-08
Outdoor wasp nest spraying	Non-prof	-	-	-	-	-	-	0.84	8.87E-03	0.055	2.26E-07
Outdoor spot application (ant nest treatment, gel/powder)	Prof	-	-	-	-	-	-	0.19	1.97E-03	0.012	5.01E-08
Outdoor spot application (ant nest treatment, bait)	Prof	-	-	-	-	-	-	0.19	1.97E-03	0.012	5.01E-08

PNEC: Predicted no effect concentration; STP: sewage treatment plant; sed: sediment; GW: groundwater

Conclusions

Understanding the differences in the updated ESD is essential for ensuring consistency across future PT18 insecticide environmental exposure calculations and subsequent risk assessments and will require greater understanding on how a given insecticide is used to ensure appropriate assumptions are applied.

Results

Like-for-like comparisons show notably higher emission to the environment in the 2024 ESD for:

- Indoor spraying (barrier, surface), professional
- Indoor diffusers (electric & passive)
- Indoor powders by dusting (void/crack and crevice)

All other indoor and outdoor scenarios show comparably lower emissions to the environment and subsequently lower risk.

Key differences between the 2008 and 2024 ESD:

- Simultaneity factor calculation:** Resulting in lower simultaneity factors (lowering emissions) for some scenarios and higher simultaneity factors (increasing emissions) for others. Indoor powders by dusting (voids/crack and crevice) emissions are particularly affected, showing considerably increased emissions where other default inputs for are largely unchanged from the previous ESD
- Default 'treatment line/area/volume':** Generic values for small/medium/large treatments included for residential and non-residential buildings, whereas previously defaults only existed for certain treatment types. Majority of large/non-residential buildings default values are lower in the 2024 ESD. Treatment volumes are now applicable for indoor diffusers (not considered in 2008 ESD) significantly impacting emissions
- A default number of applications has been introduced for indoor 'direct spraying on target organisms' (not considered in 2008 ESD)
- The 2024 ESD considers direct emissions to surface water (via rainwater discharge) for outdoor scenarios, potentially complicating risk assessments for substances where risk is driven by the aquatic compartment

References

- [1] OECD (2008) Emission Scenario Document for insecticides, acaricides and products to control other arthropods for household and professional uses. ENV/JM/MONO(2008)14
- [2] ECHA (2024) Emission Scenario Document for Product Type 18: insecticides, acaricides and products to control other arthropods for household and professional uses. Version 1.0, December 2024
- [3] European Chemicals Agency (2024) Draft Competent Authority Report: Prallethrin – Product Type 18, version 2.0: April 2024
- [4] European Chemicals Agency (2024) Information on biocides: Biocidal Active Substances. Available at: <https://echa.europa.eu/ro/information-on-chemicals/biocidal-active-substances> (Accessed: 27 March 2026)

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