

## EFSA Calculator – Summary for operator exposure scenarios

The European Food Safety Authority (EFSA) has published a spreadsheet-based calculator as part of its Guidance document on the assessment of exposure to pesticides<sup>1</sup>. The calculator contains two models: the Agricultural Operator Exposure Model (AOEM), for sprayed pesticides in outdoor situations, and a subset of the US Pesticide Handlers Exposure Database (PHED), for pesticides applied as granules.

The AOEM is a new model based on 34 GLP exposure studies conducted in Europe between 1994 and 2009, not used in previous regulatory models. Internal and external validation of model showed good agreement with measured exposure.

The exposure scenarios, application and pesticide parameters, and types of personal protective equipment, are summarized in the table below. Note that not all variables may be applicable to all scenarios.

AOEM (sprayed pesticides)				
<b>Exposure scenario</b>				
<b>Mixing/loading</b>				
	Mixing/loading knapsack			
	Mixing/loading tank			
<b>Application (outdoor)</b>			<b>Work rate<sup>2</sup></b>	
	Downward spraying; vehicle-mounted Subset: drift reduction		10 or 50 ha (depending on crop type)	
	Downward spraying; manual hand-held (spray gun) or manual knapsack		1 or 4 ha	
	Upward spraying; vehicle-mounted Subset: drift reduction Subset: closed or open cab		8 - 50 ha (depending on crop type)	
	Upward spraying; manual hand-held (spray gun) or manual knapsack		1 or 4 ha	
<b>Formulation</b>	SC, EC, etc.		<b>Dose</b> (kg a.i./ha)	Free variable
	WP, SP		<b>Application volume</b> (L spray solution/ha)	Free variable
	WG, SG		<b>Crop type</b>	Various
	Water soluble bag (mixing/loading only)			
<b>PPE during mixing &amp; loading</b>			<b>Exposure reduction</b>	
	Respiratory	None (=potential exposure)	--	
		Mask – FP1, P1 and similar	Inhalation: 75 % Dermal (head): 20 %	
		Mask – FP2, P2 and similar	Inhalation: 90 % Dermal (head): 20 %	

<sup>1</sup> Guidance on the assessment of exposure of operators, workers, residents and bystanders in risk assessment for plant protection products. European Food Safety Authority. EFSA Journal 2014; 12(10): 3874. [\[http://www.efsa.europa.eu/en/efsajournal/pub/3874.htm\]](http://www.efsa.europa.eu/en/efsajournal/pub/3874.htm)

<sup>2</sup> The area treated reflects the technical standard of the equipment used in the original studies underpinning exposure data. In practice, the treated area will depend on the type of equipment used. The assessments proposed for operators, given modern equipment, are also considered to cover the assessment of less modern equipment in correlation with smaller areas treated per day and using smaller amounts of PPPs. The values used for the proposed models should not be adjusted for smaller areas treated with less modern equipment.

<b>AOEM (sprayed pesticides)</b>				
	Clothing	None (= "potential exposure")	--	
		Work wear: arms body and legs covered (cotton)	Dermal (body): 90%	
		Protective (chemical resistant) coveralls	Dermal (body): 95 %	
		Gloves	Liquids (hands): 90%; solids (hands): 95%	
		Hood	Dermal (head): 50%	
		Hood & visor	Dermal (head): 95%	
<b>PPE during application</b>			<b>Exposure reduction</b>	
	Respiratory	None (= "potential exposure")	--	
		Mask – FP1, P1 and similar	Inhalation: 75 % Dermal (head): 20 %	
		Mask – FP2, P2 and similar	Inhalation: 90 % Dermal (head): 20 %	
	Clothing	None (= "potential exposure")	--	
		Work wear: arms body and legs covered (cotton)	Dermal (body): 90%	
		Protective (chemical resistant) coveralls	Dermal (body): 95 %	
		Gloves	Liquids (hands): 90%; solids (hands): 95%	
		Hood	Dermal (head): 50%	
		Hood & visor	Dermal (head): 95%	
	<b>No PPE</b>		= potential exposure under PPE layer: assumed similar to shorts and T-shirt	
	<b>Exposure estimate from database</b>		75 <sup>th</sup> percentile (= in 75% of cases, exposure will be lower than the estimated value; in 25% of cases higher) (95 <sup>th</sup> percentile also provided)	
	<b>Body weight</b>		60 kg (default)	
<b>Exposure routes</b>		Dermal & inhalation (both for mixing/loading & application)		
<b>Exposure duration</b>		8 hours per day		
<b>Pesticide absorption</b>		Dermal = product specific (100% = default); Inhalation = 100%		

PHED (pesticides applied as granules)			
<b>Exposure scenario</b>			
<b>Mixing/loading</b>			
	Loading vehicle		
	Loading manual applicator		
<b>Application (outdoor)</b>			<b>Work rate</b>
	Vehicle mounted: Broadcast application of granules		10 or 50 ha (depending on crop type)
	Vehicle mounted: In-furrow application of granules		
	Manual application of granules		1 or 4 ha
<b>Formulation</b>	granules	<b>Dose (kg a.i./ha)</b>	Free variable
		<b>Crop type</b>	Various
<b>PPE during mixing &amp; loading</b>			<b>Exposure reduction</b>
	Respiratory	None (=potential exposure)	--
		Mask – FP1, P1 and similar	Inhalation: 75 % Dermal (head): 20 %
		Mask – FP2, P2 and similar	Inhalation: 90 % Dermal (head): 20 %
	Clothing	None (=“potential exposure”)	--
		Certified protective coveralls	Measured (not specified)
		Chemical resistant gloves	Measured (not specified)
<b>PPE during application</b>			<b>Exposure reduction</b>
	Respiratory	None (=“potential exposure”)	--
		Mask – FP1, P1 and similar	Inhalation: 75 % Dermal (head): 20 %
		Mask – FP2, P2 and similar	Inhalation: 90 % Dermal (head): 20 %
	Clothing	None (=“potential exposure”)	--
		Certified protective coveralls	Measured (not specified)
		Chemical resistant gloves	Measured (not specified)
<b>No PPE</b>		= potential exposure under PPE layer: assumed similar to shorts and T-shirt	
<b>Exposure estimate from database</b>		75 <sup>th</sup> percentile (= in 75% of cases, exposure will be lower than the estimated value; in 25% of cases higher) (95 <sup>th</sup> percentile also provided)	
<b>Body weight</b>		60 kg (default)	
<b>Exposure routes</b>		Dermal & inhalation (both for mixing/loading & application)	
<b>Exposure duration</b>		8 hours per day	
<b>Pesticide absorption</b>		Dermal = product specific (100% = default); Inhalation = 100%	