Biocides in Facades – State of Knowledge

Michael Burkhardt[1], Conrad Dietschweiler[1], Timothy Wangler[2]

1 HSR University of Applied Sciences Rapperswil, Institute of Environmental and Process Engineering (UMTEC), Rapperswil, Switzerland

2 ETH Zürich, Institute for Technology in Architecture, Zürich, Switzerland

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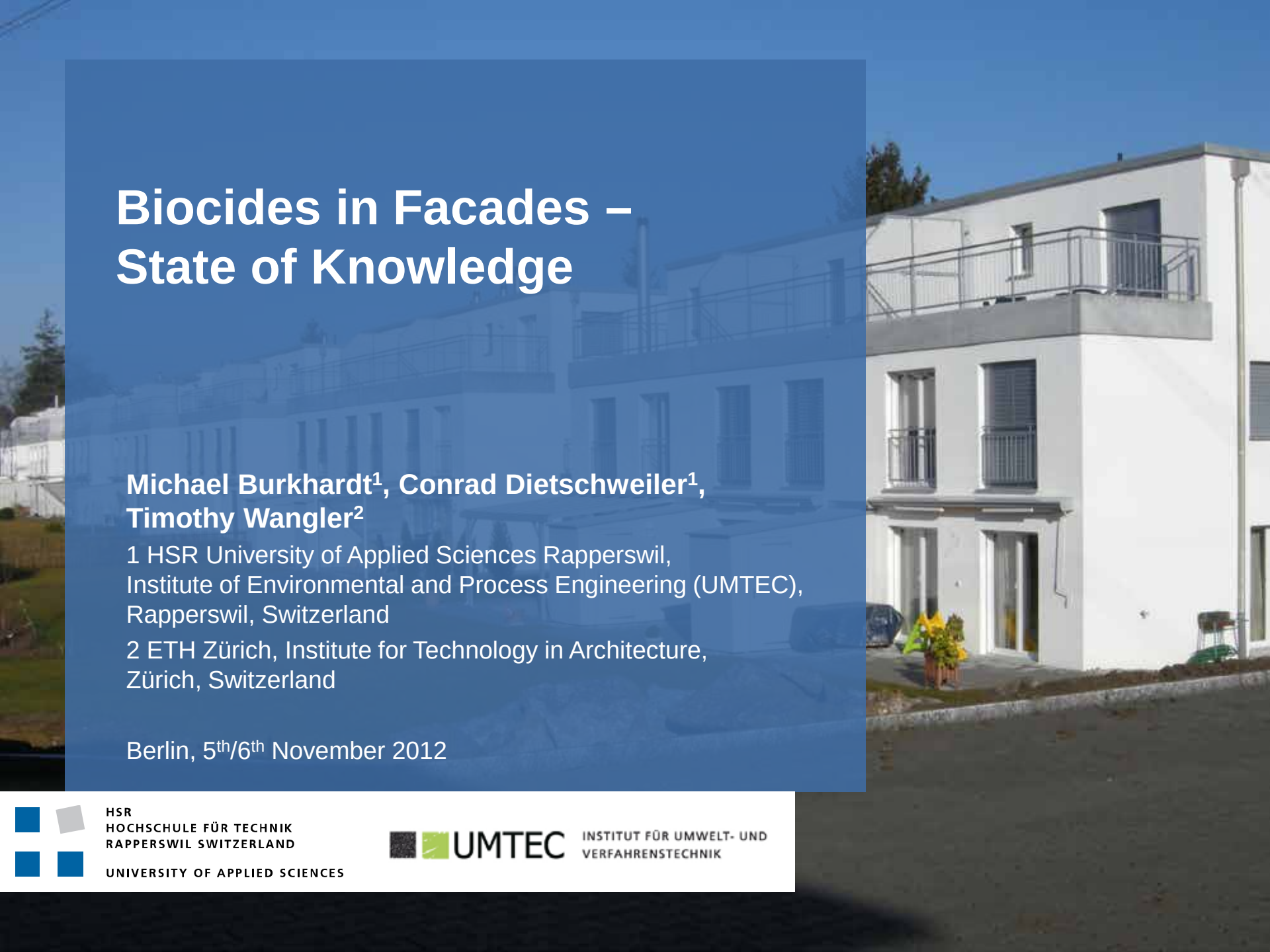

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RAPPERSWIL SWITZERLAND

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Control of Algae and Fungi Growth

Biocides in Paint/Render: Film Preservatives (PT 7)

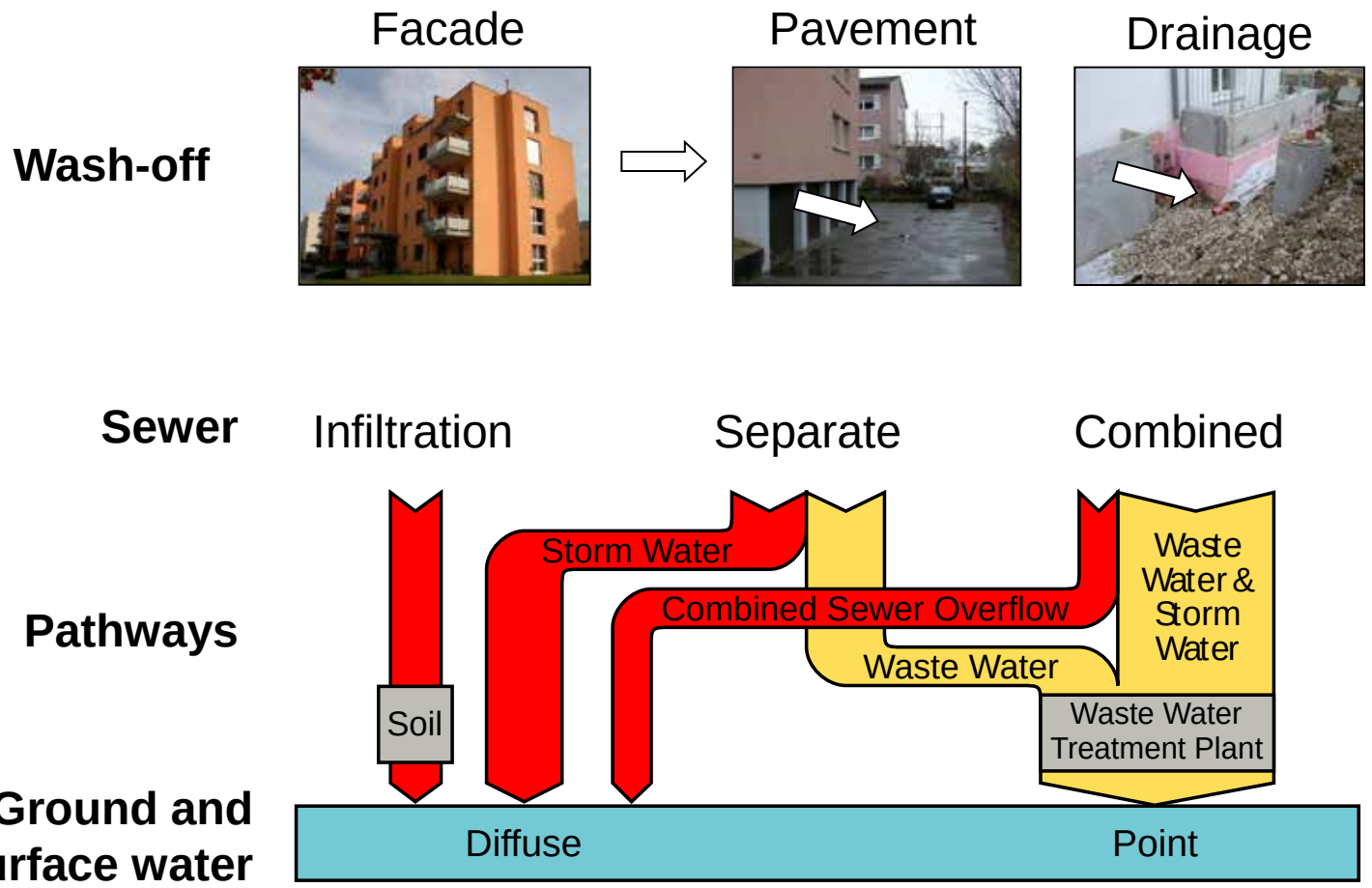
Substance Class	Biocide	PNEC*[1] (ng/L)	Solubility[3] (mg/L)	logPow[3]	Relevance
Triazine	Irgarol 1051	1	7	3.9	no
	Terbutryn	34	22	3.7	high
Phenylurea	Diuron	20	35	2.7	high
	Isoproturon	200[2]	70	2.5	low
Isothiazolinone	DCOIT	8	14	4.9	low
	OIT	13	480	2.4	high
Carbamate	IPBC	26	168	2.4	low
	Carbendazim	34	8	1.6	medium
Metal organic	Zinc pyrithione	3	8	0.9	high

* PNEC: Predicted No Effect Concentration for aquatic organisms (algae)

- Application: 3 kg/m^2 render, 0.3 kg/m^2 paint
- Biocides: 200 - 2000 ppm, 3-5 in combination
- Germany (2011): 248’000 t polymeric paints/renders

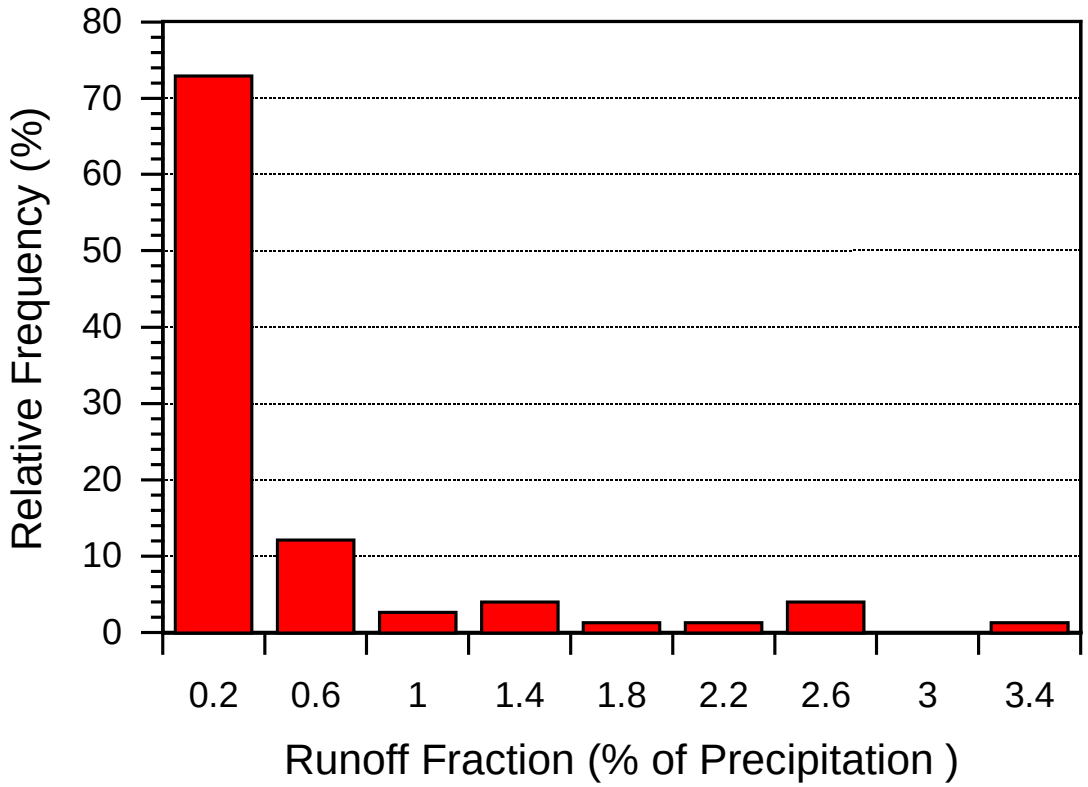
1 Burkhardt, M. et al. 2009. UWSF; 2 Chèvre, N. 2009. person. Comm. 3 Paulus, w. 2004, Springer.

From Facades Coatings to Aquatic Systems



Runoff at Facades (Building Height 10.5 m)

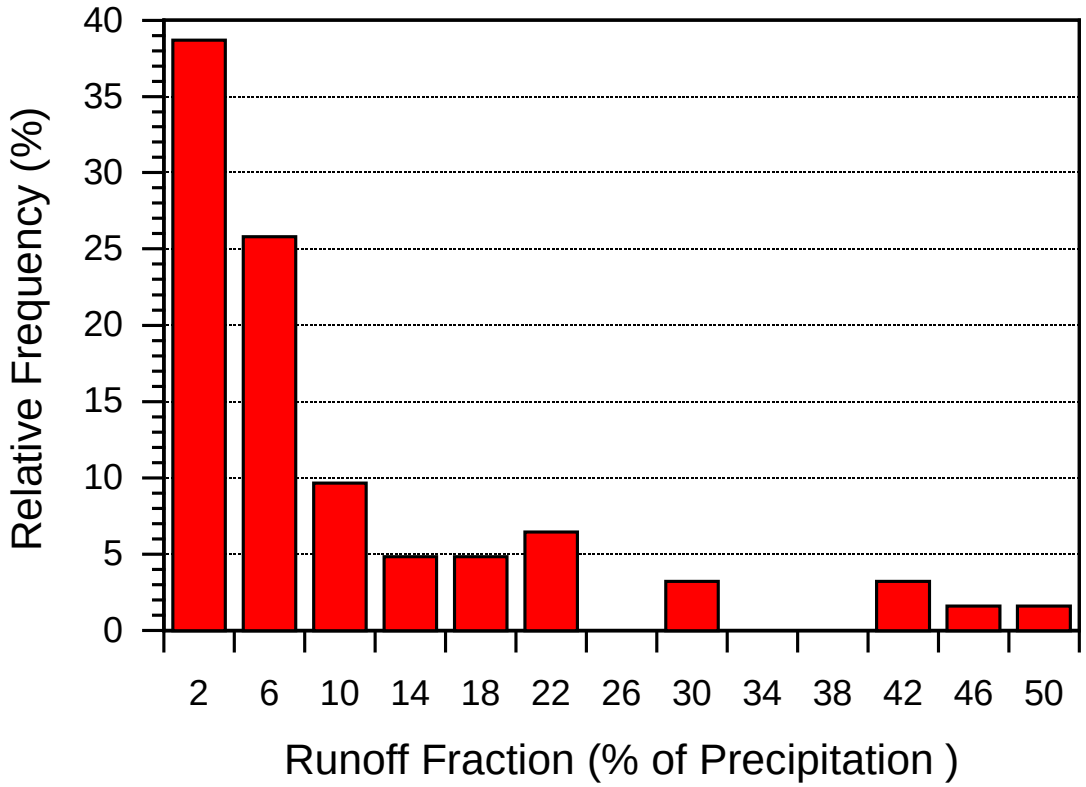
74 Runoff events in 360 days (~900 mm/a precipitation; >20% no runoff)



Runoff fraction <0.7% of horizontal precipitation

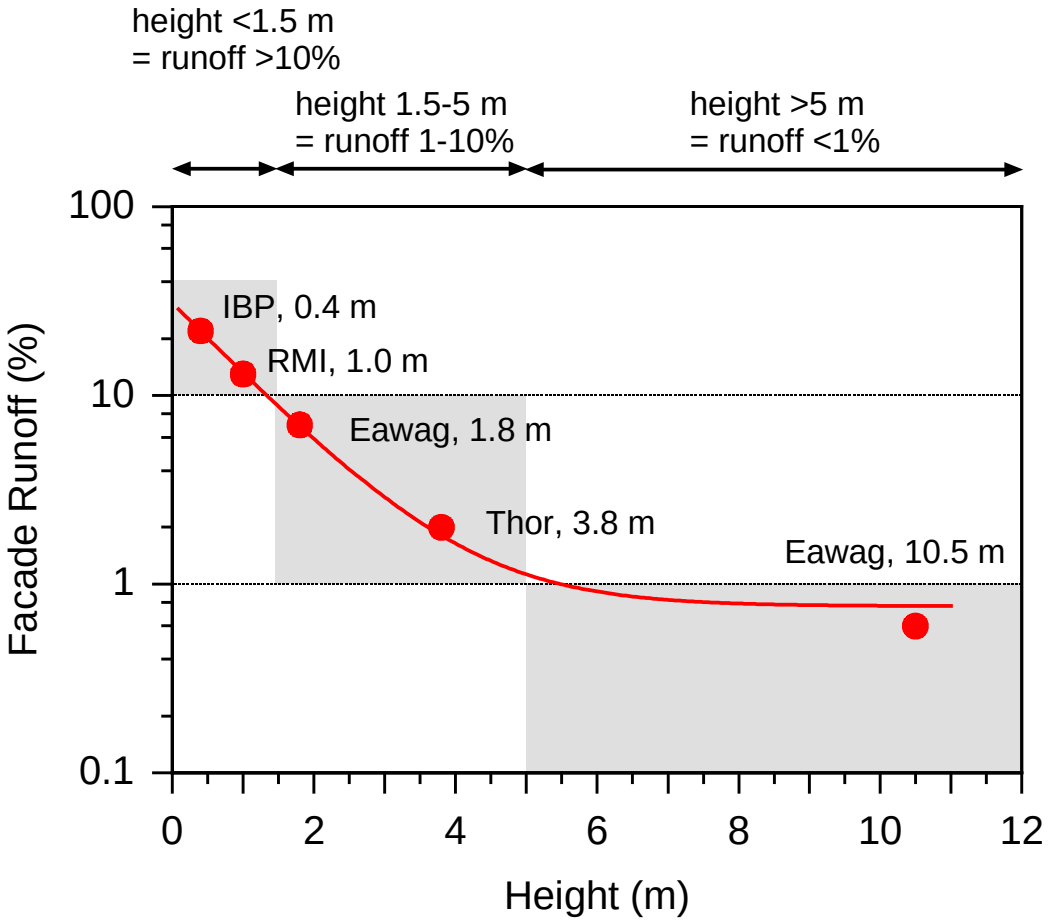
Runoff at Semi-Field Scale (Height 1.8 m)

62 Runoff events in 372 days (815 mm precipitation; <10% no runoff)



Runoff fraction <7% of horizontal precipitation

Runoff and Building Height



Height has significant effect to runoff (and mg/m² …)

Modelling of Wind Driven Rain (ISO 15927-3:2009)

ISO/TC 163/SC 2

Secretariat: SN

Voting begins on:
2008-10-30

Voting terminates on:
2008-12-30

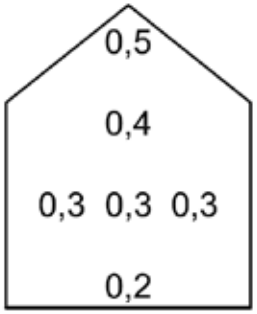
Hygrothermal performance of buildings — Calculation and presentation of climatic data —

Part 3:
Calculation of a driving rain index for vertical surfaces from hourly wind and rain data

Description of wall	Average value	Distribution
Two-storey gable	0,4	0,5 / 0,4 / 0,3 0,3 0,3 / 0,2
Three-storey	0,3	0,5 / 0,4 / 0,3 0,3 0,3 / 0,3 0,3 0,3 / 0,2
Multi-storey building with flat roof (pitch < 20°)	0,2 for a ten-storey building, for example, but with a higher intensity at top	0,5 for top 2,5 m 0,2 for remainder
Two-storey wall with eaves	0,3	Pitched roof (≥20°) typical overhang: 350 mm / 0,3 / 0,3 / 0,3
Three-storey wall with eaves	0,4	Pitched roof typical overhang: 350 mm / 0,4 / 0,4 / 0,4
Two-storey building with flat roof (pitch < 20°)	0,4	0,5 / 0,4 / 0,2

Parameter “wall-factor“

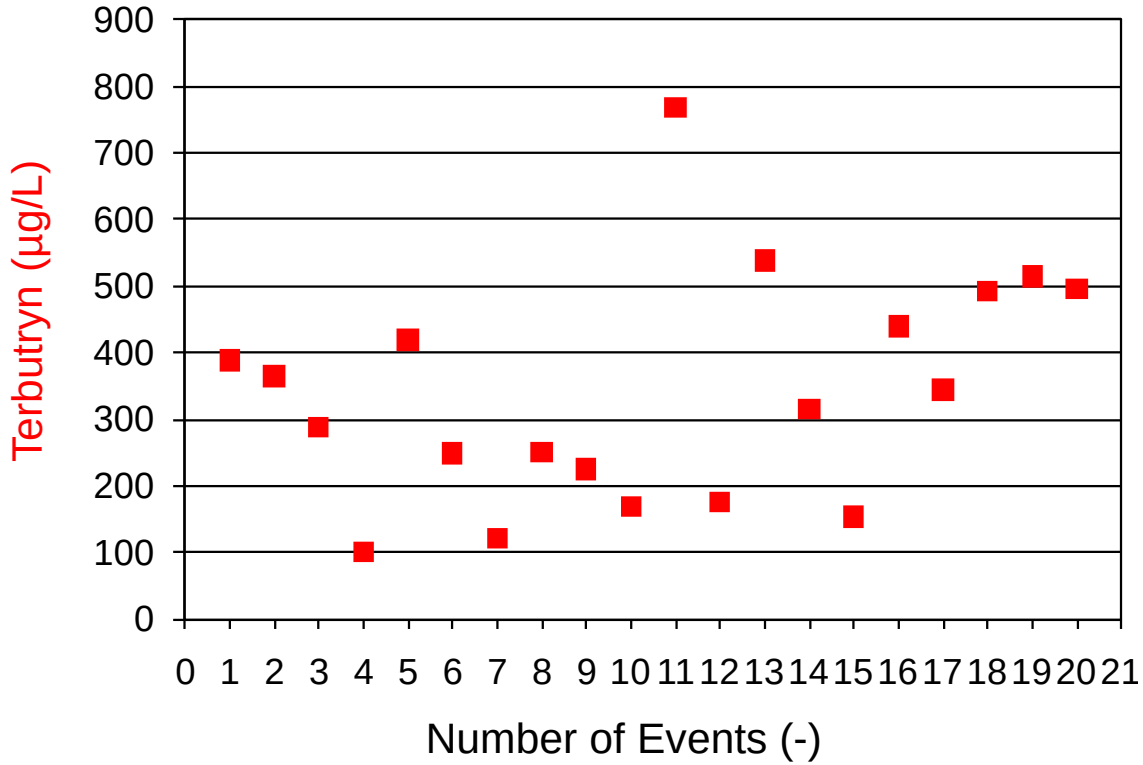
2-storey gable with average *W*-factor 0.4



Modelling promising tool to predict runoff

Leaching of Biocides (Height 10.5 m)

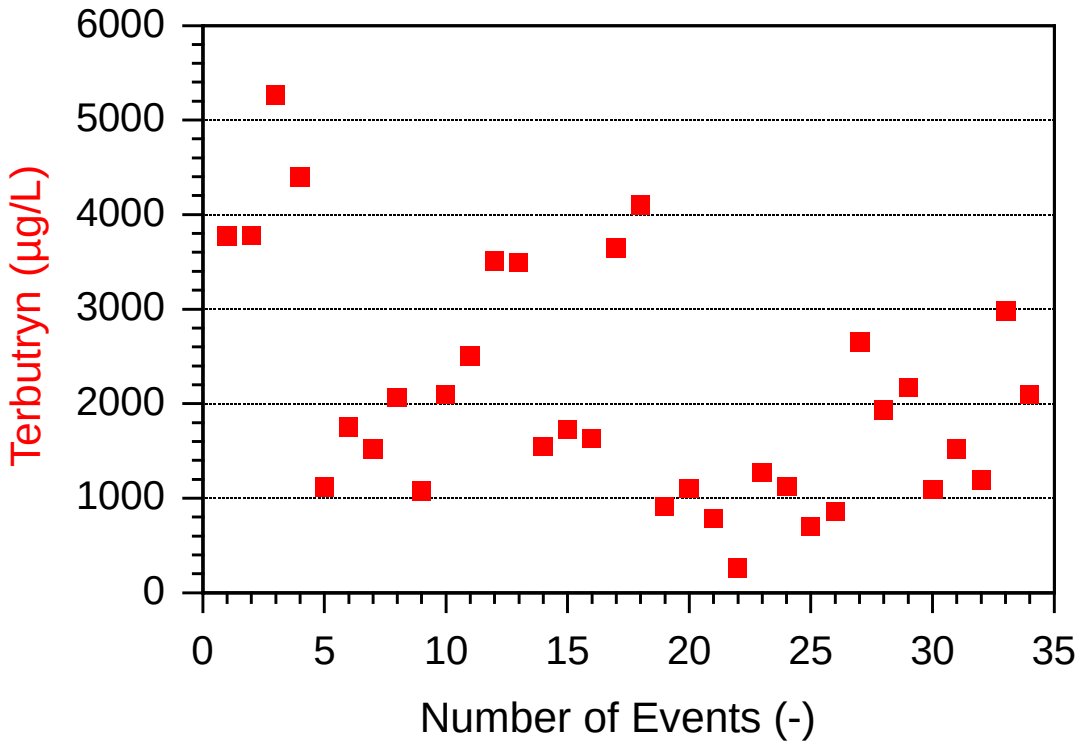
20 Leaching events in 100 days (facade 6-9 months; 1700 mg/m^2 a.i.)



Concentration pattern

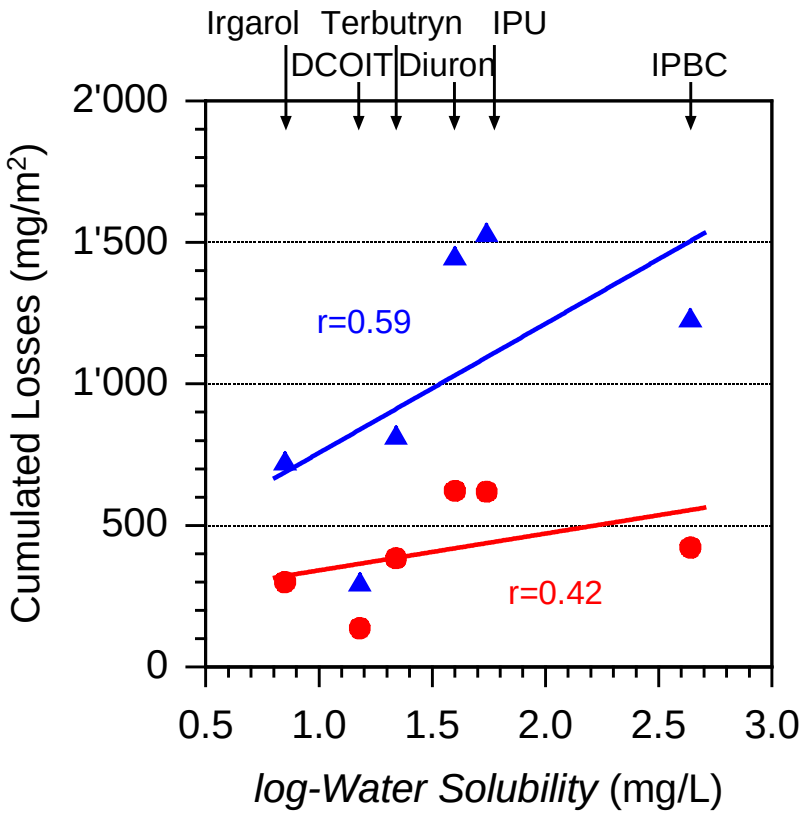
Leaching at Semi-Field Scale (Height 1.8 m)

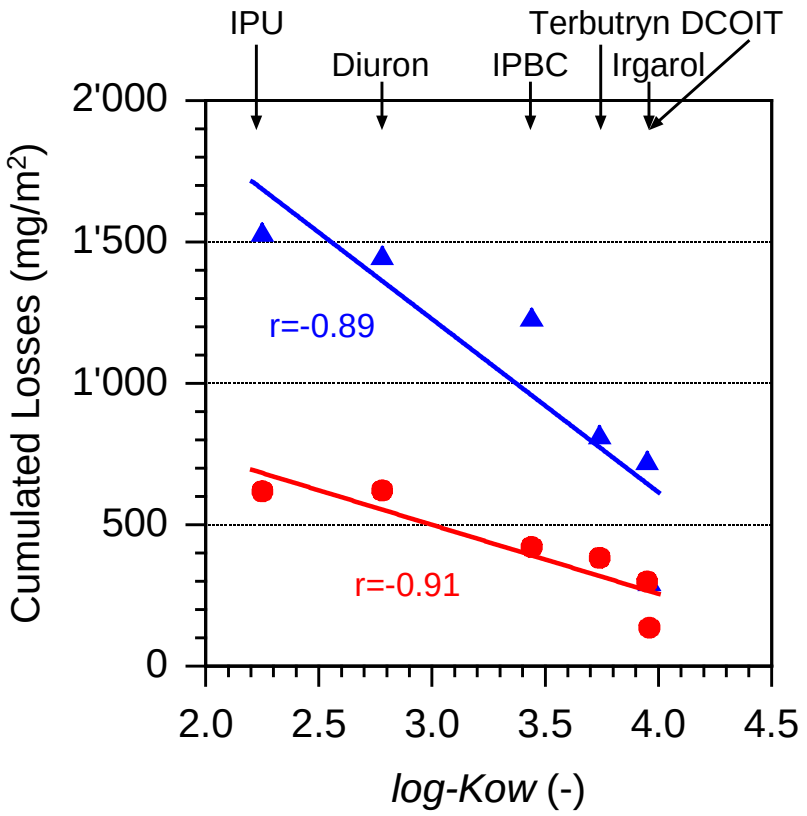
34 Leaching events in 372 days (facade 0-12 months; 3188 mg/m^2 a.i.)



Concentration pattern with tendency to decrease

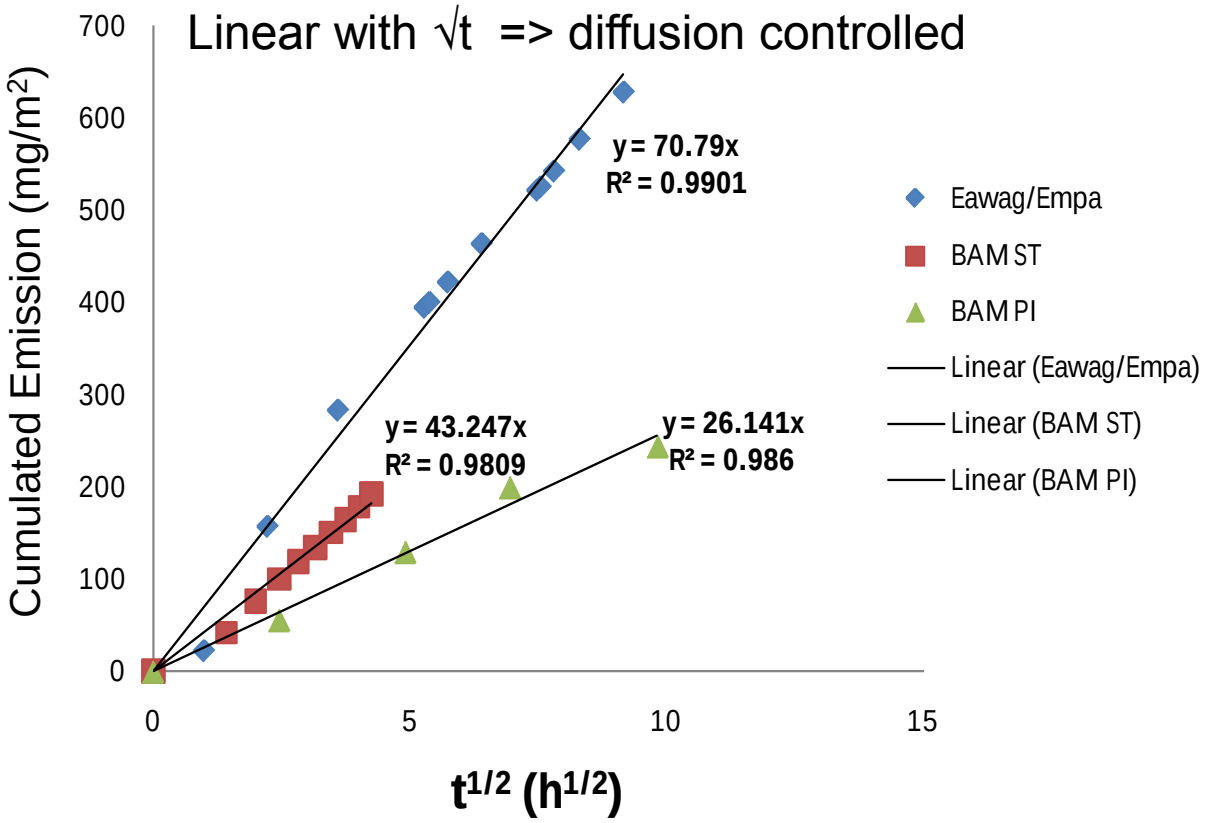
Lipophilic Properties of Film Preservatives





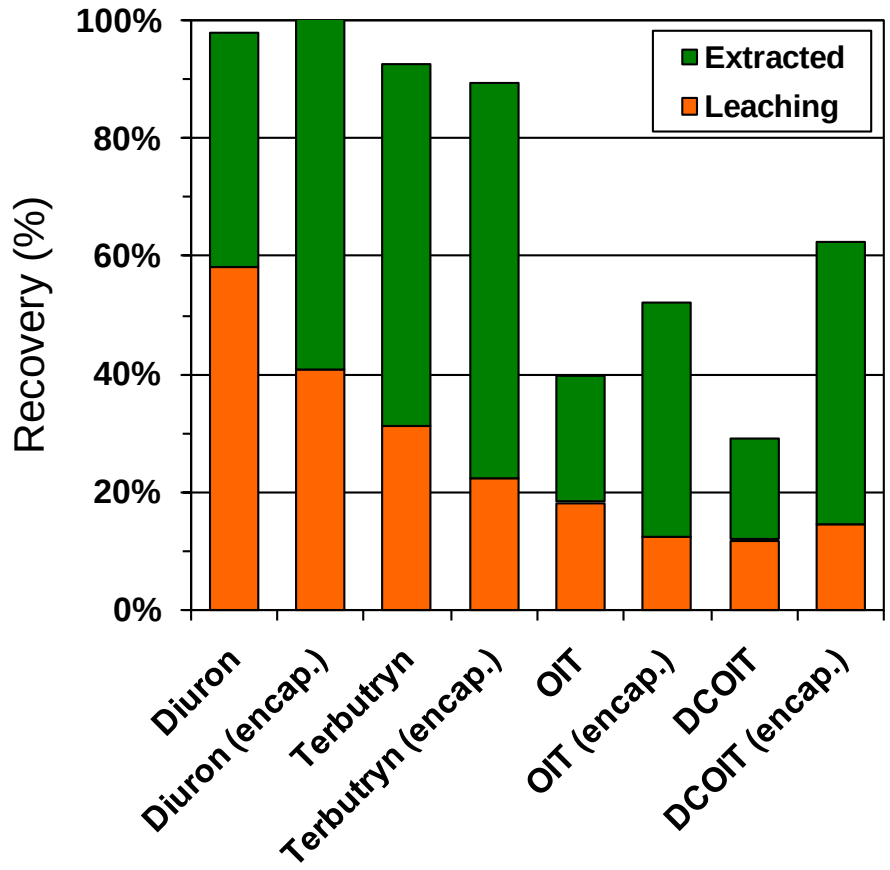
logPow high => release low (polymeric binder)

Diffusion controlled Process under Laboratory Conditions



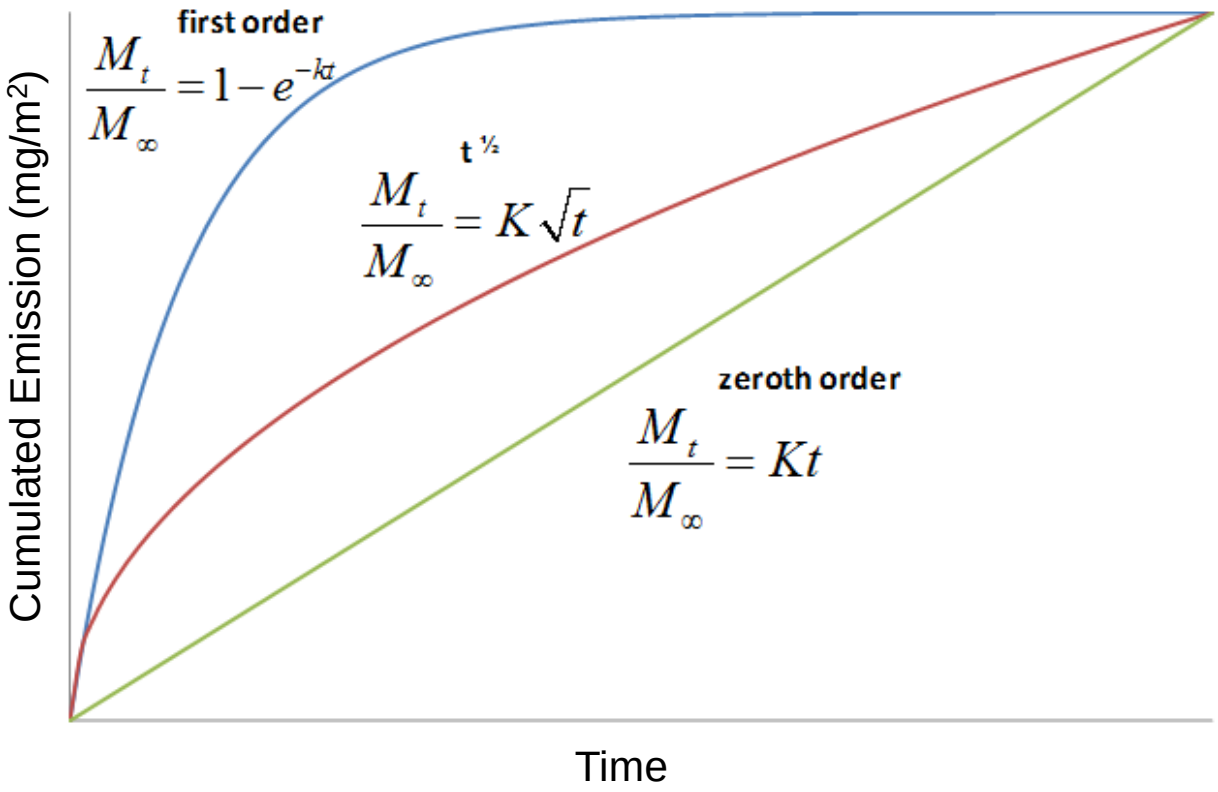
Release controlled by water contact time – not volume (dry/wet-cycle and temperature accelerate emission)

Mass Balance for Encapsulated Biocides



Reduction of “burst” release

Encapsulation and further Product Development



1st order release represents past, 0th kinetic future

Conclusions

- Market
  - Market has reacted rapidly to insight of leaching
    => Need for close cooperation (exchange of information is lacking)
  - Encapsulated film preservatives are of practical relevance
    => Release pattern will change
- Leaching: Product and Hydrological Conditions
  - “Wash-off” is controlled by hydrological situation (exposition)
    => Modelling promising tool; Model-house of BPD is not representative
  - Release is related to “new” polymeric coatings (“hydrophobic”) and influenced by substance, binder, embedding, composition of product, etc.
    => Not a general issue of façades (2-3 biocides expected in storm water)
- Environmental Occurrence: Sewer System
  - Spatial distribution pattern is related to product, age and sewers
  - Temporal occurrence pattern hard to determine (pulse exposure)

Thank you for attention !

Contact: michael.burkhardt@hsr.ch

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