LIFE16
ENV/IT/000167

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VERMEER FCM

Migration and hazards of chemicals present in food contact materials

24th of November 2022

By B. Mertens, P. Ciffroy, E. Van Hoeck & E. Benfenati

The LIFE VERMEER project (EC funded)

LIFE16 ENV/IT/000167

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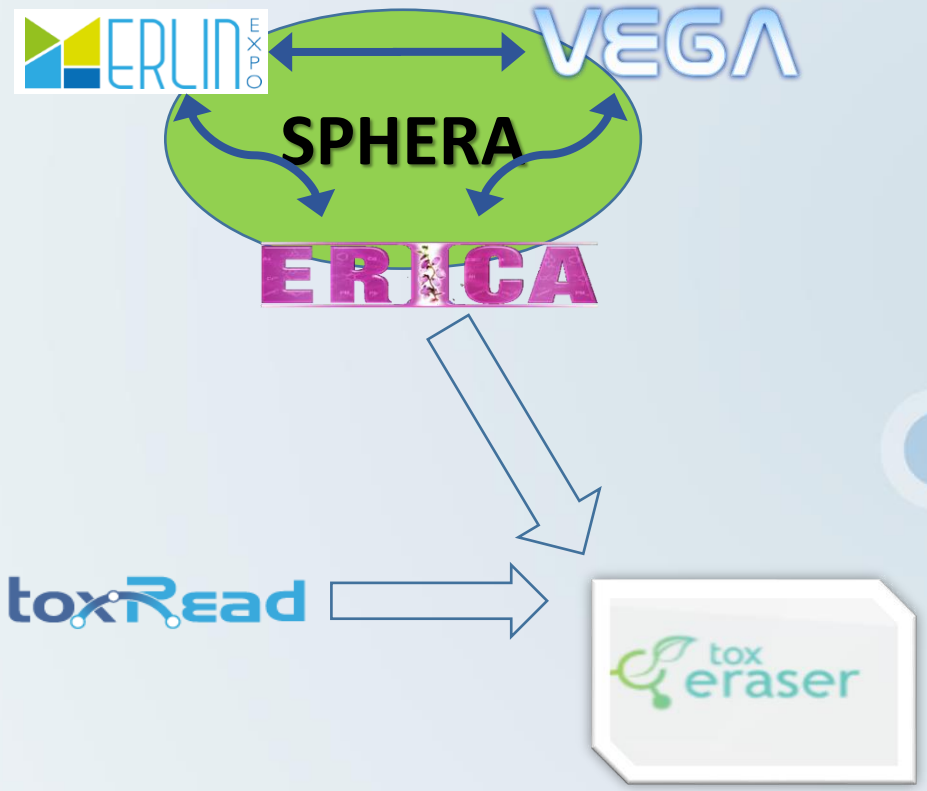
Start date: 9-2017 End date: 4-2022



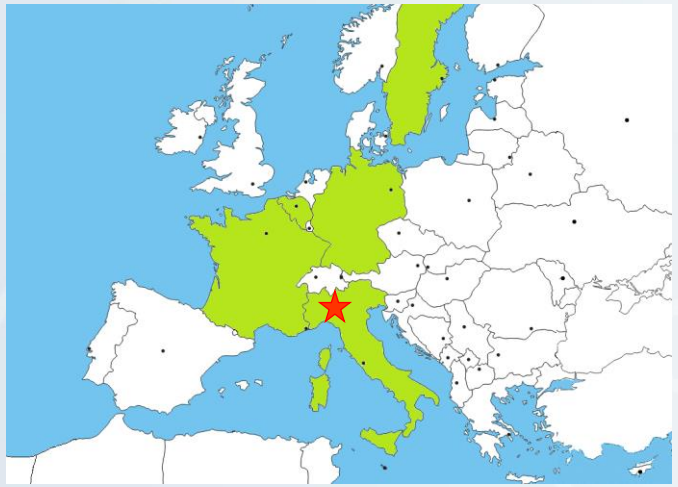
Integrating **VEGA**, **ToxRead**, **MERLIN-Expo**, and **ERICA** in a **platform for risk assessment and substitution** of risky substances

Towards substitution:

1. Identification of the risky substances
2. Identification of possible substitutes
3. Application to **6** case studies

Partners of VERMEER

- Coordinating beneficiary:
  - ✓ *Istituto di Ricerche Farmacologiche Mario Negri IRCCS*
- Associated beneficiaries
  - ✓ *Angel Consulting SAS*
  - ✓ *Federal Institute for Risk Assessment (BfR)*
  - ✓ *Electricitè de France (EDF)*
  - ✓ *ÅF Making Future.*
  - ✓ *Institut National de L'Environnement Industriel et de risques (INERIS)*
  - ✓ *KODE srl*
  - ✓ *SC Sviluppo Chimica S.p.a*
  - ✓ *SCIENSANO*



LIFE VERMEER project - Case studies

- *Food Contact Materials*
- *Biocides*
- *Oil fractions*
- *Solvents*
- *Dispersants*
- *Cosmetics*

Background: aim of Life-VERMEER

EXPOSURE X HAZARD = RISK

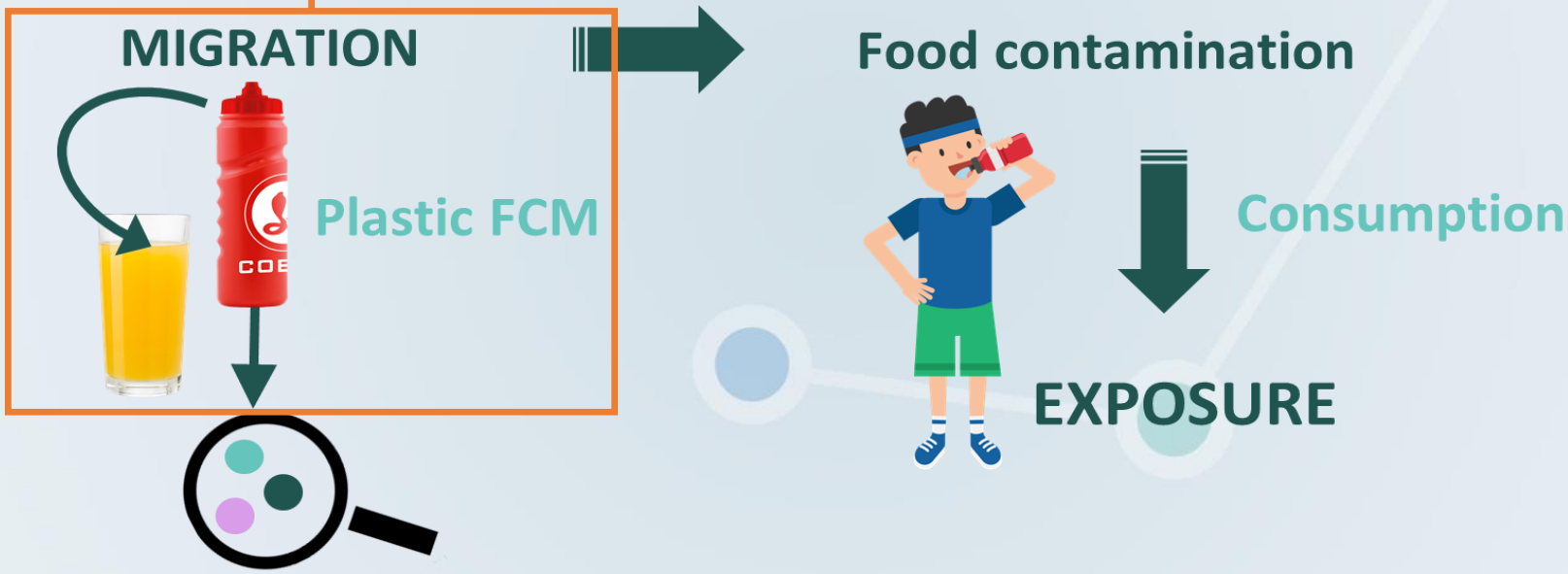
Several case studies including FCM

Food software

VERMEER FCM

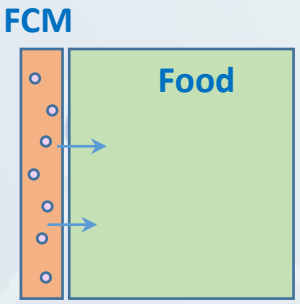
VERMEER FCM: Migration model

Development of a **model for migration** for **plastic FCM**
+ **Validation of the model** using experimental migration data
+ **Integration** of the model in MERLIN-EXPO



Migration model is currently being extended from plastic FCM to other FCM types!

VERMEER FCM: Migration model



- **One FCM layer** (model not adapted for multi-layers FCM)
- **One dimensional (1D) diffusion** model between the FCM layer and Food

Fick's law: $\frac{\partial C_i}{\partial t} = D_i . \frac{\partial^2 C_i}{\partial x^2}$

- When only one FCM layer is considered, mass-balance equation based on Fick's law → **analytical solution** (Crank, 1975 ; Piringer et al, 2008)

VERMEER FCM: Migration model – Analytical solution

$$m_{Food}(t) = m_{FCM,0} \cdot \left(\frac{\rho_{\mathrm{FCM}} \cdot \alpha}{\rho_{Food} + \rho_{\mathrm{FCM}} \cdot \alpha}\right) \cdot \left[1 - \sum_{n=1}^{\infty} \frac{2\alpha \cdot (1+\alpha)}{1+\alpha+\alpha^2 q_n^2} exp\left(-D_{FCM} \cdot t \cdot \frac{q_n^2}{d_{FCM}^2}\right)\right]$$

Mass of the targeted chemical in food at time t

Initial mass of the targeted chemical in FCM

Density of Food and FCM

Diffusion coefficient of the chemical in FCM

Contact time between Food and FCM

Roots of the trigonometric identity

$$\alpha = \frac{V_{Food}}{V_{FCM} \cdot K_{FCM,Food}} = \frac{d_{Food}}{d_{FCM} \cdot K_{FCM,Food}}$$

Thickness of the FCM and Food layers

Partition coefficient of the chemical between Food and FCM

VERMEER FCM – Migration model: diffusion coefficient

- **Piringer's model (2007)**

$$D_{FCM} = f(A_{FCM}, M_{chemical}, Temp)$$

Conductance of the FCM

Molar mass of the migrating chemical

Temperature

Largely used, but calibrated only for plastic FCMs

- **Huang's model (2017)**

$$D_{FCM} = f(b_{FCM}, M_{chemical}, Temp)$$

FCM-specific parameter

Molar mass of the migrating chemical

Temperature

More recent, but calibrated for a wider range of FCMs (not only plastics)

VERMEER FCM – Migration model: partition coefficient

$$K_{FCM,Food} = \left(\frac{\rho_{FCM} \cdot C_{FCM}}{\rho_{Food} \cdot C_{Food}}\right)_{equ}$$

- **Huang's model (2019)**

$$K_{FCM,Food} = f(K_{ow}, EtOH_{food}, Temp)$$

Temperature

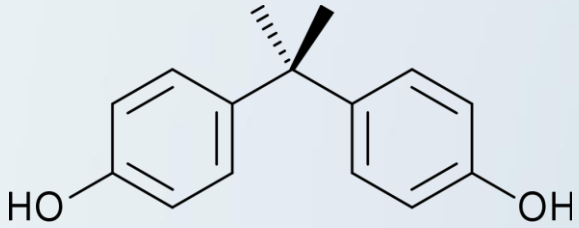
Octanol-Water partition coefficient (lipophilicity)

Ethanol-equivalent (food proxi)

Calibrated for a wide range of FCMs (not only plastics)

VERMEER FCM: Migration model – Input data & endpoints

Target chemical



SMILES code

Initial concentration in FCM

(in mg chemical/kg FCM)

Molecular weight

FCM

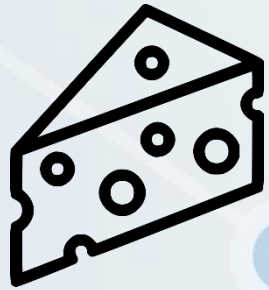
Type of FCM

(LDPE, HDPE, HIPS, PA, PEN, PEN, PP, PS + Other FCM if you have specific data)

Thickness of FCM layer

Contact area

Food



Type of Food

(e.g. water, oil, chocolate, etc)

Volume of Food

Temperature

Concentration of the target chemical in food at time t

VERMEER FCM – Migration model: validation

- Experimental data from Begley et al., 2005
- Simulated concentration vs Experimental concentration for LDPE, HDPE, HIPS, PP, PA, PS, PET, PEN

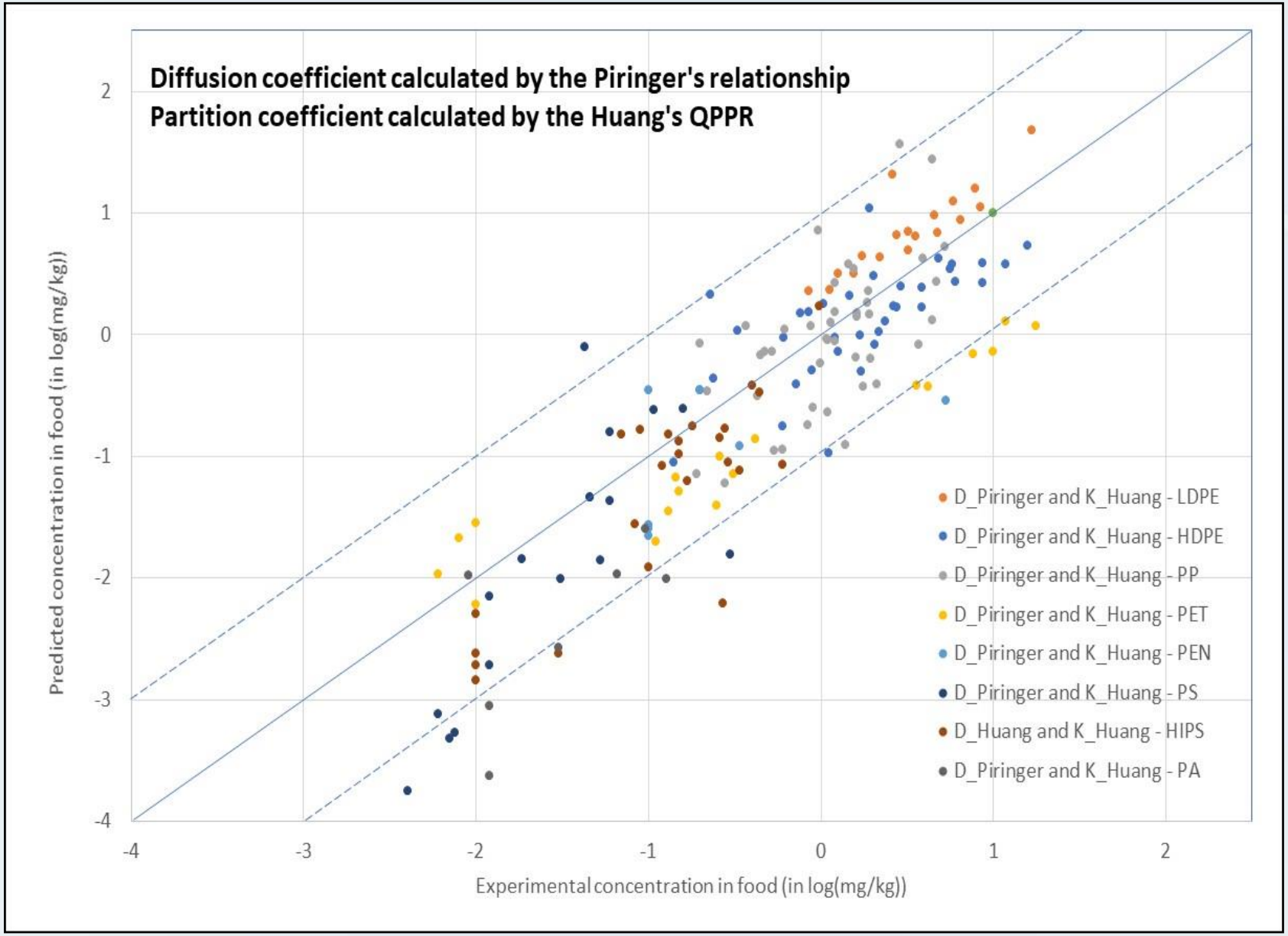
Table IV.I. Migration data from LDPE.

PM/reference number	CAS number	Additive	M_r	d_P (cm)	$c_{P,0}$ (mg kg^{-1})	T (°C)	t	$m_{F,t}$ (mg kg^{-1}) exp.	A'_P	Polymer: remarks[1]
68320 (1)	2082-79-3	Irganox 1076	531	0.05	930	40	10 days	2.6	7.0	LLDPE; 0.91
68320 (2)	2082-79-3	Irganox 1076	531	0.2	220	40	1 day	0.85	9.7	0.918
							2 days	1.26	9.8	
							4 days	1.74	9.8	
							10 days	2.75	9.8	
95200 (2)	1709-70-2	Irganox 1330	775	0.2	585	40	1 day	1.13	10.1	0.918
							2 days	1.55	10.1	
							4 days	2.20	10.1	
							10 days	3.56	10.1	
74240 (2)	31570-04-4	Irgafos 168	646	0.2	760	80	1 h	3.20	10.2	0.918
							2 h	4.54	10.2	
							3.5 h	5.87	10.1	
							6 h	7.86	10.1	

Table IV.II. Migration data from HDPE.

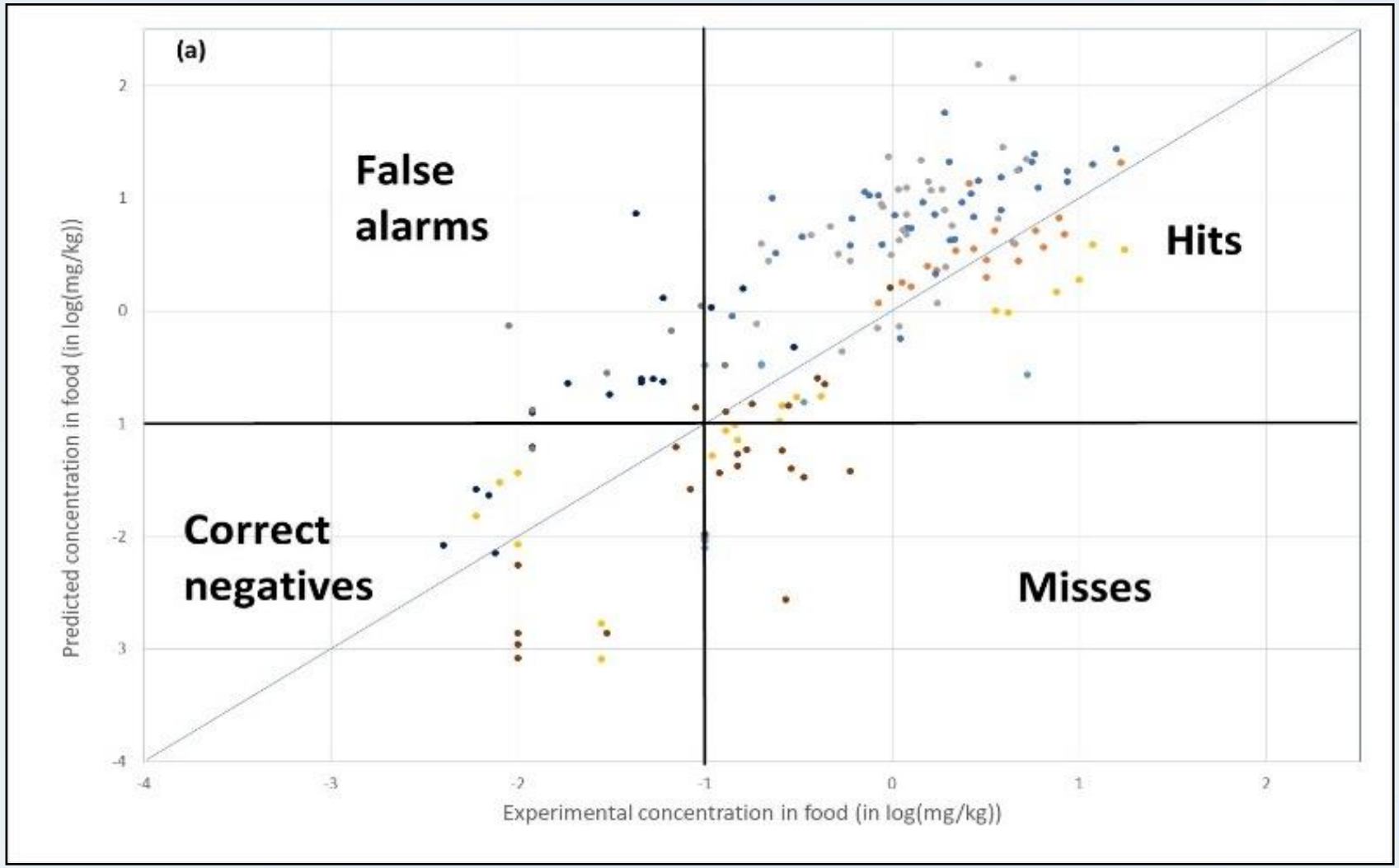
PM/reference number	CAS number	Additive	M_r	d (cm)	$c_{P,0}$ (mg kg^{-1})	T (°C)	t	$m_{F,t}$ (mg kg^{-1}) exp.	A'_P	Polymer: remarks[1]
74240 (2)	31570-04-4	Irgafos 168	646	0.2	1070	80	1 h	0.89	11.3	0.946
							2 h	1.26	11.3	0.946
							3.5 h	1.70	11.4	0.946
74240 (2)	31570-04-4	Irgafos 168	646	0.2	1070	80	6 h	2.36	11.5	0.946
68320 (2)	2082-79-3	Irganox 1076	531	0.2	2000	40	4 days	3.84	11.9	0.948
							10 days	6.06	11.9	0.948
							20 days	8.70	11.9	0.948

VERMEER FCM: Migration model - validation



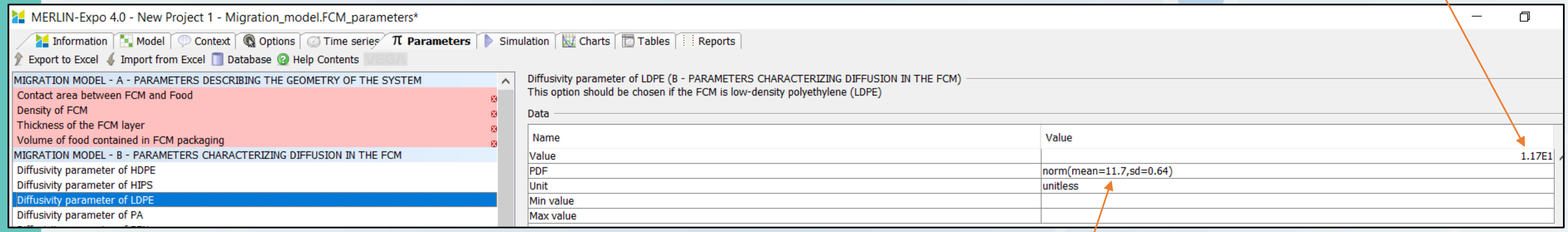
VERMEER FCM: Migration model – Link with Regulation?

Objective of the prediction: to estimate if the concentration in food exceeds a given threshold (e.g. 0.05 mg.kg^{-1} food)



VERMEER FCM: Migration model – Uncertainty analysis

Best estimate of the parameter



Probability density function of the parameter

Random sampling (Monte Carlo) for each uncertain parameter

- 10000 (for example) random combinations of uncertain parameters
- 10000 simulations
- 10000 results (i.e. 10000 $C_{food}(t)$)

VERMEER FCM: Migration model

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Food and Chemical Toxicology

journal homepage: www.elsevier.com/locate/foodchemtox

Check for updates

Modeling the migration of chemicals from food contact materials to food: The MERLIN-expo/VERMEER toolbox

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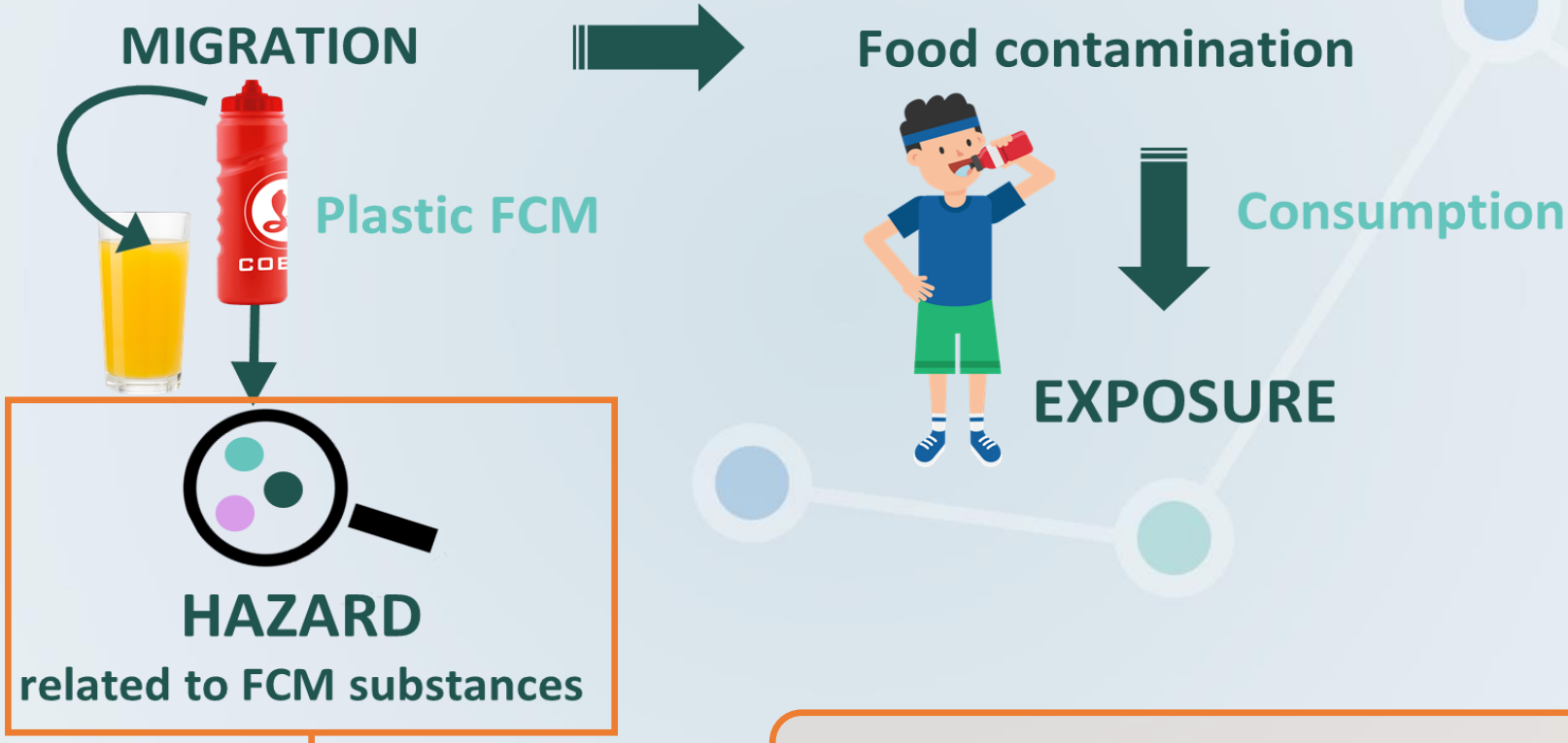
[d] AFRY, Facilia Sweden Section, Frösundaleden 2, SE16970, Stockholm, Sweden
[e] Department of Environmental Health Sciences, Istituto di Ricerche Farmacologiche Mario Negri IRCCS, Via Mario Negri 2, 20156, Milano, Italy

VERMEER FCM: Hazard models



VEGAHUB

Selection out of the 95 **VEGA models** those addressing endpoints relevant for FCM

VERMEER FCM: Hazard models

Toxicological requirements

Described in Notes for Guidance for the preparation of an application for the safety assessment of a substance to be used in plastic FCM (EFSA 2008 – updated in 2017)

Migration threshold	Toxicological data required
X < 0.05 mg/kg food	• Genotoxicity data
0.05 ≤ X < 5 mg/kg food	• Genotoxicity data • Subchronic oral toxicity data (90-day study) • Data to demonstrate absence of accumulation potential in man
5 mg/kg ≤ X < 60 mg/kg food	• Genotoxicity data • Subchronic oral toxicity data (90-day study) • Toxicokinetic data • Data on reproductive and developmental toxicity • Data from long term toxicity/carcinogenicity studies

VERMEER FCM: Information

Information | Model | Context | Options | Time series | Parameters | Simulation | Charts | Tables | Reports

New | Open | Save | Save As | Save Assessment | Preferences | Help Contents

Author

Philippe Ciffroy

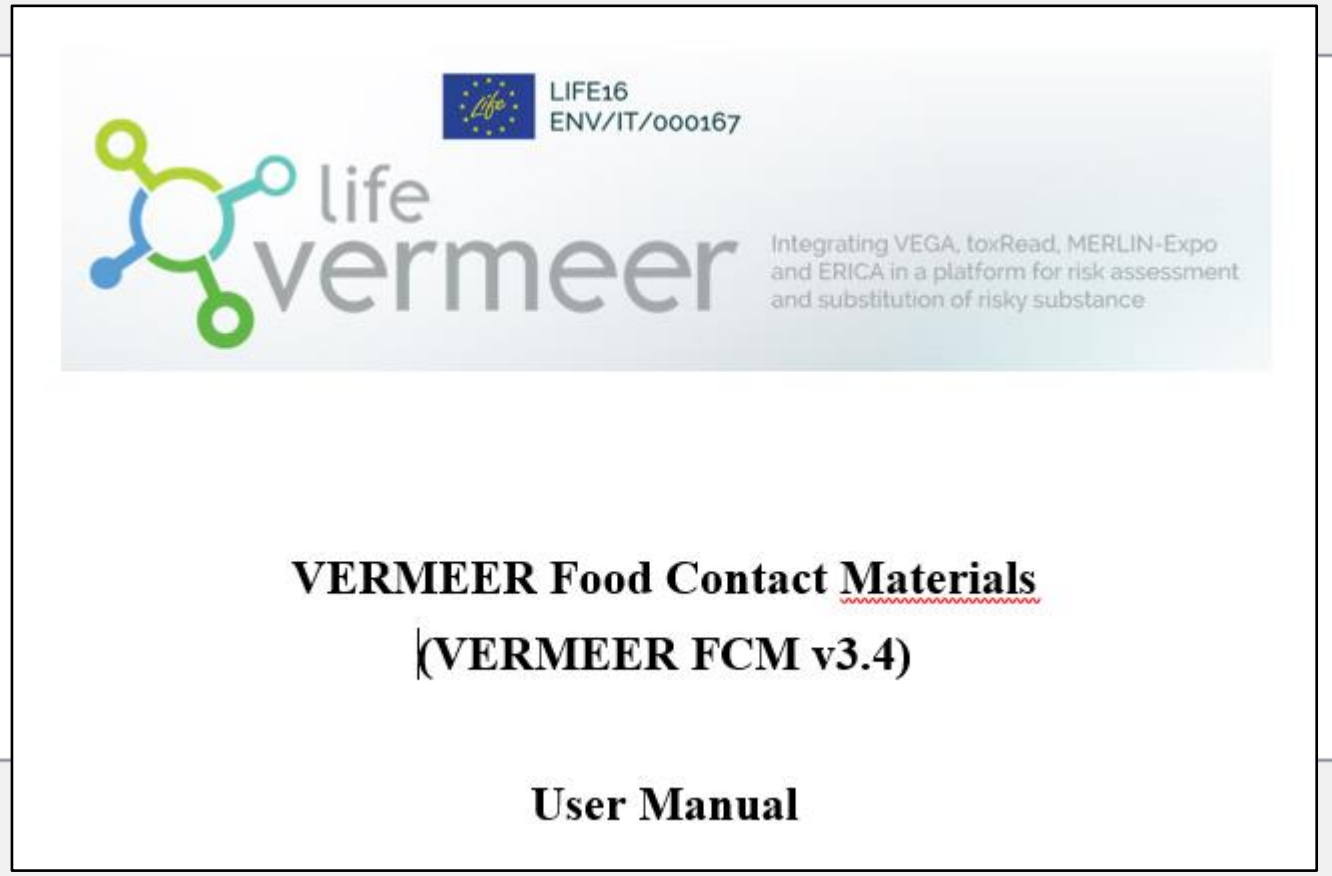
Description

For the User Manual of SPHERA FCM, please visit the following page:

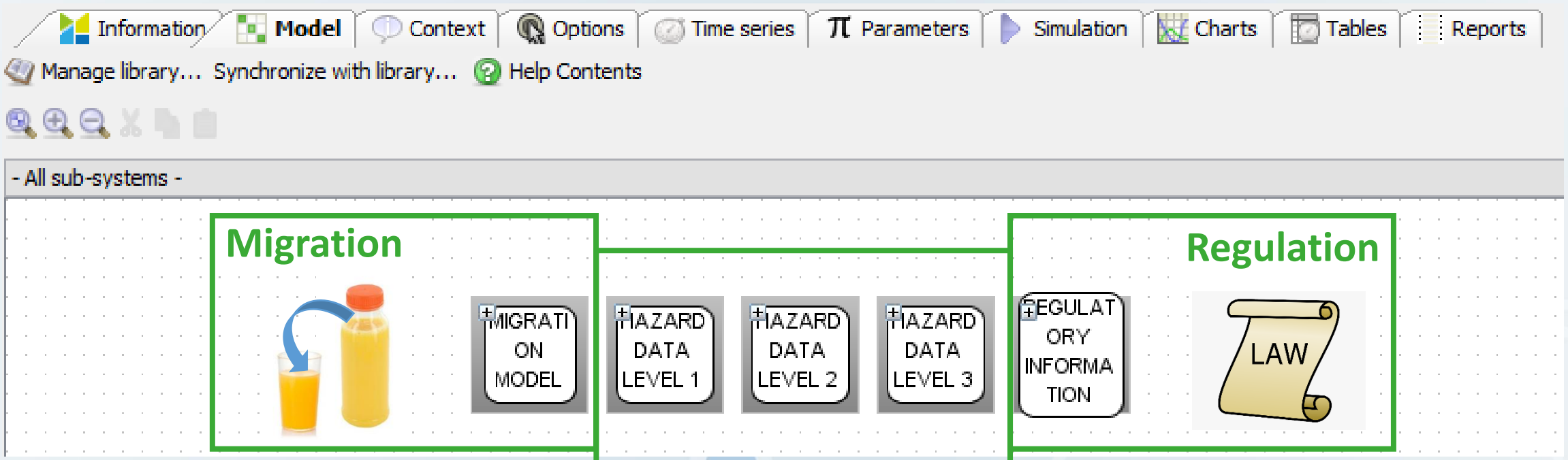
https://merlin-expo.eu/learn/documentation/sphera-tools/

Edit...

Documents



VERMEER FCM: The tool



Input VERMEER FCM

Info related to chemical, FCM and food

Output VERMEER FCM

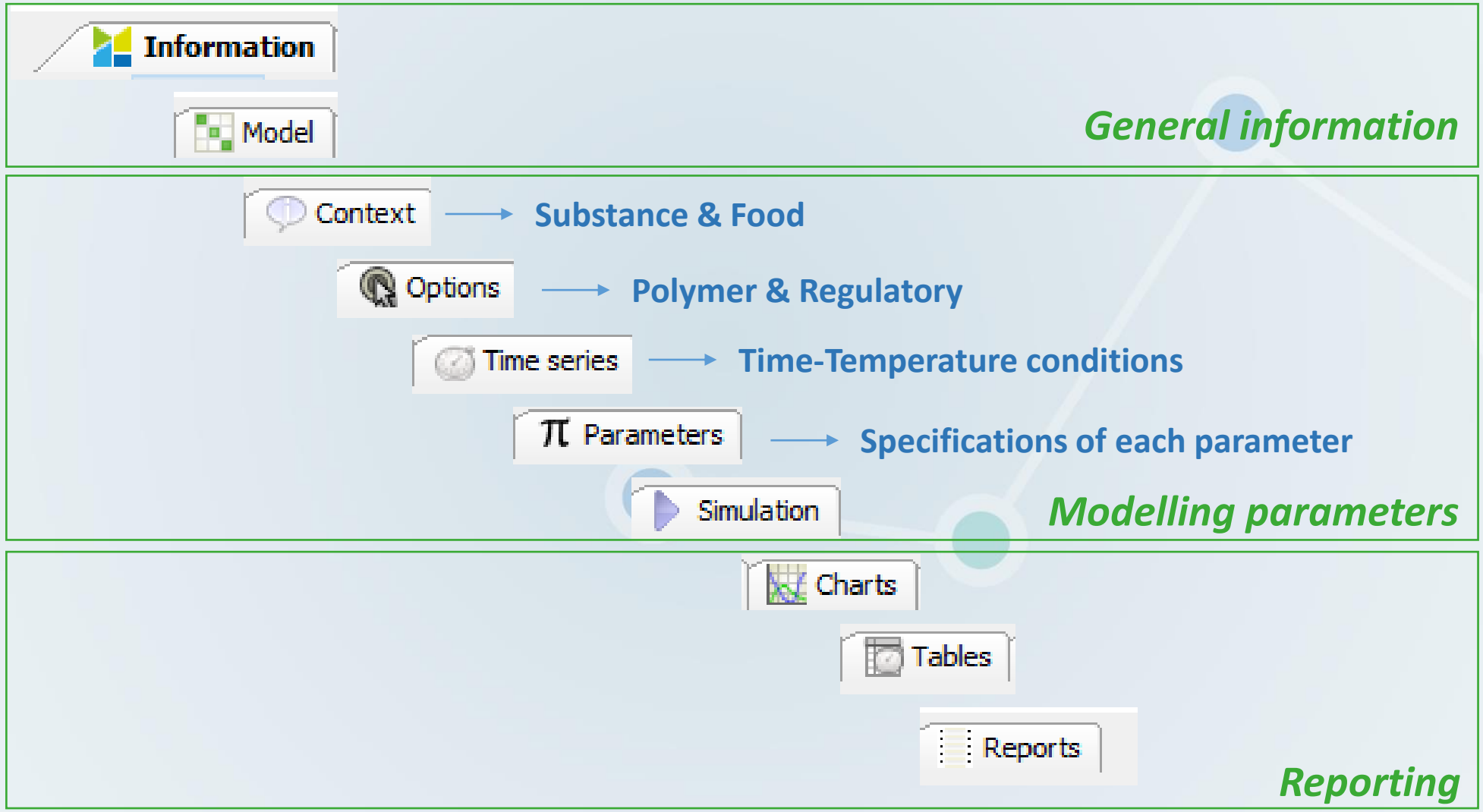
Regulatory info

Migration estimates

Toxicological prediction

Disable blocks you don't want to use

MERLIN-Expo – VERMEER FCM



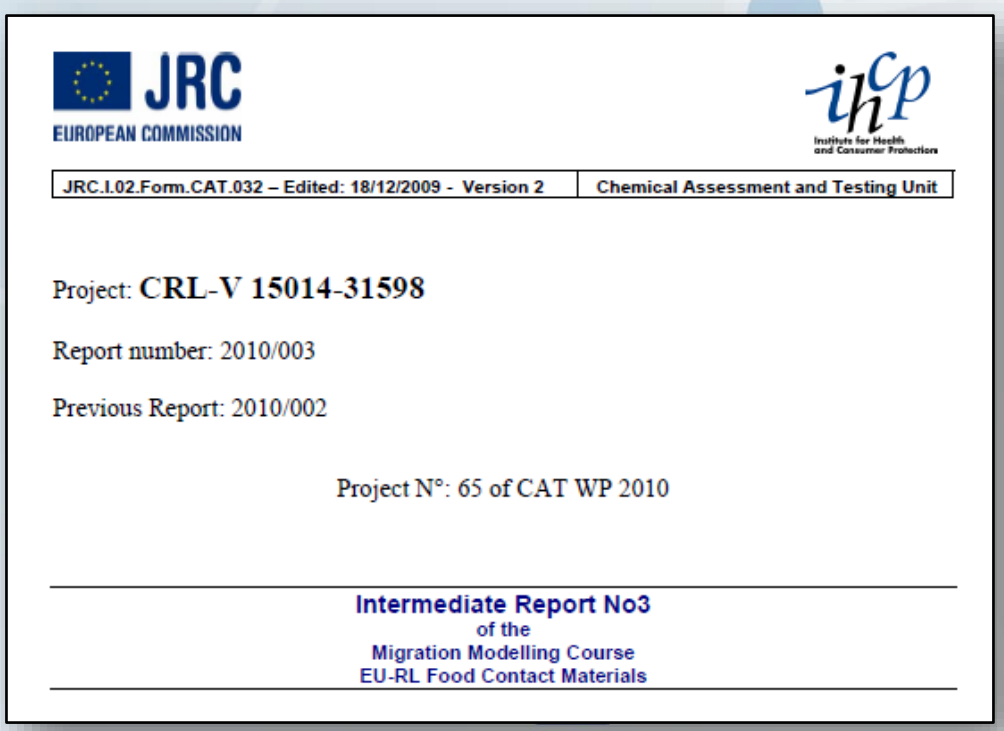
Case study – *Yoghurt container*

Empty container made of polystyrene intended for milk products

Migration of Tinuvin P (CAS: 2440-22-4)

2-(2-Hydroxy-5-methylphenyl)benzotriazole

Specifications of the FCM and food were available



JRC EUROPEAN COMMISSION

ihcp Institute for Health and Consumer Protection

JRC.I.02.Form.CAT.032 – Edited: 18/12/2009 - Version 2	Chemical Assessment and Testing Unit

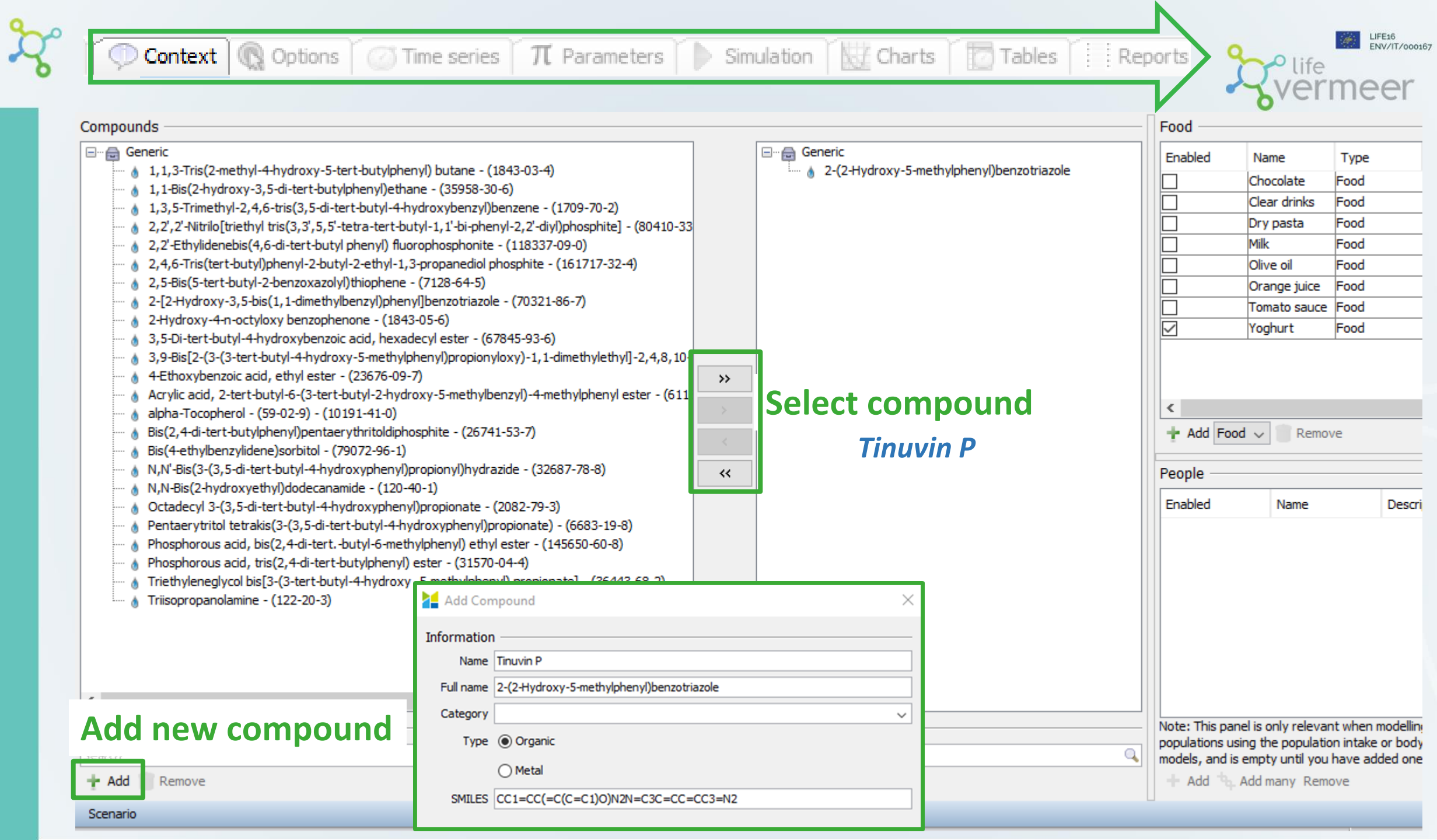
Project: **CRL-V 15014-31598**

Report number: 2010/003

Previous Report: 2010/002

Project N°: 65 of CAT WP 2010

Intermediate Report No3
of the
Migration Modelling Course
EU-RL Food Contact Materials


Context
Options
Time series
Parameters
Simulation
Charts
Tables
Reports
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Compounds
Generic
1,1,3-Tris(2-methyl-4-hydroxy-5-tert-butylphenyl) butane - (1843-03-4)
1,1-Bis(2-hydroxy-3,5-di-tert-butylphenyl)ethane - (35958-30-6)
1,3,5-Trimethyl-2,4,6-tris(3,5-di-tert-butyl-4-hydroxybenzyl)benzene - (1709-70-2)
2,2',2'-Nitrilo[triethyl tris(3,3',5,5'-tetra-tert-butyl-1,1'-bi-phenyl-2,2'-diyl)phosphite] - (80410-33
2,2'-Ethylidenebis(4,6-di-tert-butyl phenyl) fluorophosphonite - (118337-09-0)
2,4,6-Tris(tert-butyl)phenyl-2-butyl-2-ethyl-1,3-propanediol phosphite - (161717-32-4)
2,5-Bis(5-tert-butyl-2-benzoxazolyl)thiophene - (7128-64-5)
2-[2-Hydroxy-3,5-bis(1,1-dimethylbenzyl)phenyl]benzotriazole - (70321-86-7)
2-Hydroxy-4-n-octyloxy benzophenone - (1843-05-6)
3,5-Di-tert-butyl-4-hydroxybenzoic acid, hexadecyl ester - (67845-93-6)
3,9-Bis[2-(3-(3-tert-butyl-4-hydroxy-5-methylphenyl)propionyloxy)-1,1-dimethylethyl]-2,4,8,10-
4-Ethoxybenzoic acid, ethyl ester - (23676-09-7)
Acrylic acid, 2-tert-butyl-6-(3-tert-butyl-2-hydroxy-5-methylbenzyl)-4-methylphenyl ester - (611
alpha-Tocopherol - (59-02-9) - (10191-41-0)
Bis(2,4-di-tert-butylphenyl)pentaerythritoldiphosphite - (26741-53-7)
Bis(4-ethylbenzylidene)sorbitol - (79072-96-1)
N,N'-Bis(3-(3,5-di-tert-butyl-4-hydroxyphenyl)propionyl)hydrazide - (32687-78-8)
N,N-Bis(2-hydroxyethyl)dodecanamide - (120-40-1)
Octadecyl 3-(3,5-di-tert-butyl-4-hydroxyphenyl)propionate - (2082-79-3)
Pentaerytritol tetrakis(3-(3,5-di-tert-butyl-4-hydroxyphenyl)propionate) - (6683-19-8)
Phosphorous acid, bis(2,4-di-tert.-butyl-6-methylphenyl) ethyl ester - (145650-60-8)
Phosphorous acid, tris(2,4-di-tert-butylphenyl) ester - (31570-04-4)
Triethyleneglycol bis[3-(3-tert-butyl-4-hydroxy
Triisopropanolamine - (122-20-3)
Generic
2-(2-Hydroxy-5-methylphenyl)benzotriazole
Select compound
Tinuvin P
Food
Enabled
Name
Type
Chocolate Food
Clear drinks Food
Dry pasta Food
Milk Food
Olive oil Food
Orange juice Food
Tomato sauce Food
Yoghurt Food
Add Food
Remove
People
Enabled
Name
Descri
Note: This panel is only relevant when modelling
populations using the population intake or body
models, and is empty until you have added one
Add
Add many
Remove
Add new compound
Add
Remove
Scenario
Add Compound
Information
Name Tinuvin P
Full name 2-(2-Hydroxy-5-methylphenyl)benzotriazole
Category
Type Organic
Metal
SMILES CC1=CC(=C(C=C1)O)N2N=C3C=CC=CC3=N2

Compounds

- Generic
  - 1,1,3-Tris(2-methyl-4-hydroxy-5
  - 1,1-Bis(2-hydroxy-3,5-di-tert-bu
  - 1,3,5-Trimethyl-2,4,6-tris(3,5-di-
  - 2,2',2'-Nitrilo[triethyl tris(3,3',5,5
  - 2,2'-Ethylidenebis(4,6-di-tert-but
  - 2,4,6-Tris(tert-butyl)phenyl-2-bu
  - 2,5-Bis(5-tert-butyl-2-benzoxazo
  - 2-[2-Hydroxy-3,5-bis(1,1-dimeth
  - 2-Hydroxy-4-n-octyloxy benzoph
  - 3,5-Di-tert-butyl-4-hydroxybenzo
  - 3,9-Bis[2-(3-(3-tert-butyl-4-hydr
  - 4-Ethoxybenzoic acid, ethyl este
  - Acrylic acid, 2-tert-butyl-6-(3-ter
  - alpha-Tocopherol - (59-02-9) - (1
  - Bis(2,4-di-tert-butylphenyl)penta
  - Bis(4-ethylbenzylidene)sorbitol -
  - N,N'-Bis(3-(3,5-di-tert-butyl-4-hy
  - N,N-Bis(2-hydroxyethyl)dodecan
  - Octadecyl 3-(3,5-di-tert-butyl-4-
  - Pentaerytritol tetrakis(3-(3,5-di-t
  - Phosphorous acid, bis(2,4-di-tert
  - Phosphorous acid, tris(2,4-di-tert
  - Triethyleneglycol bis[3-(3-tert-bu
  - Triisopropanolamine - (122-20-3)

>> > < <<

Filter

Search

Add Remove

Food

Enabled	Name	Type	Description
☐	Chocolate	Food	Food ethanol equivalent = 70
☐	Clear drinks	Food	Food ethanol equivalent = 20
☐	Dry pasta	Food	Food ethanol equivalent = 35
☐	Milk	Food	Food ethanol equivalent = 60
☐	Olive oil	Food	Food ethanol equivalent = 95
☐	Orange juice	Food	Food ethanol equivalent = 40
☐	Tomato sauce	Food	Food ethanol equivalent = 25
☑	Yoghurt	Food	Food ethanol equivalent = 50

Select food or simulant

Add Food Remove

Add new food: specify Food ethanol equivalent under parameters!

Yoghurt – 50% Ethanol

Note: This panel is only relevant when modelling exposure to populations using the population intake or body population models, and is empty until you have added one of them.

Add Add many Remove

Scenario

Toggle

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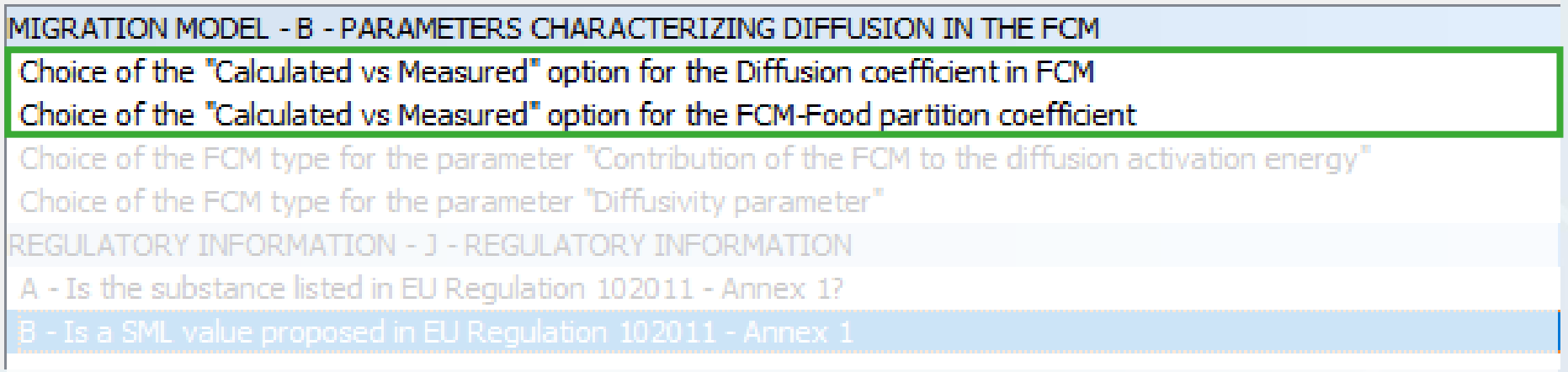

Use default parameters for the diffusion/partition

versus

measured (in house) parameters

Measured parameters

Diffusion coefficient in FCM: 4,31E-14 cm^2/s

FCM-Food Partition coefficient K: 1

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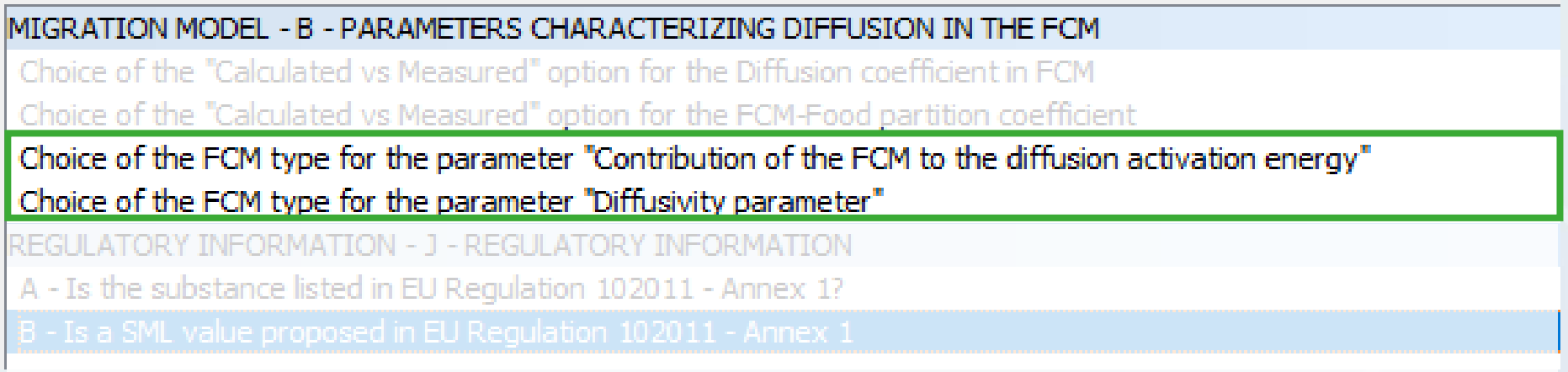

Select polymer type

Polystyrene (PS)

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MIGRATION MODEL - B - PARAMETERS CHARACTERIZING DIFFUSION IN THE FCM

Choice of the "Calculated vs Measured" option for the Diffusion coefficient in FCM

Choice of the "Calculated vs Measured" option for the FCM-Food partition coefficient

Choice of the FCM type for the parameter "Contribution of the FCM to the diffusion activation energy"

Choice of the FCM type for the parameter "Diffusivity parameter"

REGULATORY INFORMATION - J - REGULATORY INFORMATION

A - Is the substance listed in EU Regulation 102011 - Annex 1?

B - Is a SML value proposed in EU Regulation 102011 - Annex 1

Regulatory information (cfr. Context)

Regulation (EU) No. 10/2011

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
FCM substance No	Ref. No	CAS No	Substance name	Use as additive or polymer production aid (yes/no)	Use as monomer or other starting substance or macromolecule obtained from microbial fermentation (yes/no)	FRF applicable (yes/no)	SML [mg/kg]	SML(T) [mg/kg] (Group restriction No)	Restrictions and specifications	Notes on verification of compliance
444	61440	0002440-22-4	2-(2'-hydroxy-5'-methylphenyl)benzotriazole	yes	no	no		(12)		

Specific Migration Limit (SML): SML(T): 30 mg/kg

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Temperature (FCM)

Temperature is used in the calculation of the diffusion coefficient and the partition coefficient.

Options

Interpolation: Use Input Above

Cyclic: ☐

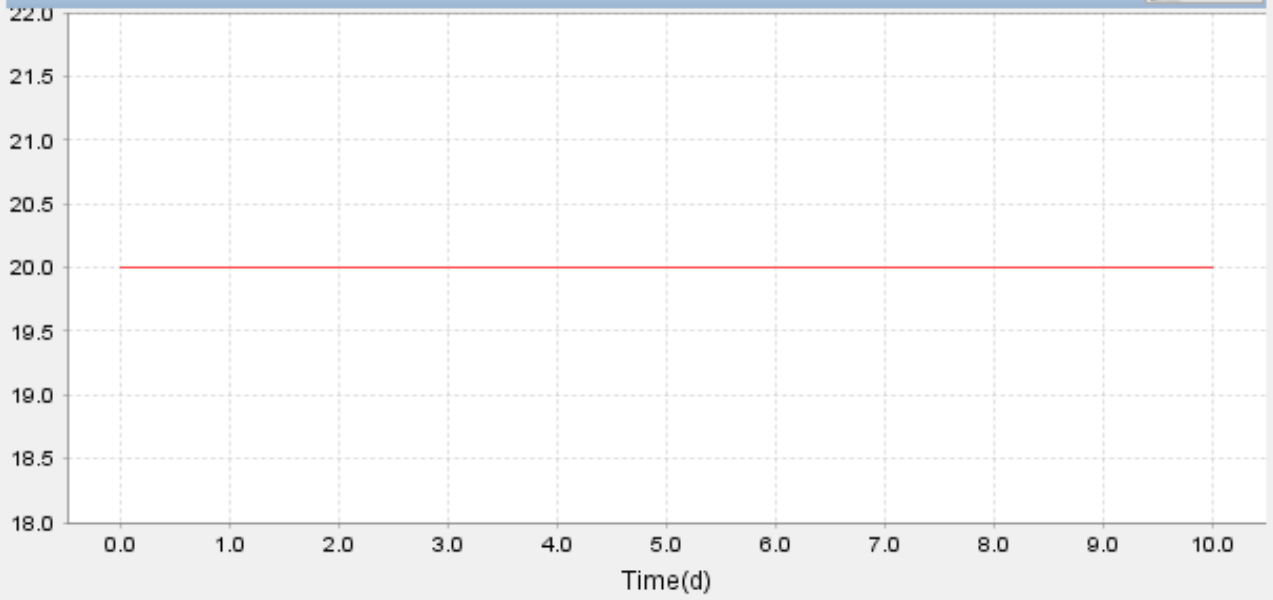
Data

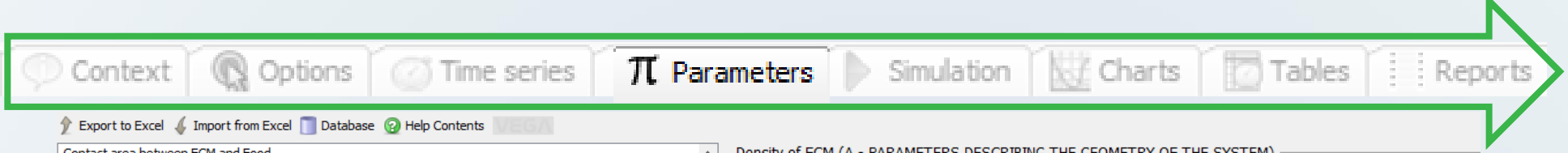
Time (d)	Value (°C)
0	20
10	20

Add time-temperature conditions

10 days @ 20°C

Editor — Toggle





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Export to Excel | Import from Excel | Database | Help Contents

- Contact area between FCM and Food
- **Density of FCM**
- Thickness of the FCM layer
- Volume of food contained in FCM packaging
- MIGRATION MODEL - B - PARAMETERS CHARACTERIZING DIFFUSION IN THE FCM
- Diffusivity parameter of HDPE
- Diffusivity parameter of HIPS
- Diffusivity parameter of LDPE
- Diffusivity parameter of PA
- Diffusivity parameter of PEN
- Diffusivity parameter of PET
- Diffusivity parameter of PP
- Diffusivity parameter of PS
- Diffusivity parameter of the other polymer
- Measured diffusion coefficient
- Measured FCM-Food Partition coefficient (in log10 unit)
- Specific contribution of HDPE to the diffusion activation energy
- Specific contribution of HIPS to the diffusion activation energy
- Specific contribution of LDPE to the diffusion activation energy
- Specific contribution of PA to the diffusion activation energy
- Specific contribution of PEN to the diffusion activation energy
- Specific contribution of PET to the diffusion activation energy
- Specific contribution of PP_homo to the diffusion activation energy
- Specific contribution of PS to the diffusion activation energy
- Specific contribution of rubber PP to the diffusion activation energy
- Specific contribution of the other polymer to the diffusion activation energy
- MIGRATION MODEL - C - PARAMETERS DESCRIBING THE CHEMICAL
- Initial concentration of the chemical in FCM
- Molar mass of the migrating chemical
- Octanol-Water partition coefficient (in log10) calculated by the MlogP model VEGA
- Octanol-Water partition coefficient (in log10) calculated by the MlogP model - ADI VEGA
- MIGRATION MODEL - D - PARAMETERS CHARACTERIZING THE FOOD
- Density of food
- Food Ethanol-equivalent
- HAZARD DATA LEVEL 1 - E - MUTAGENICITY
- Mutagenicity qualitative prediction by the consensus VEGA model VEGA
- Mutagenicity qualitative prediction by the consensus VEGA model - ADI VEGA
- HAZARD DATA LEVEL 1 - F - IN VITRO MICRONUCLEUS ACTIVITY
- In vitro micronucleus activity qualitative prediction by the IRFMN model VEGA
- In vitro micronucleus activity qualitative prediction by the IRFMN model - ADI VEGA
- HAZARD DATA LEVEL 2 - G - SUB-CHRONIC ORAL TOXICITY
- log(NOAEL) quantitative prediction by the IRFMN model VEGA
- log(NOAEL) quantitative prediction by the IRFMN model - ADI VEGA
- HAZARD DATA LEVEL 3 - H - CARCINOGENICITY
- Carcinogenicity qualitative prediction by the ANTARES model VEGA

Name
Search

Category
- All categories -

Tags
- All tags -

Sub-system
- All sub-systems -

Density of FCM (A - PARAMETERS DESCRIBING THE GEOMETRY OF THE SYSTEM)
Is used in the calculation of the partition coefficient K_FCM_Food

Data

Name	Value
Value	1.1E0
PDF	
Unit	g cm^{-3}
Min value	
Max value	

Editor

For several parameters:

Best estimates (or default) values proposed by VERMEER

FCM – Value can be changed to own value

Probability Density Function (PDF):

Optional, to be used when parameters are uncertain

(probabilistic approach)

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Export to Excel | Import from Excel | Database | Help Contents

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MIGRATION MODEL - C - PARAMETERS DESCRIBING THE CHEMICAL
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Molar mass of the migrating chemical
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Octanol-Water partition coefficient (in log10) calculated by the MlogP model - ADI VEGA
MIGRATION MODEL - D - PARAMETERS CHARACTERIZING THE FOOD
Density of food
Food Ethanol-equivalent

Automatically calculated by VEGA

Context | Options | Time series | π Parameters | Simulation | Charts | Tables | Reports

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HAZARD DATA LEVEL 1 - E - MUTAGENICITY
Mutagenicity qualitative prediction by the consensus VEGA model VEGA
Mutagenicity qualitative prediction by the consensus VEGA model - ADI VEGA
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HAZARD DATA LEVEL 3 - H - CARCINOGENICITY
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Carcinogenicity qualitative prediction by the ANTARES model - ADI VEGA
Carcinogenicity qualitative prediction by the CAESAR model VEGA
Carcinogenicity qualitative prediction by the CAESAR model - ADI VEGA
Carcinogenicity qualitative prediction by the IRFMN oral classification model VEGA
Carcinogenicity qualitative prediction by the IRFMN oral classification model - ADI VEGA
Carcinogenicity qualitative prediction by the ISSCAN model VEGA
Carcinogenicity qualitative prediction by the ISSCAN model - ADI VEGA
Carcinogenicity qualitative prediction by the ISS model VEGA
Carcinogenicity qualitative prediction by the ISS model - ADI VEGA
Carcinogenicity quantitative oral slope factor prediction by the IRFMN model VEGA
Carcinogenicity quantitative oral slope factor prediction by the IRFMN model - ADI VEGA
HAZARD DATA LEVEL 3 - I - DEVELOPMENTAL TOXICITY
Developmental Reproductive toxicity PG VEGA
Developmental Reproductive toxicity PG ADI VEGA
Development qualitative prediction by the CAESAR model VEGA
Development qualitative prediction by the CAESAR model - ADI VEGA

Quantitative/qualitative value of the prediction

Indication of confidence related with prediction

Automatic determination

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HAZARD DATA LEVEL 1 - E - MUTAGENICITY

Mutagenicity qualitative prediction by the consensus VEGA model VEGA

Mutagenicity qualitative prediction by the consensus VEGA model - ADI VEGA

VEGA

Hazard_data_level_1.Mutagenicity_co

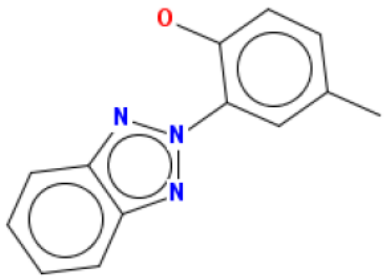
Mutagenicity (Ames test) CONSE

Mutagenicity (Ames test) Consensus n

Material	Report
2-(2-Hydroxy-5-methylphenyl)be	sensus score: 0.3) VEGA Show report

1. Prediction Summary

Prediction for compound



Prediction:

Prediction is Mutagenic with a consensus score of 0.3, based on 4 models.

Compound:
Compound SMILES: Oc1ccc(cc1n2nc3ccccc3(n2))C
Used models: 4
Predicted Consensus Mutagen activity: Mutagenic
Mutagenic Score: 0.3
Non-Mutagenic Score: 0.1
Model Caesar assessment: Mutagenic (moderate reliability)
Model ISS assessment: NON-Mutagenic (low reliability)
Model SarPy assessment: Possible NON-Mutagenic (low reliability)
Model KNN assessment: Mutagenic (moderate reliability)

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HAZARD DATA LEVEL 1 - E - MUTAGENICITY
Mutagenicity qual
Mutagenicity qual
HAZARD DATA LEV
In vitro micronucl
In vitro micronucl
HAZARD DATA LEV
log(NOAEL) quant
log(NOAEL) quant
HAZARD DATA LEV
Carcinogenicity qu
Carcinogenicity qu
Carcinogenicity qu
Carcinogenicity qu
HAZARD DATA LEV
Developmental Re
Developmental Re
Development qua
Development qua

VEGA

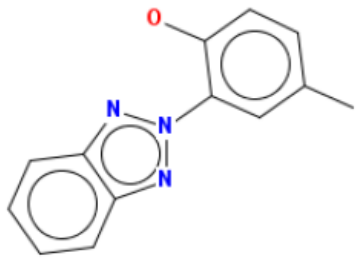
Hazard_data_level_2.log_NOAE

NOAEL (IRFMN/CORAL)
Quantitative model for NOAEL

Material	ts	Assessment	Report
2-(2-Hydroxy-5-methylphe	(mg/kg)	-0.783 (low reliability)	VEGA Show report

1. Prediction Summary

Prediction for compound



Prediction: Reliability:

Prediction is -0.783, but the result may be not reliable. A check of the information given in the following section should be done, paying particular attention to the following issues:
- only moderately similar compounds with known experimental value in the training set have been found
- accuracy of prediction for similar molecules found in the training set is not optimal
- some similar molecules found in the training set have experimental values that disagree with the predicted value
- the maximum error in prediction of similar molecules found in the training set has a moderate value, considering the experimental variability
- a prominent number of atom centered fragments of the compound have not been found in the compounds of the training set or are rare fragments (4 unknown fragments found)

Compound:
Compound SMILES: Oc1ccc(cc1n2nc3ccccc3(n2))C
Experimental value [-log(mg/kg)]: -
Predicted NOAEL [-log(mg/kg)]: -0.783
Predicted NOAEL [mg/kg]: 6.07
Experimental NOAEL [mg/kg]: -
Reliability: the predicted compound is outside the Applicability Domain of the model
Remarks:
none

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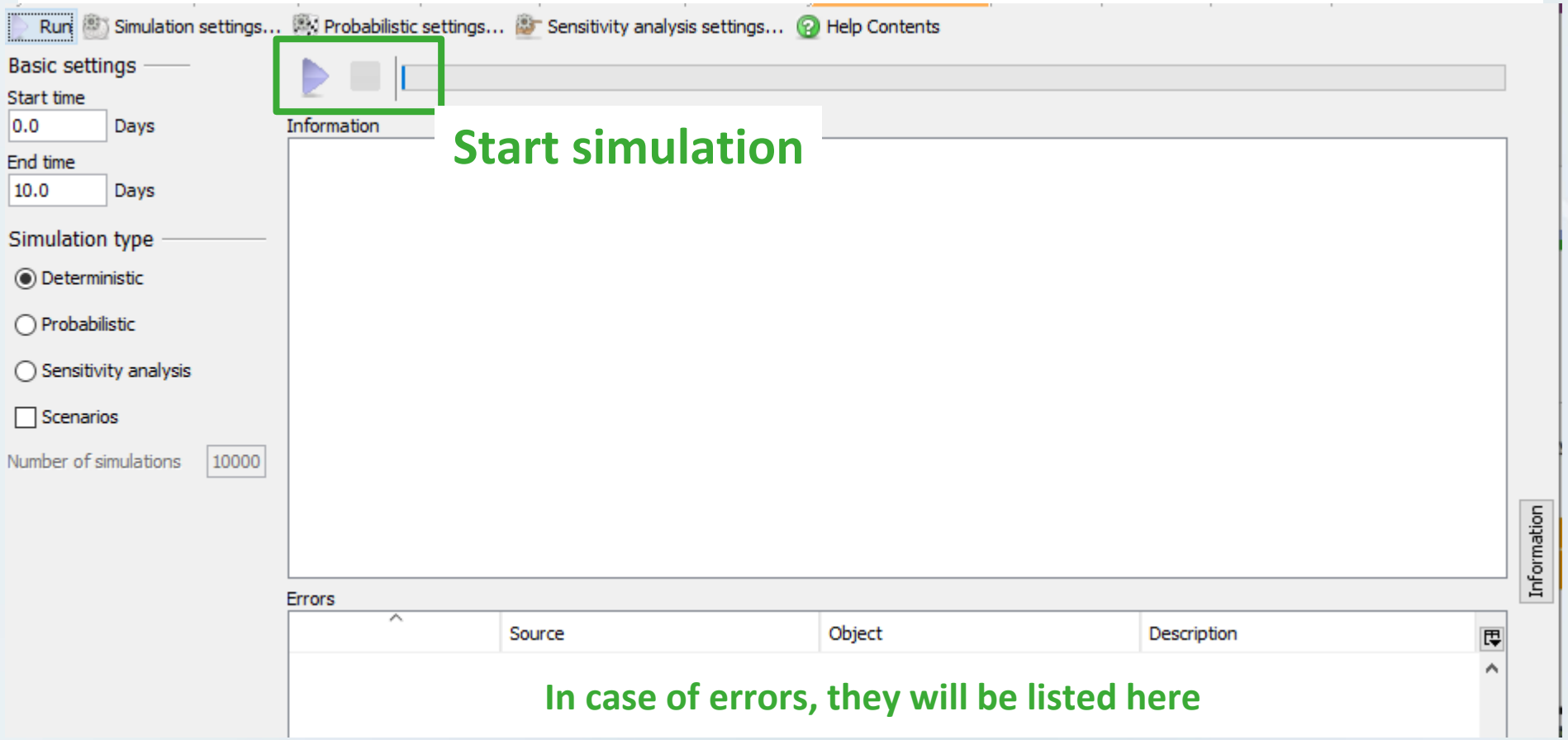
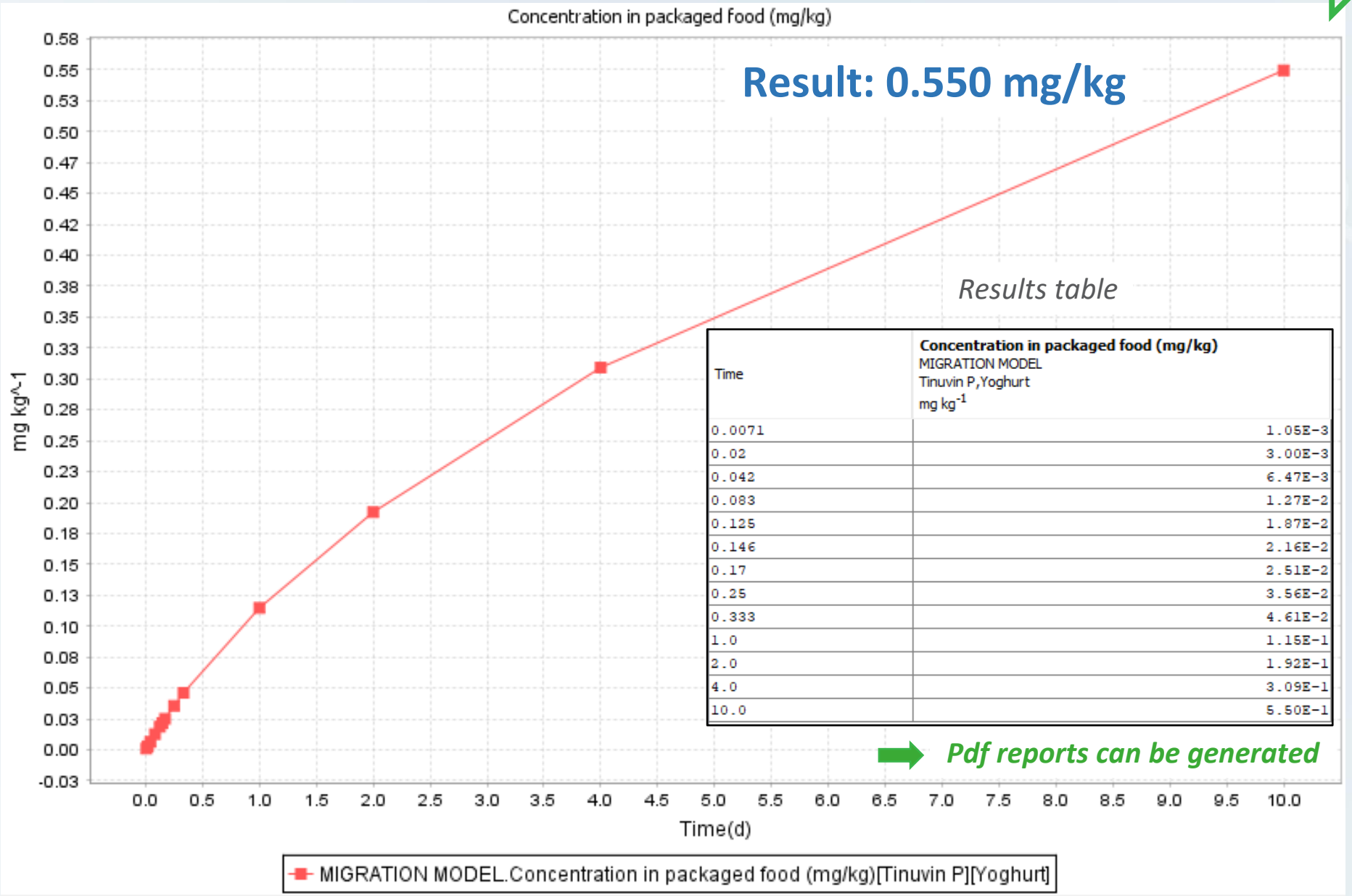


Context | Options | Time series | Parameters | Simulation | Charts | Tables | Reports



Result: 0.550 mg/kg

Results table

Time	Concentration in packaged food (mg/kg) MIGRATION MODEL Tinuvin P,Yoghurt mg kg^{-1}
0.0071	1.05E-3
0.02	3.00E-3
0.042	6.47E-3
0.083	1.27E-2
0.125	1.87E-2
0.146	2.16E-2
0.17	2.51E-2
0.25	3.56E-2
0.333	4.61E-2
1.0	1.15E-1
2.0	1.92E-1
4.0	3.09E-1
10.0	5.50E-1

Pdf reports can be generated

ERLIN EXPO

0.550 mg/kg

MIGRATEST © EXP

0.686 mg/kg

AKTS

SML- SPECIFIC MIGRATION LIMITS Software

0.701 mg/kg

The result obtained with VERMEER FCM is similar compared to the other results

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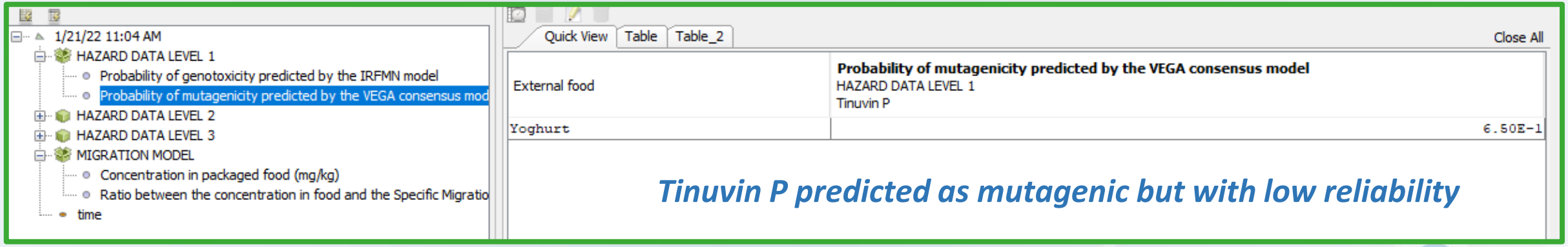
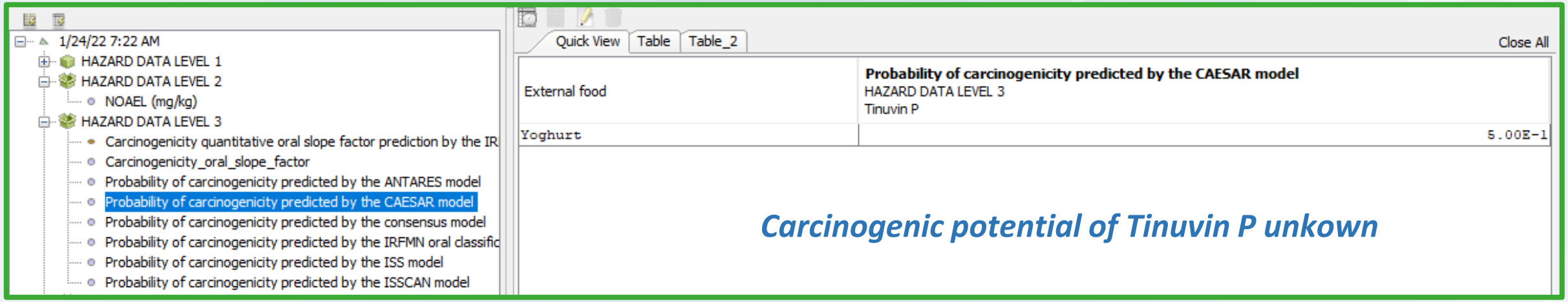
Mutagenicity



Carcinogenicity



Extra guidance on how hazard data need to be interpreted will be added to the VERMEER FCM tool

Further validation of VERMEER FCM

Which type of migration data do we need?

1. Experimental migration values + info on associated parameters

- Parameters describing geometry of the system
  - Contact area between FCM and food
  - Density of FCM
  - Thickness FCM layer
  - Volume Food
- FCM parameters
  - Nature of FCM (default values for diffusivity parameter & Specific contribution of the polymer matrix to the diffusion activation energy)
- Chemical parameters
  - Initial concentration in FCM
  - Molar mass
- Food parameters
  - Density of the food

Further validation of VERMEER FCM

Which type of migration data do we need?

2. FCM material to perform migration tests + information on different parameters

If you are willing to contribute, don’t hesitate to contact us!

Possible applications of VERMEER FCM

- Model migration of compound of interest to have an indication on type and amount of toxicological data needed
- Evaluate impact of modifications in characteristics of polymer on migration
- Model migration of compound for different types of food packed in the FCM
- …

- Evaluate possible hazards for compound of interest
- Evaluate possible hazards of NIAS

- Check quickly whether compound of interest is included in Annex I
- Collect info on SML (if available) and restricted use for compound of interest

Future of VERMEER FCM

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SILIFOOD

Development of a semi-automated workflow including (Q)SAR models to support the risk assessment of non-evaluated food contact material substances

C. Streel , I. Van Overmeire , G. Selvestrel, A. Roncaglioni, E. Benfenati, E. Van Hoeck and B. Mertens

RISK ASSESSMENT

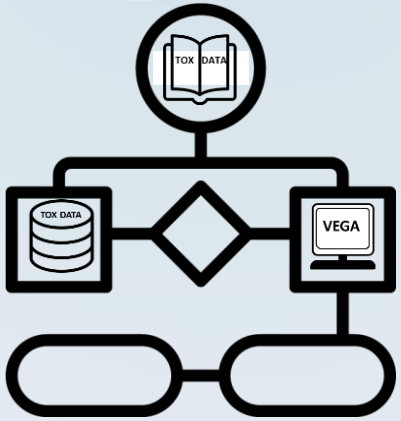
HAZARD

Regulatory information

Available toxicological data in a (non)-FCM context

- Endocrine disrupting activity
- Genotoxicity and carcinogenicity data
- Health based guidance values (HBGV)
- Reference points (RP)
- Cramer classifications (*cf. TCC approach*)

***In silico* predictions using** VEGA HUB



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EXPOSURE

Food software

VERMEER FCM

Future of VERMEER FCM

SILIFOOD

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Timing: 1/10/2021-31/03/2023

Partners:

Funded by:

SILIFOOD
RF 21/6349

federal public service
HEALTH, FOOD CHAIN SAFETY AND ENVIRONMENT

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kode from data to knowledge

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Making Future.