EVALUATING LABORATORY AND FIELD DISSIPATION STUDIES TO OBTAIN DEGT50 IN SOIL

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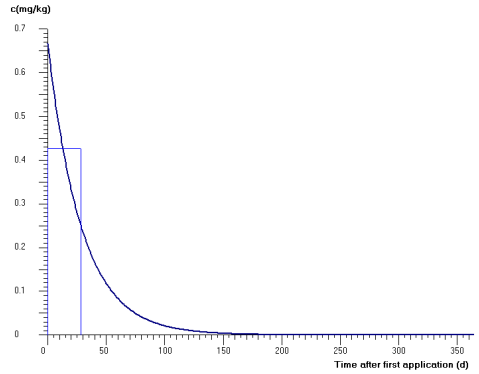
- Introduction
- EFSA Guidance for estimating the half life in field dissipation studies
- Calculation of degradation rates – an example
- Impact on leaching to groundwater
- Additional Panel recommendations
- Summary and conclusions

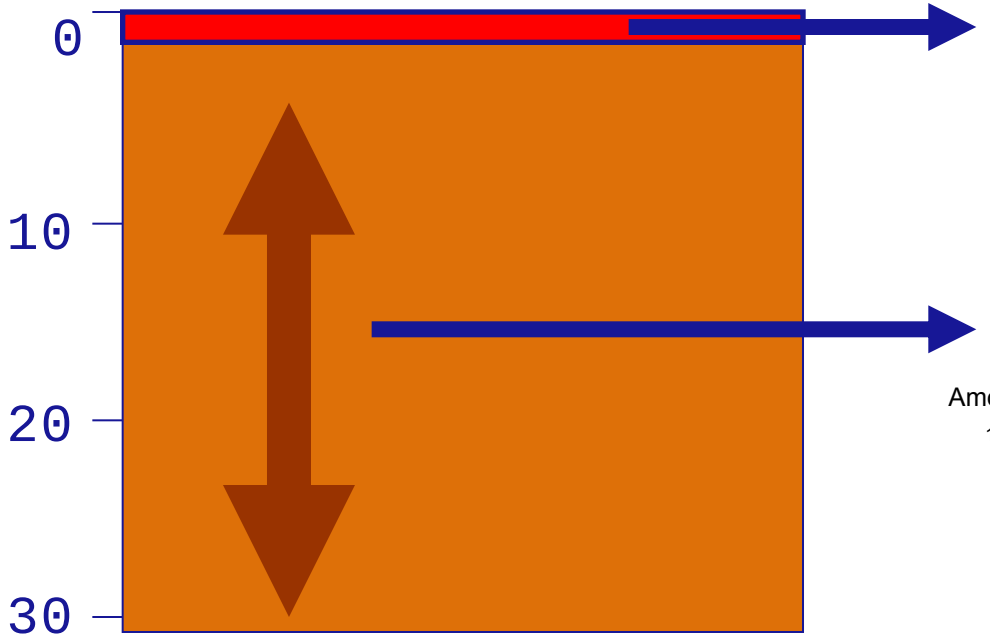
EFSA PPR Panel December 2010: New guidance on how to derive the half-life for degradation in soil

Aim to develop procedures

- for estimating $DegT50_{matrix}$ reliably from individual field dissipation studies
- for assessing the relevant population of $DegT50_{matrix}$
- for estimating reliably the geomean of the relevant population of $DegT50_{matrix}$



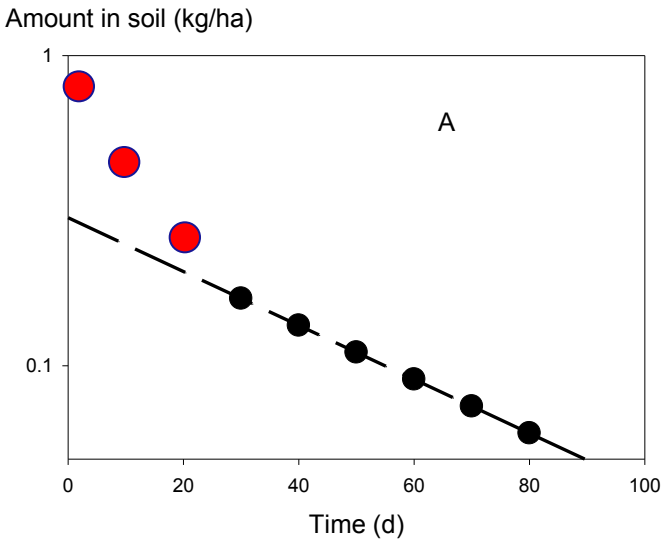
Problems when estimating the half life based on field studies



soil depth (cm)

• decline in top mm

• decline in soil matrix

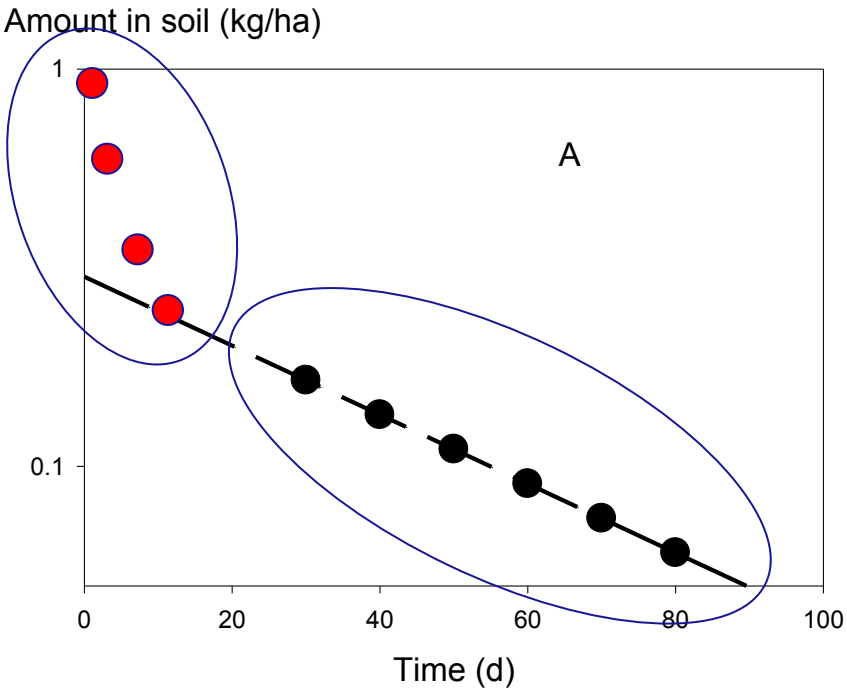


Aims of the proposed guidance

To develop procedures

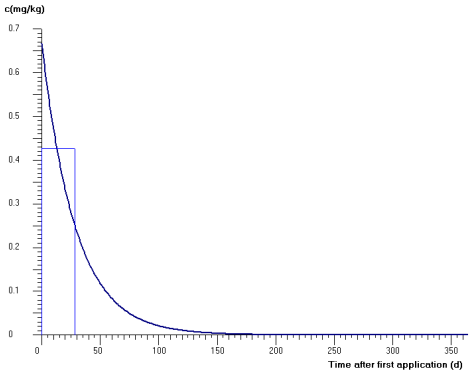
- for estimating reliably the end of the initial decline in the top millimetre

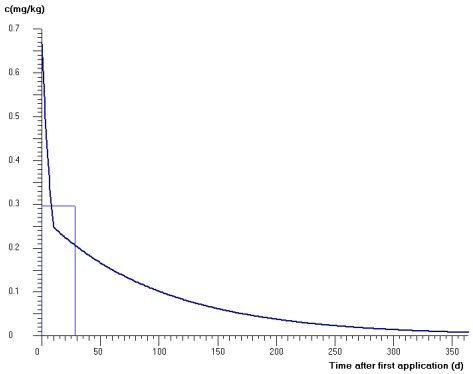
- For estimating reliably $DegT50_{matrix}$ based on the slow phase of the degradation



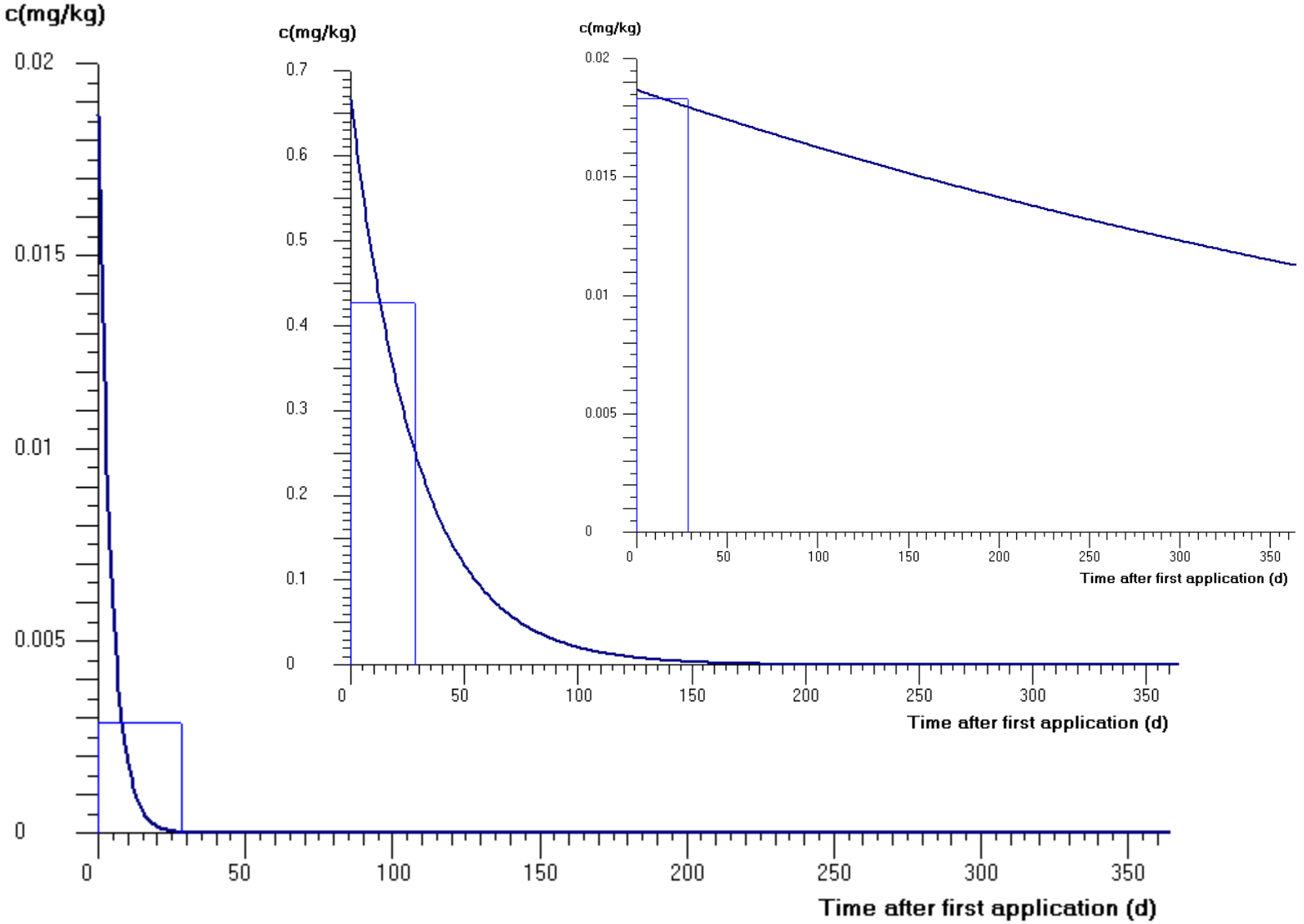
Principles of the guidance

- The estimation of *DegT50*$_{matrix}$ *must* guarantee that it does not include surface loss processes.
- SFO kinetics cannot describe faster decline at the initial stage
- Bi-phasic kinetic models are the preferred option when analysing field experiments
- Always the slow phase of the bi-phasic models is considered for the estimation of *DegT50*$_{matrix}$

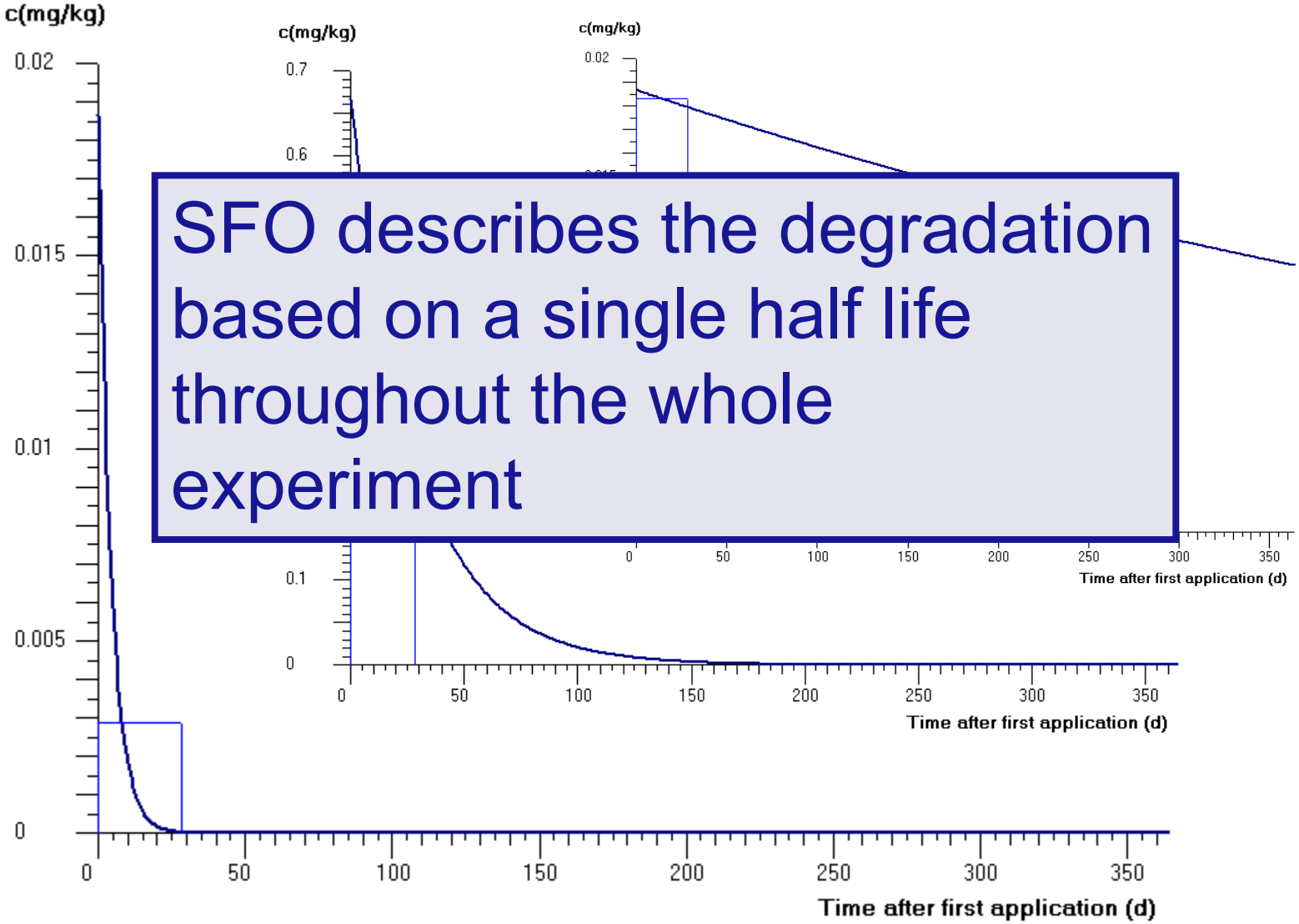




Examples for SFO kinetics

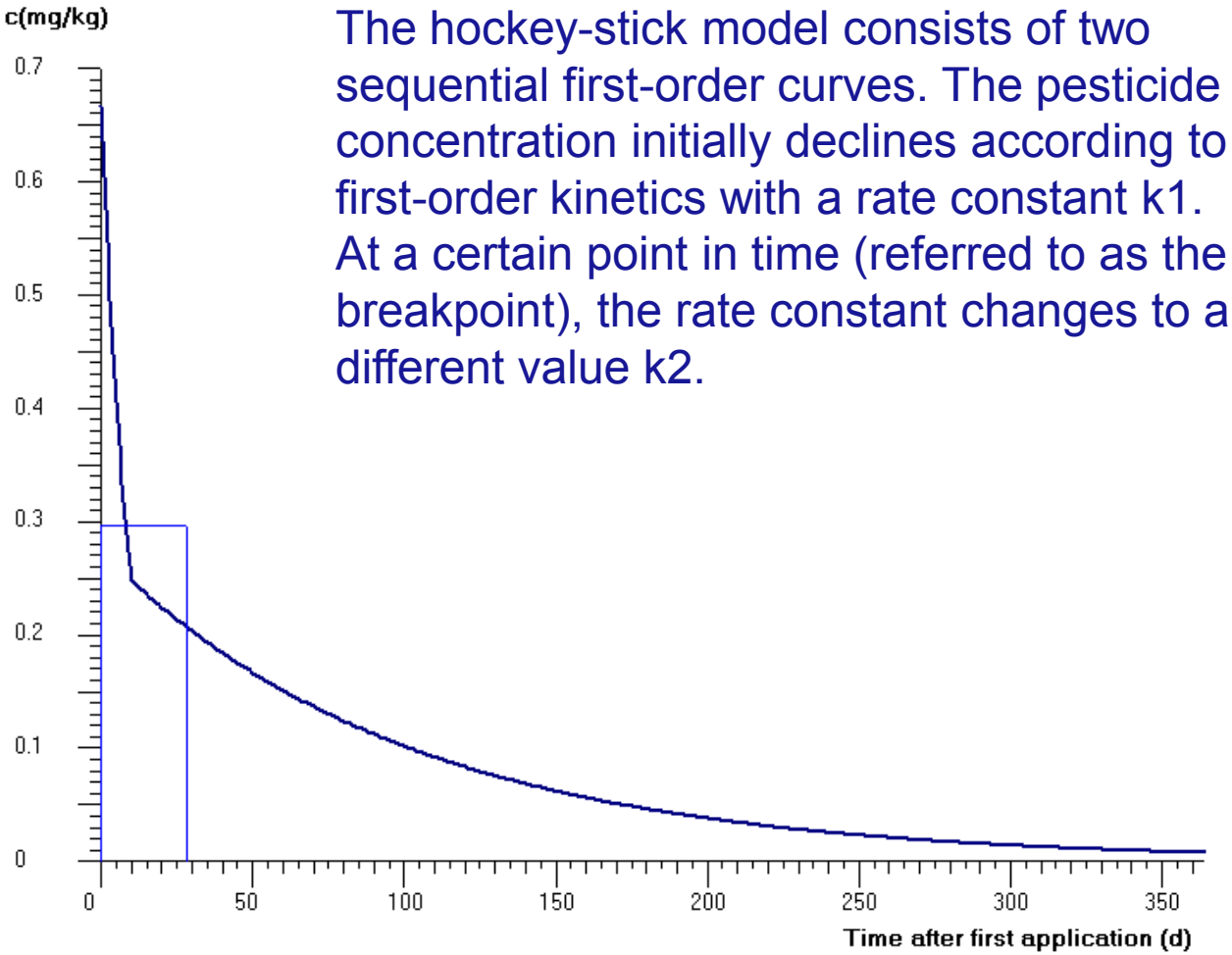


Examples for SFO kinetics



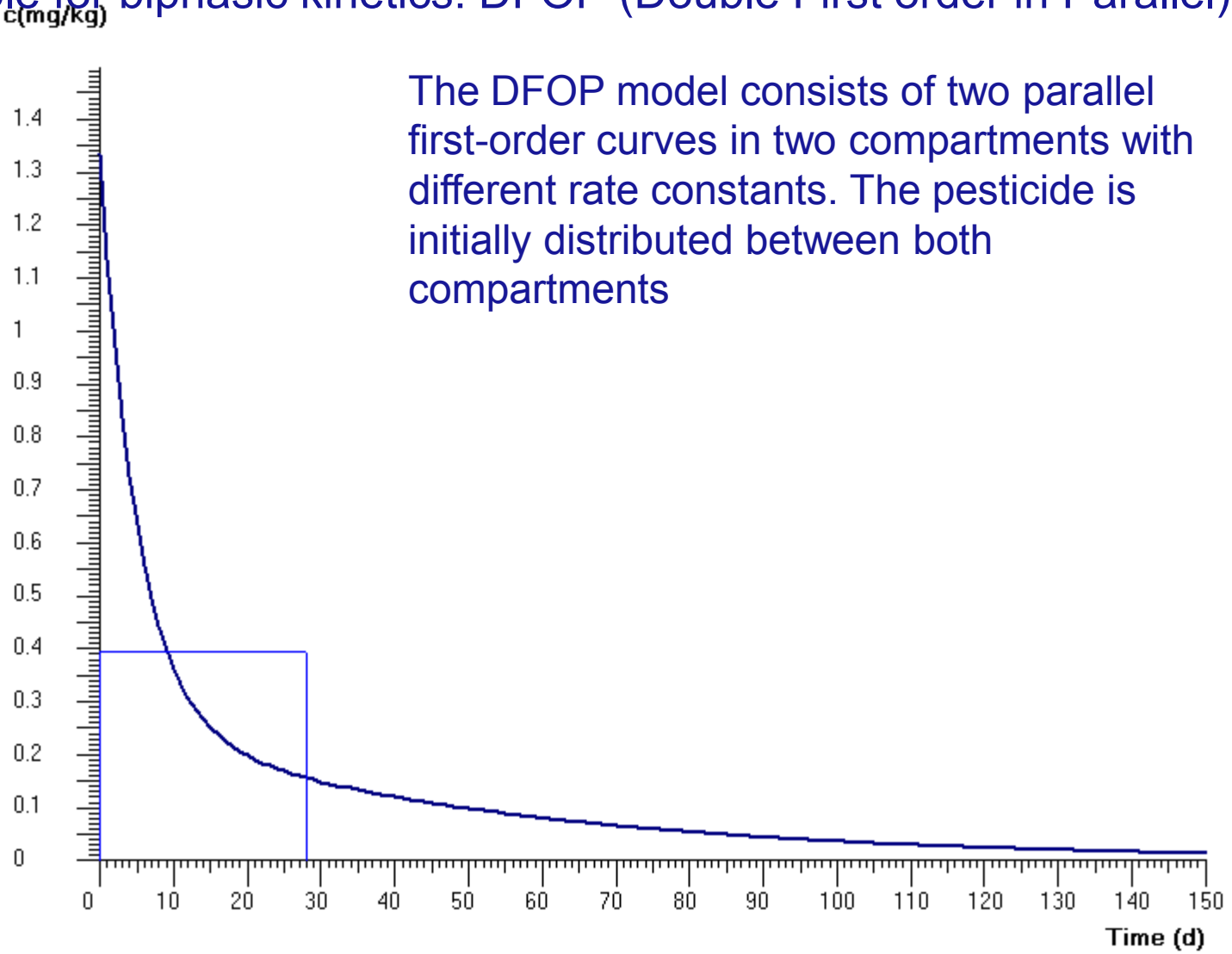
SFO describes the degradation based on a single half life throughout the whole experiment

Example for biphasic kinetics: Hockey Stick (HS)



The hockey-stick model consists of two sequential first-order curves. The pesticide concentration initially declines according to first-order kinetics with a rate constant k1. At a certain point in time (referred to as the breakpoint), the rate constant changes to a different value k2.

Example for biphasic kinetics: DFOP (Double First order in Parallel)



The DFOP model consists of two parallel first-order curves in two compartments with different rate constants. The pesticide is initially distributed between both compartments

Further principles

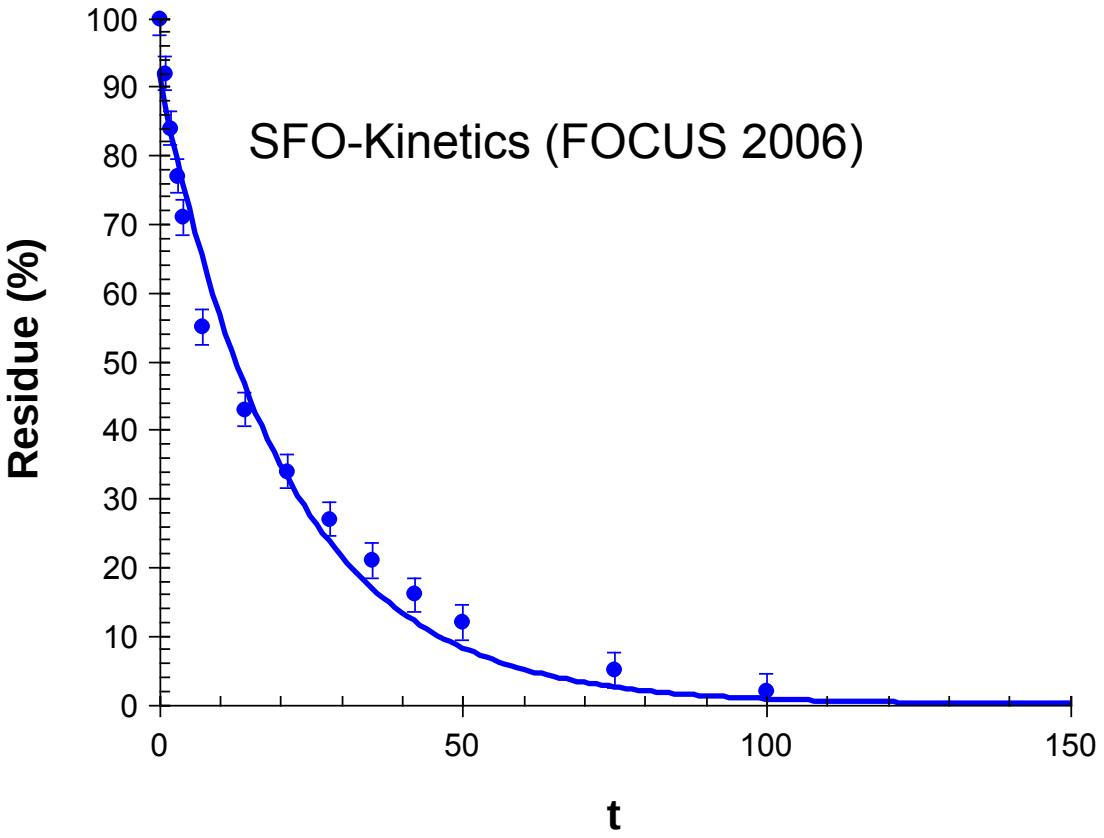
- The kinetic analyses using bi-phasic models are the preferred option, but they cannot guarantee that their slow phase always represent $DegT50_{matrix}$ (e.g. when more than one surface process occurred)
- The field experiment is split into two parts before and after 10 mm rain has fallen
- It has to be checked that at least 10 mm has fallen before the slow phase of the experiment begins

Calculation of the DT50 – an example (standard SFO evaluation)

Time (d)	Residue (%)
0	100
1	92
2	84
3	77
4	71
7	55
14	43
21	34
28	27
35	21
42	16
50	12
75	5
100	2

10 mm rainfall after 5 d

Results of a field persistence experiment
(all residue data normalised to 20 °C



Kinetics	DegT50 (d)	FOCUS chi²-error (%)
SFO	14.4	8.3

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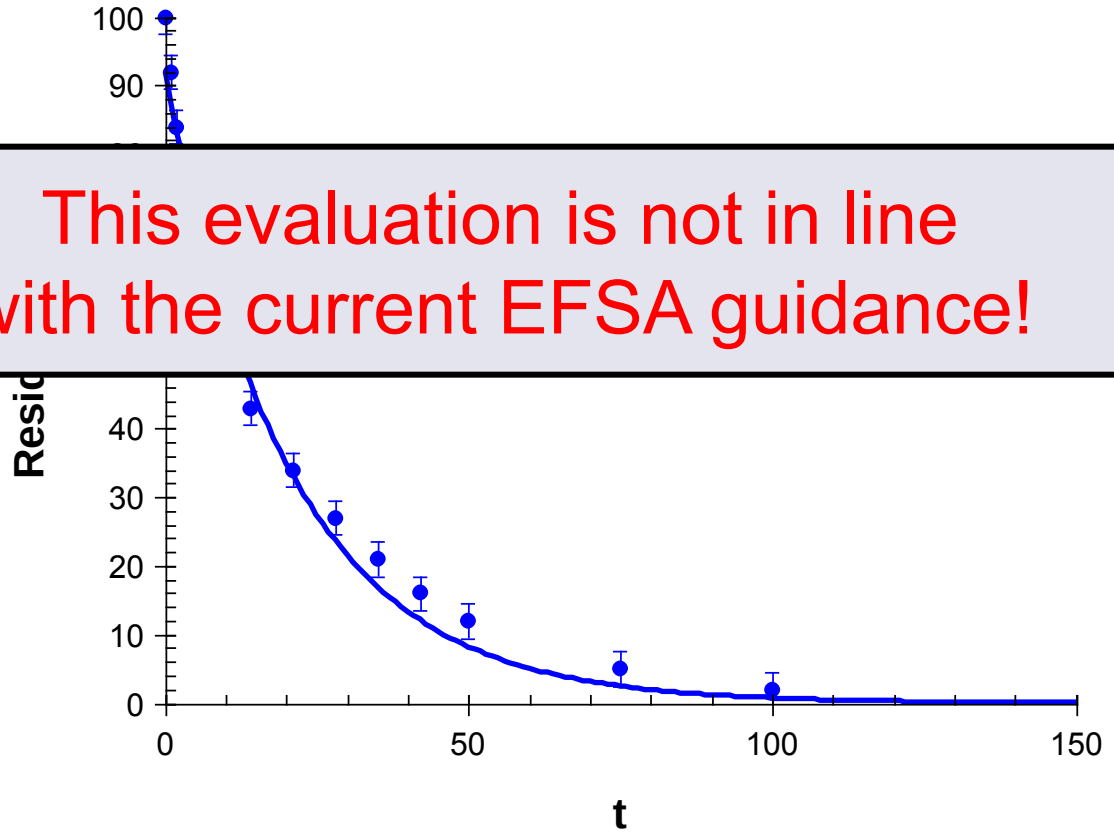
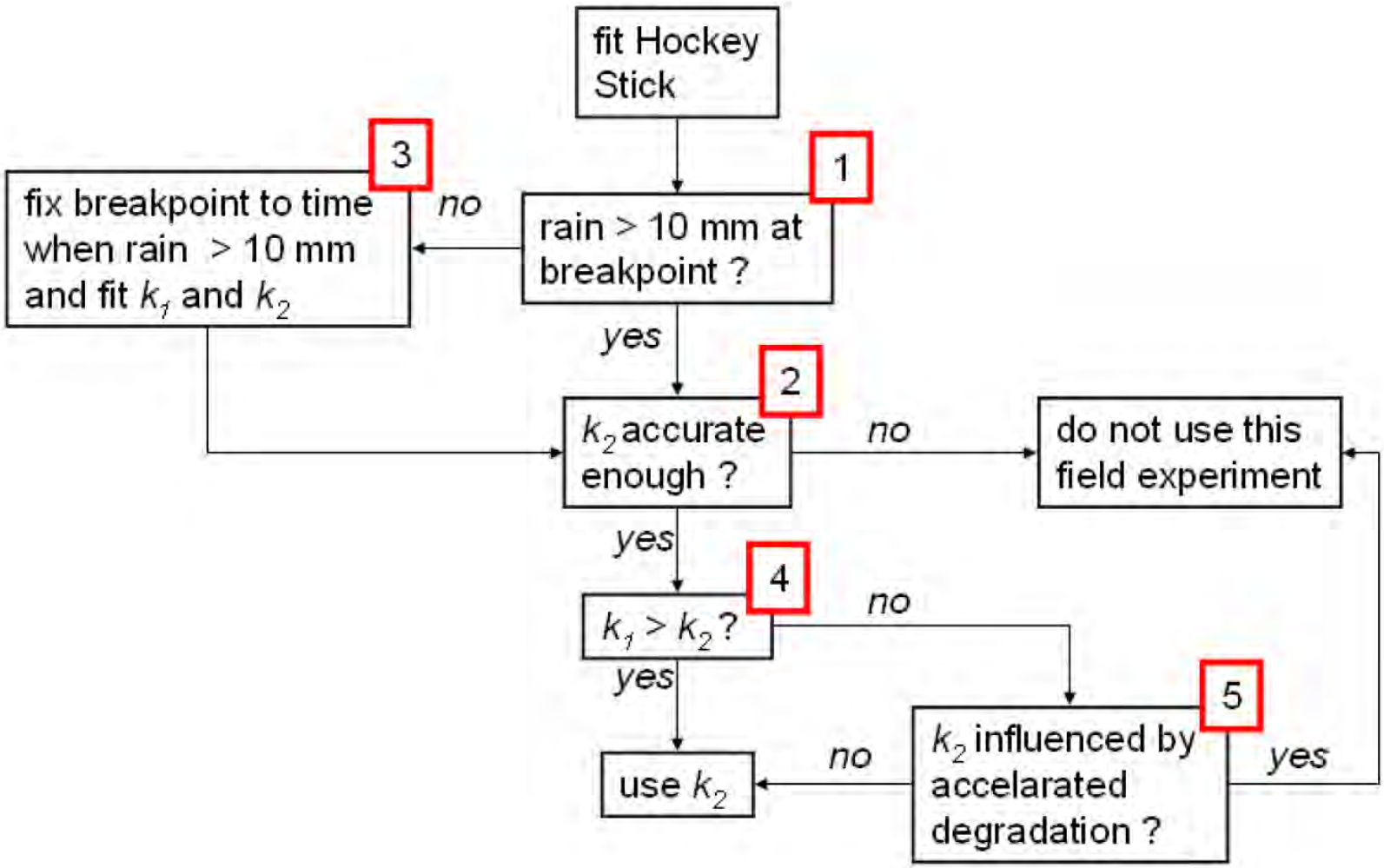


This evaluation is not in line with the current EFSA guidance!

Kinetics	DegT50 (d)	FOCUS chi²-error (%)
SFO	14.4	8.3

Calculation of the DT50 – EFSA flowchart for Hockey Stick fitting



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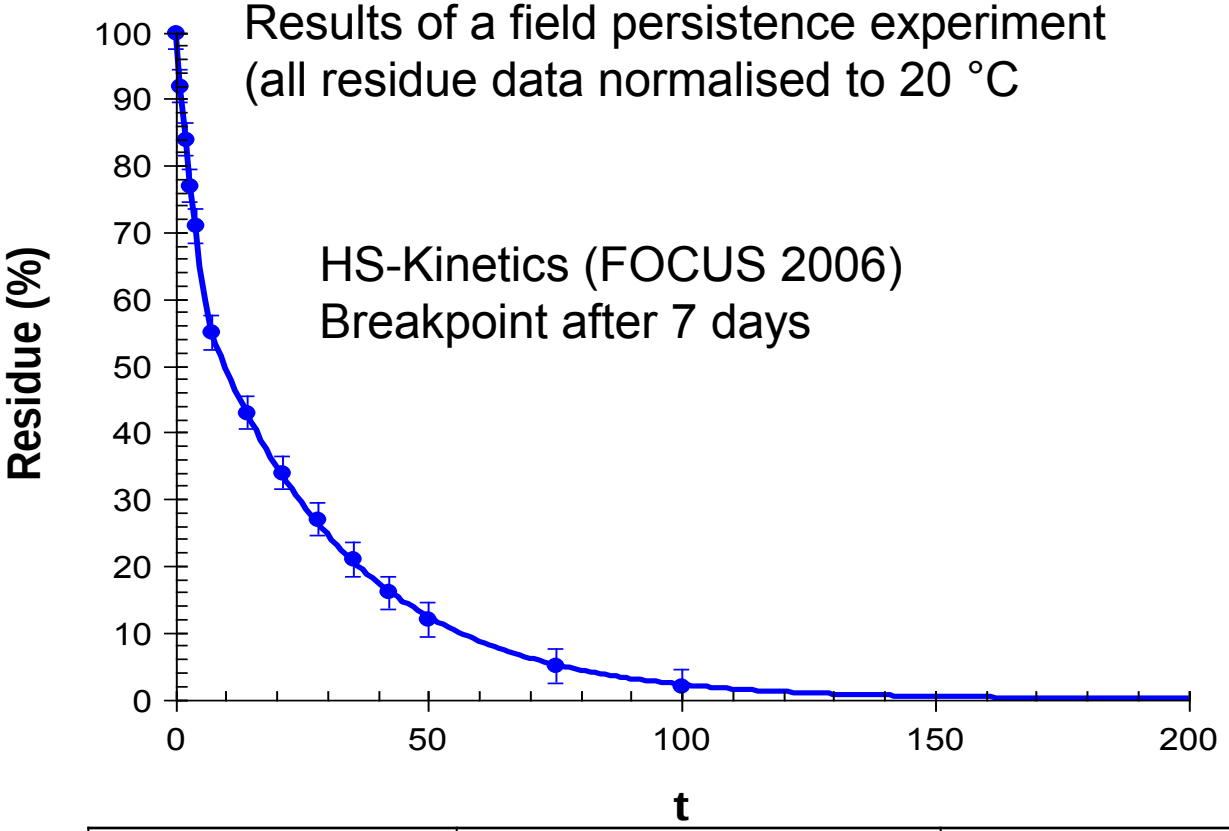
HS-Kinetics (FOCUS 2006)
Breakpoint after 7 days



Kinetics	DegT50 (d)	FOCUS chi²-error (%)
SFO	14.4	8.3
HS (slow phase)	**20.0**	**0.5**

Calculation of the DT50 – an example (HS evaluation)

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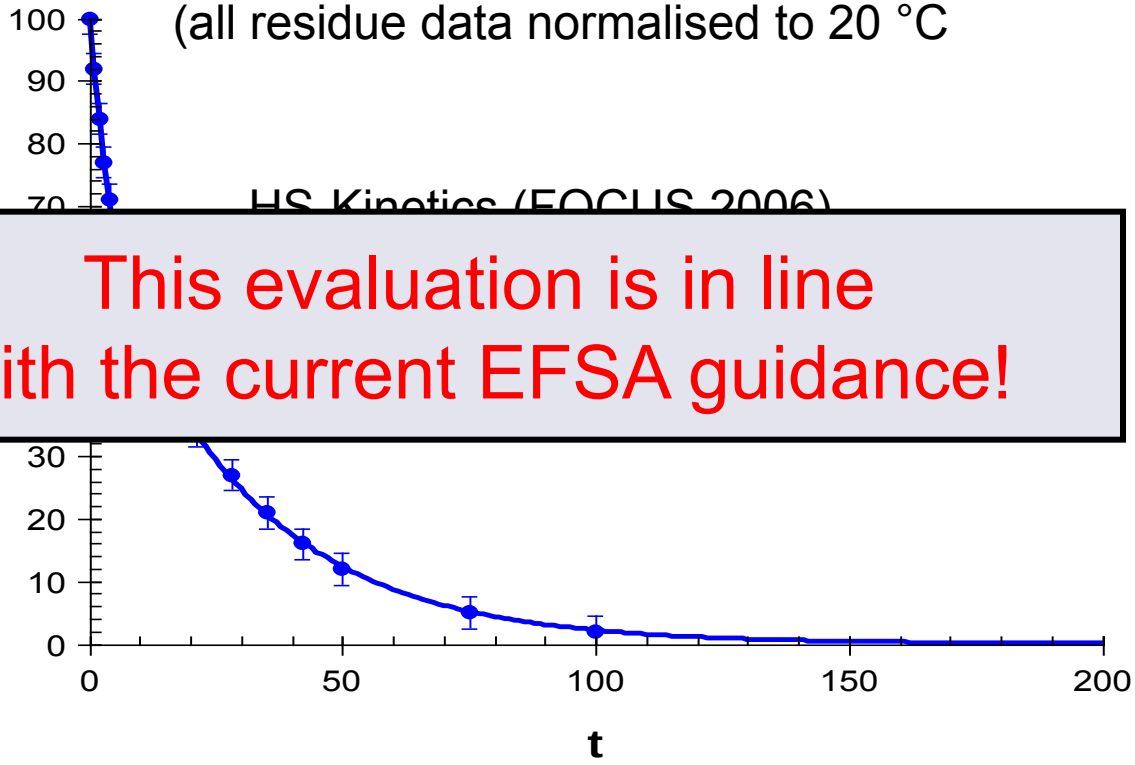

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Kinetics	DegT50 (d)	FOCUS chi²-error (%)
SFO	14.8	8.7
HS slow phase	**20.0**	**0.5**

Calculation of the DT50 – an example (special SFO evaluation)

Time (d)	Residue (%)
0	100
1	92
2	84
3	77
4	71
7	55
14	43
21	34
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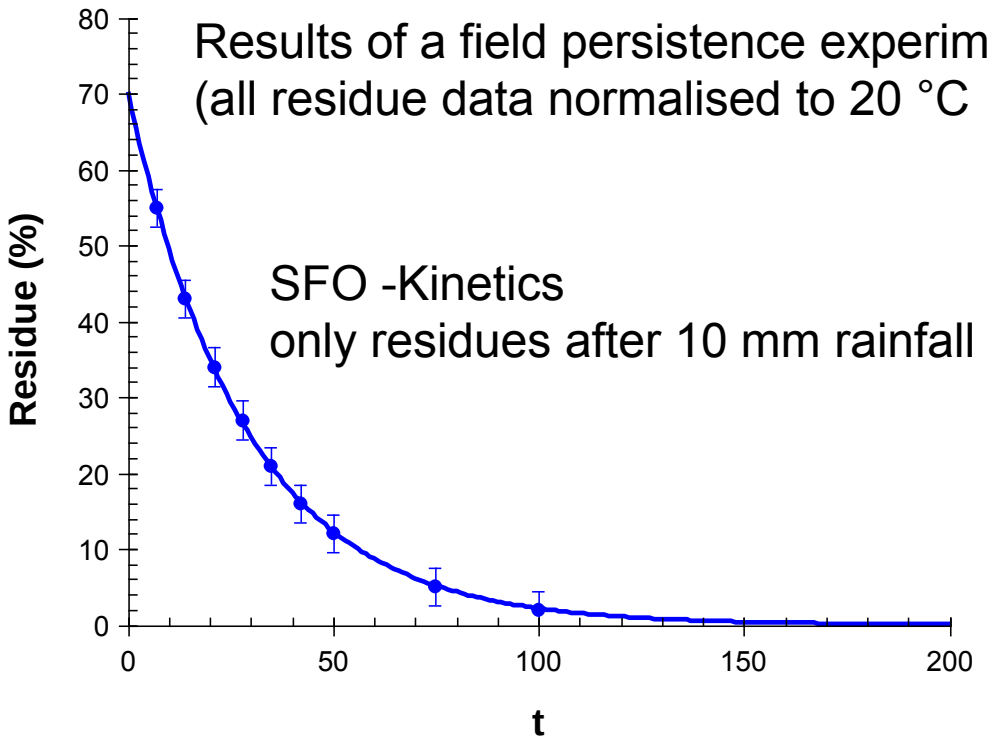
10 mm rainfall after 5 d



Kinetics	DegT50 (d)	FOCUS chi²-error (%)
SFO	14.4	8.3
HS (slow phase)	**20.0**	**0.5**
special SFO	20.0	0.9

Calculation of the DT50 – an example (special SFO evaluation)

Time (d)	Residue (%)
0	100
1	92
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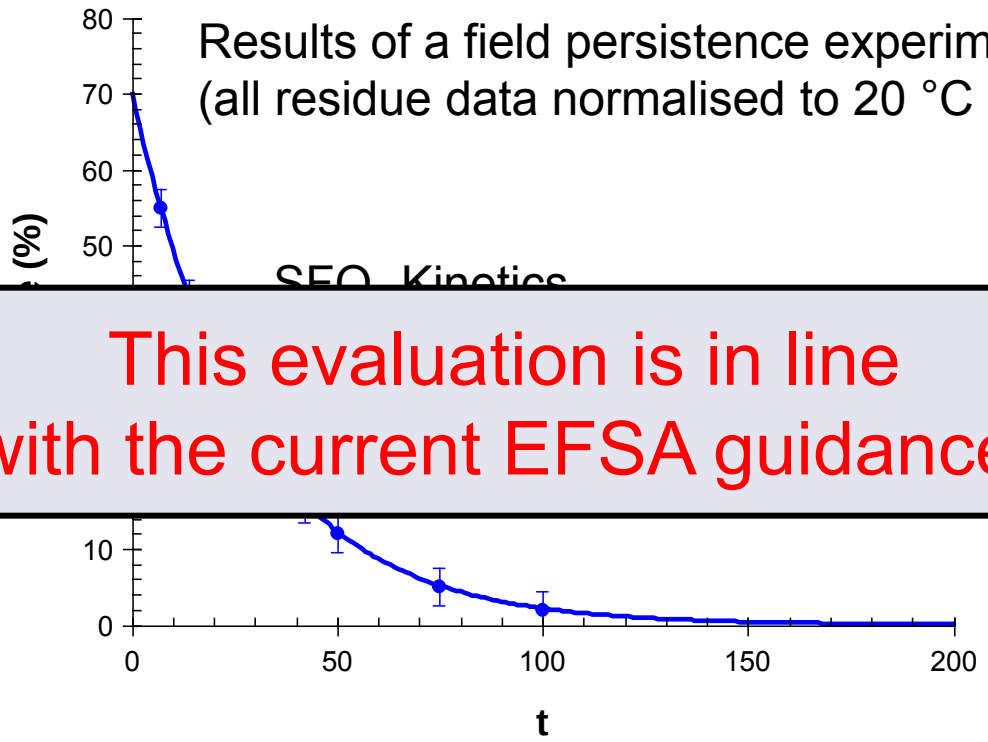

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Kinetics	DegT50 (d)	FOCUS chi²-error (%)
SFO	14.4	8.3
HS (slow phase)	**20.0**	**0.5**
special SFO	20.0	0.9

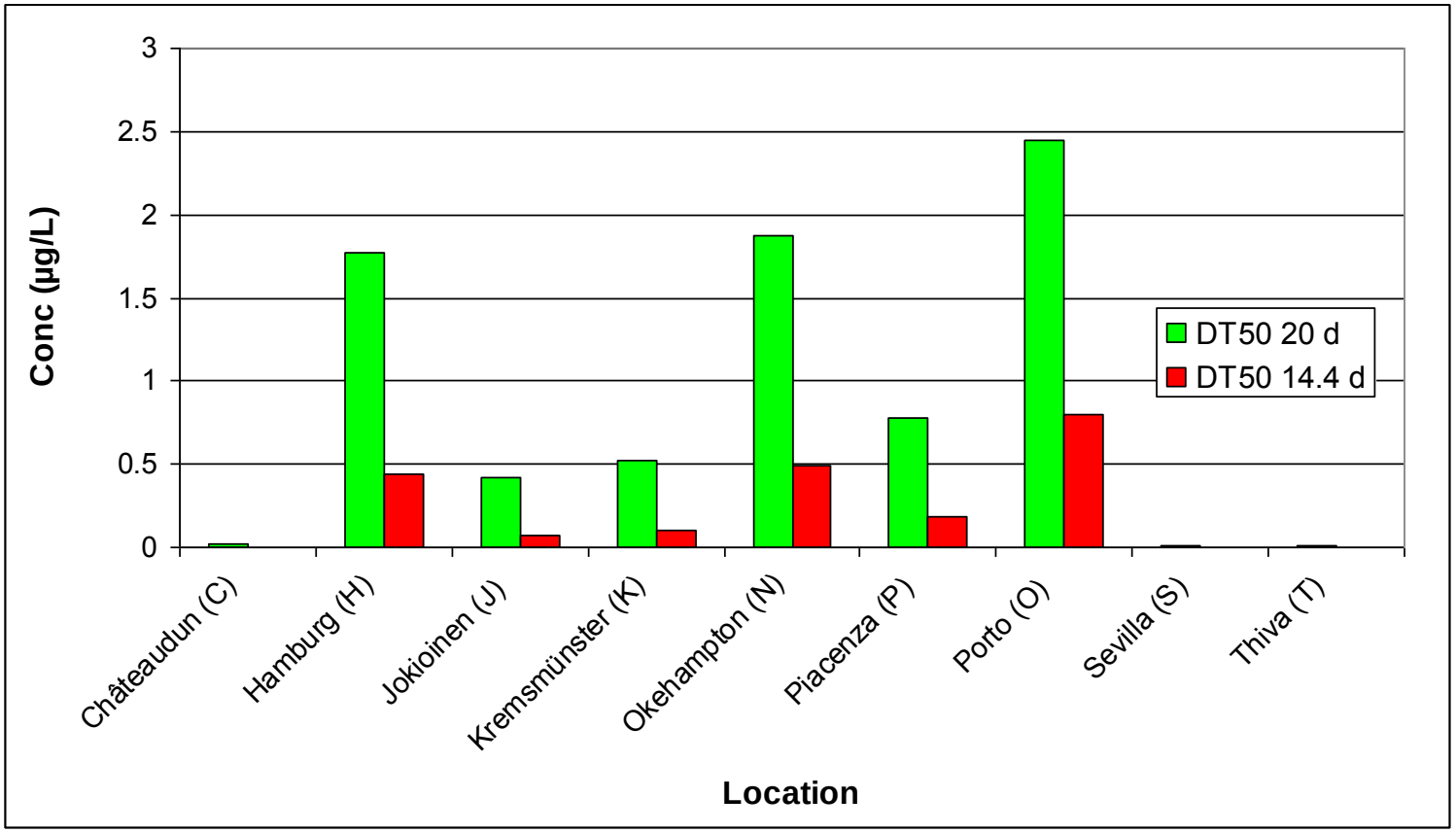
Input parameters for an example leaching simulation

	DegT50 (d)	KOC (L/kg)
HS (slow phase)	**20.0**	**60**
standard SFO	**14.4**	**60**

annual applications of 1 kg/ha in maize, 1 day before crop emergence

all input data expect degradation according to FOCUS D

Results of simulations with FOCUSPELMO 4.4.3 (standard 80th percentile)



annual applications of 1 kg/ha in maize, 1 day before crop emergence

all input data exept degradation rate according to FOCUS D

- The Panel recommends incorporating the plant protection product to a depth of about 10 cm into the soil when the results should be used to estimate $DegT50_{matrix}$

- Depending on substance properties and the application pattern, alternative options such as irrigation after spraying could also be appropriate when estimating the DegT50matrix if it is guaranteed that the compound was transported into the soil matrix.

- When deriving a half-life from field experiments it has to be ensured that the value is not influenced by initial processes in the top millimetres of soil

- DFOP and HS are the preferred kinetic models when estimating $DegT50_{matrix}$

- Though rather small effects is expected for PECsoil the consequence of the new guidance on leaching concentrations can be significant

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