

# Fertilizers Environmental Exposure Tool

# **FEE Tool**

The Fertilizers Environmental Exposure tool (FEE tool) has been developed by Fertilizers Europe to aid members and non-members assess quantitative exposure scenarios for fertilizer constituents in various environmental compartments (soil, water, sediments) as requested by REACH.

The tool has been developed with the support of an internal Task Force composed by REACH experts and agronomists from member companies and an external consultancy company, ARCHE.

Currently, models as ECETOC TRA, Chesar and EUSES cannot be used for the existing environmental exposure assessment of fertilizers, because no local emission scenario for direct application to soil is included. To assess the quantitative exposure scenarios for fertilizer constituents in the various environmental compartments (soil, water, sediment), a specific tool needs to be used. The FEE tool has been developed for fertilizer micronutrients such as copper, manganese and zinc, which are identified as hazardous for the aquatic environment. However, it can also be used to assess more nutrients and other inorganic and organic substances, if needed. In a next update of the EUSES tool implemented by ECHA elements from FEE tool are planned to be integrated.



Fertilizers Europe has also developed specific Environmental Release Categories (SpERC), Generic Exposure Scenarios (GES), Safe Use of Mixture Information (SUMI).

All documents can be freely downloaded from the dedicated REACH website: https://www.reachfertilizers.com/



For the development of this tool 3 aspects were considered:

1) The environmental fate calculations (Processes/parameters included: drift, runoff, crop interception, leaching, volatilization, biodegradation...) For this, the REACH R16 guidance document for environmental exposure was used as basis, together with the regional REACH model, Simplebox. Where needed, this was complemented with calculation methods from the FOCUS model Steps 1-2.

2) Substance data. For the 3 nutrients (copper, manganese and zinc), substance data is already included in the FEE tool. Substance properties (like molecular weight, water solubility and Kd) are taken from the REACH dossiers for the respective substances. Also Predicted No Effect Concentrations (PNECs) and deficiency thresholds (or PEC regionals; Predicted Environmental Concentrations, for soil) are already included in the tool. Assessment of other (in)organic fertilizer substances is also possible but requires manual input of substance data.

3) Also, crop relevant data and yield data, the latter based on the Eurostat database, are included in the FEE tool. A literature review was performed for the 3 micronutrients, and typical concentrations of the nutrients taken up by different crop types are included in the tool. Together, this data on crop concentrations and crop yield are used to calculate the amount of crop offtake in the model. This means the amount of nutrients removed from an agricultural field by harvest.

The FEE-tool without refinement options can be used to generate Generic Exposure Scenarios, considering the conditions defined by the SPERCs. These can be used by raw material suppliers and included in their Chemical Safety Reports (CSR) and extended safety datasheets (e-SDS). For scenarios that are not covered by the Generic Exposure Scenarios, the FEE tool can be used for scaling or refinement and used to generate specific exposure scenarios (option for formulators and companies placing fertilizers on the market). Specific exposure scenarios can take into account the use of risk management measures (RMM). These can be used by formulators, if needed, to be included in their SDSs.

# **GENERIC ASSESSMENT**

## FERTILIZER ENVIRONMENTAL EXPOSURE (FEE) TOOL

### INPUT

1. Nutrient (element) / co-formulant	Copper	
2. Specific Environmental Release Category (SpERC)	SPERC 4: Outdoor use - spray a surface spreading, sprinkler, pivo	application of liquid fertilizers; soil it, foliar spray, slurry
3. Single or multiple applications per growing season?	Multiple	
Total annual use rate of nutrient (element) / co-formulant	0.75	[kg/ha/year]
Number of applications	3	-
Time between applications	10	[days]
Fertilizer use rate per application	0.25	[kg/ha]
4. Refinement options		
Crop type	Generic crop	
Crop growth stage (BBCH)	Bare soil, BBCH 00-09	
European crop yield scenario	Low	
Crop concentration		[g/t]
Crop yield		[t/ha]
5. Risk management measures (RMM) *		[% drift reduction]
		soil incorporation
		[% runoff reduction]



# Steps 1 – 3: Generic assessment

In the INPUT sheet there is the possibility to:

- 1. Select the substance (Cu, Mn, Zn or "Other")
- 2. Choose the SPERC (SPERC 1 4)
- 3. Fill in with single or multiple applications and yearly use rate

The fields in green are mandatory, in blue and yellow are optional.



# FERTILIZER ENVIRONMENTAL EXPOSURE (FEE) TOOL

# OUTPUT

Exposure scenario				
Substance	Copper			
SpERC	SPERC 4: Out	door use - sp	pray application of liquid fertilizers; soil surface spreading, sprinkler, pivot, foliar spray, slurry.	
Application rate (total)	0.75 kg/ha/yea	_		
Number, timing applications	3 applications,	10 days betv	tween applications	
Crop type	Generic crop			
Crop growth stage	Bare soil, BBC	60-00 H:		
European crop yield scenario	Low			
Risk management measures	None			
Emission estimate	[kg/ha]	[%]		
Volatilization	0.0000	0.00	Volatilization	
Drift	0.0039	0.52	Drift     Runoff	
Runoff	0.0001	0.01	Crop offtake	
Crop offake	0.0000	0.00		

<u> 9</u>.5

0.7497

Soil accumulation

			Exposure as	sessment			Effect ass	essment	Risk charad	sterisation	
Environmental compartment	C local year 1	C local year 10	PEC regional	PEC total year 1	PEC total year 10	Unit	PNEC	Unit	RCR year 1	RCR year 10	
Soil (agricultural)	0.25	2.5	14.0	14.2	16.5	mg/kg dw	65.0	mg/kg dw	0.22	0.25	PEC local calculated as TWA conc in soil for 30 days after application; Eqn R.16-43
Freshwater (dissolved)	14.8	14.9	2.9	17.7	17.8	hg/L	7.8	µg/L	2.28	2.28	PEC local calculated as TWA conc in freshwater for 30 days after application; Eqn R.16-43
Sediment	97.6	7.79	67.5	165.1	165.2	mg/kg	87.0	mg/kg	1.90	1.90	PEC local based upon conc in surface water, calculated as 30-d TWA; Eqn. R.16-34
Groundwater				0.0076	0.0088	mg/L					Groundwater conc based upon conc in porewater agricultural soil, max is water solubility; Eqn. R. 16-55

Maximum safe application rate cal	culation	
Most sensitive environmental compartment year 1	sediment	
Most sensitive environmental compartment year 10	sediment	
Target RCR	06.0	
Estimated max application rate year 1	0.08	kg/ha/year
Estimated max application rate year 10	0.08	kg/ha/year

the risk characterisation ratio (RCR). In this example (a foliar spray of liquid Cu fertilizer (SPERC 4), with a use rate of 0,75 kg/ha/year), the FEE tool gives as result an RCR>1 for the freshwater and sediment compartments. This means that the fertilizing practice is not safe according to the generic assessment. The advice in this case is to re-run the calculation including A generic assessment (without refinement options) is based on realistic worst-case defaults and assumptions for calculating refinement options as indicated on the next page.

# **REFINED ASSESSMENT**

### FERTILIZER ENVIRONMENTAL EXPOSURE (FEE) TOOL

### INPUT

1. Nutrient (element) / co-formulant	Copper	
2. Specific Environmental Release Category (SpERC)	SPERC 4: Outdoor use - spray a surface spreading, sprinkler, pivo	application of liquid fertilizers; soil ot, foliar spray, slurry
3. Single or multiple applications per growing season?	Multiple	
Total annual use rate of nutrient (element) / co-formulant	0.75	[kg/ha/year]
Number of applications	3	-
Time between applications	10	[days]
Fertilizer use rate per application	0.25	[kg/ha]
4. Refinement options		
Crop type	Cereals, spring	
Crop growth stage (BBCH)	Intermediate crop cover, BBCH 2	20-39
European crop yield scenario	Low	
Crop concentration		[g/t]
Crop yield		[t/ha]
5. Risk management measures (RMM) *		[% drift reduction]
		soil incorporation
		[% runoff reduction]

\* To be justified, and translated into specific RMMs in correspondence with (national) requirements and product labelling



# Step 4: Refined assessment (scaling options):

In this example, again a foliar spray of liquid Cu fertilizer (SPERC 4) was selected, used for a total quantity of 0,75 kg/ha/year. As refinement options the crop "cereals, spring" was selected, with intermediate crop cover (fertilizer application at BBCH stages 20-39). This selection will lead to a reduction in drift, because for field crops such as cereals the spray boom of tractor will be kept in low position. Intermediate crop cover may reduce runoff, compared to bare soil in the generic assessment example.



			er, pivot, foliar spray, slurry								<ul> <li>Volatilization</li> </ul>	<ul> <li>Drift</li> <li>Runoff</li> </ul>	Crop offtake			
AL EXPOSURE (FEE) TOOI			spray application of liquid fertilizers; soil surface spreading, sprink		etween applications		3BCH 20-39									
MENI			Outdoor use -	'year	ons, 10 days be	oring	ie crop cover, E			[%]	0.00	0.09	0.01	2.73	97.2	
/IRON		Copper	SPERC 4:	0.75 kg/ha	3 applicatio	Cereals, s	Intermedia	Low	None	[kg/ha]	0.000	0.0007	0.0001	0.0205	0.7293	
	Exposure scenario	Substance	SpERC	Application rate (total)	Number, timing applications	Crop type	Crop growth stage	European crop yield scenario	Risk management measures	Emission estimate	Volatilization	Drift	Runoff	Crop offtake	Soil accumulation	

			Exposure as	sessment			Effect ass	essment	Risk chara	cterisation	
nvironmental compartment	C local year 1	C local year 10	PEC regional	PEC total year 1	PEC total year 10	Unit	PNEC	Unit	RCR year 1	RCR year 10	
oil (agricultural)	0.24	2.4	14.0	14.2	16.4	mg/kg dw	65.0	mg/kg dw	0.22	0.25	PEC local calculated as TVA conc in soil for 30 days after application; Eqn R. 16-43
eshwater (dissolved)	2.7	2.7	2.9	5.6	5.6	hg/L	7.8	µg/L	0.72	0.72	PEC local calculated as TVVA conc in freshwater for 30 days after application; Eqn R.16-43
diment	17.9	17.9	67.5	85.4	85.4	mg/kg	87.0	mg/kg	96.0	0.98	PEC local based upon conc in surface water, calculated as 30-d TWA; Eqn. R. 16-34
oundwater				0.0076	0.0088	mg/L					Groundwater conc based upon conc in porewater agricultural soil, max is water solubility; Eqn. R.16-55
aximum safe application rate calc	ulation										
st sensitive environmental mpartment year 1	sediment										
sst sensitive environmental mpartment year 10	sediment										
rget RCR	06-0										
timated max application rate year 1	0.45	kg/ha/year									
timated max application rate year 10	0.45	kg/ha/year									

In the Output sheet we can see now that **RCR < 1** for all compartments investigated.

# INTERMEDIATE GROWTH STAGES, SPLITINTO 3 APPLICATIONS WITH 10 DAYS INTERVALS THIS DEMONSTRATES THAT A FOLIAR SPRAY TO CEREALS WITH 0,75 KG CU PER HA AT IS SAFE.



Fertilizers Europe represents the majority of fertilizer producers in Europe and is recognised as the dedicated industry source of information on mineral fertilizers. The association communicates with a wide variety of institutions, legislators, stakeholders and members of the public who seek information on fertilizer technology and topics relating to today's agricultural, environmental and economic challenges. The Fertilizers Europe website provides information on subjects of relevance to all those interested in fertilizers contribution to global food security.

Fertilizers Europe asbl Avenue des Nerviens 9-31 1040 Etterbeek, Brussels, Belgium Tel: +32 2 675 3550 main@fertilizerseurope.com

**@FertilizersEuro**