caLIBRAte nano risk governance

Empa Materials Science and Technology

Next steps in environmental risk assessment of engineered nanomaterials by considering material-specific properties

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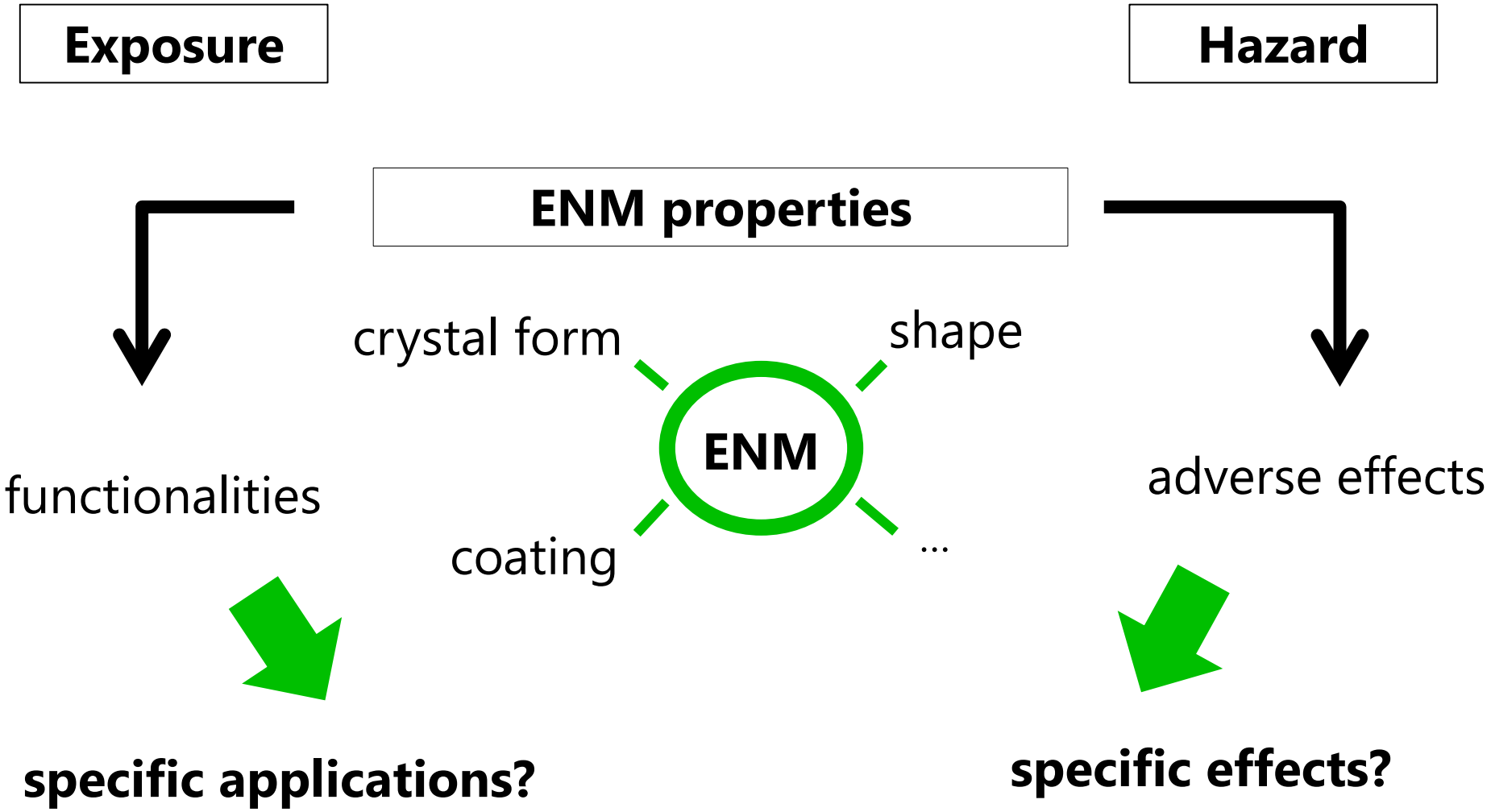
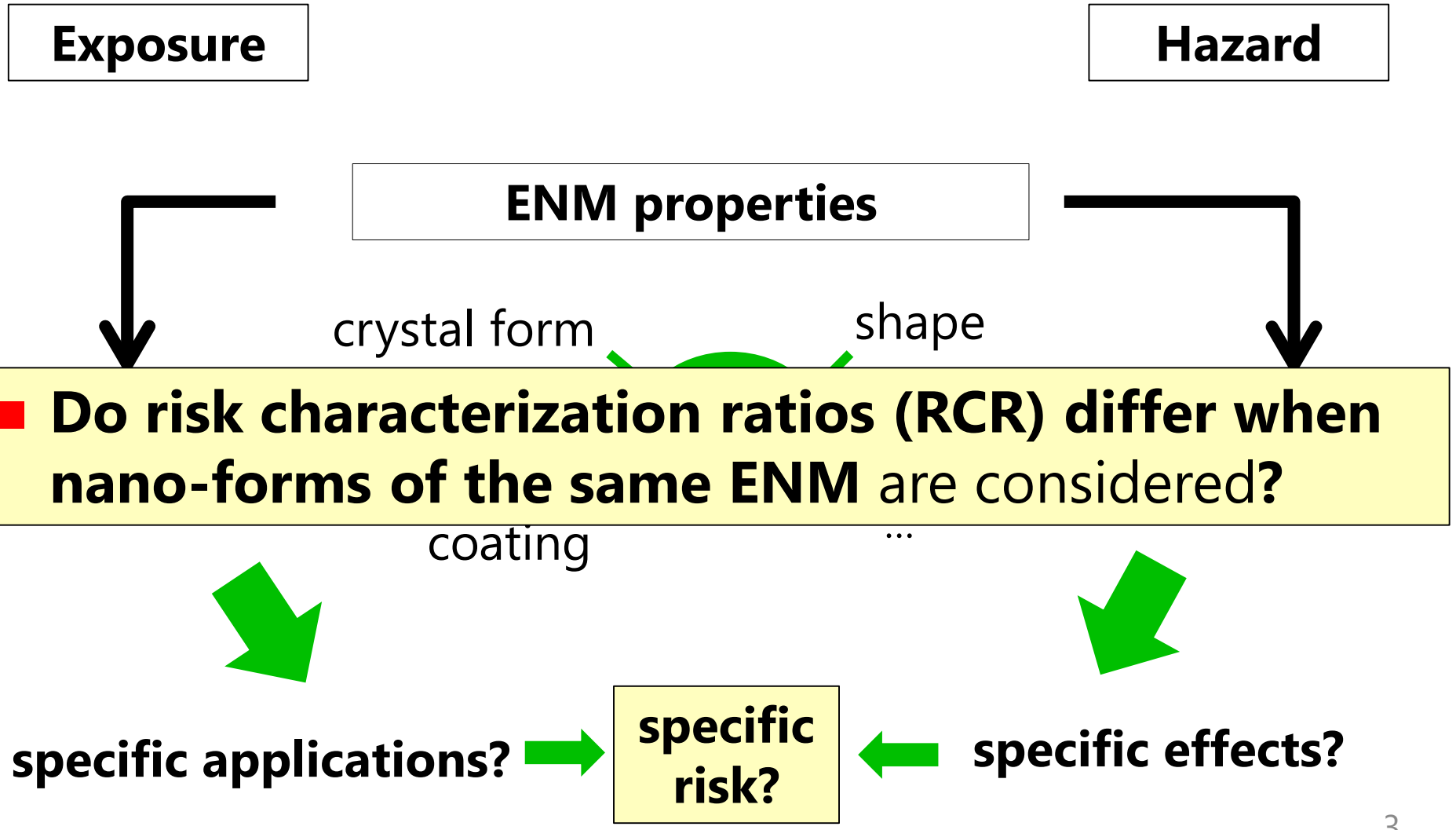
Research objective

From generic to specific ENM risk assessment



Research objective

From generic to specific ENM risk assessment



Estimation of risk for different nano-forms

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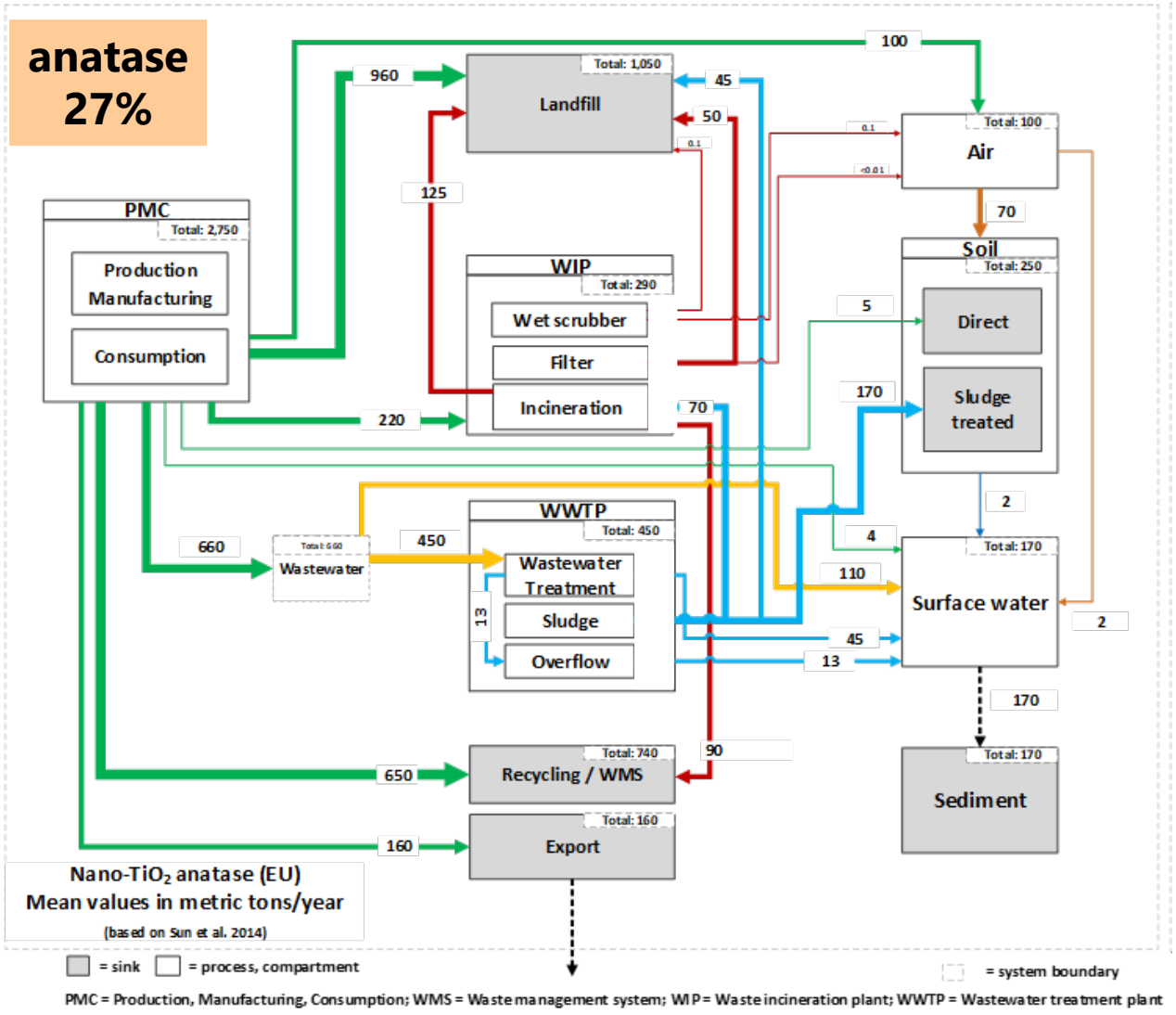
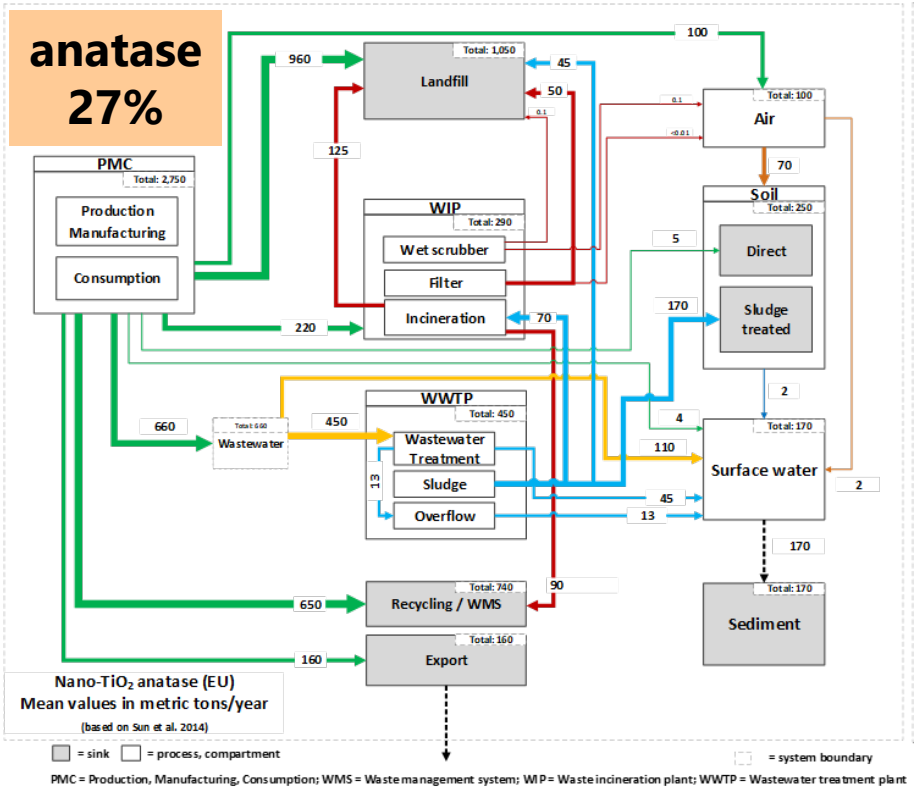
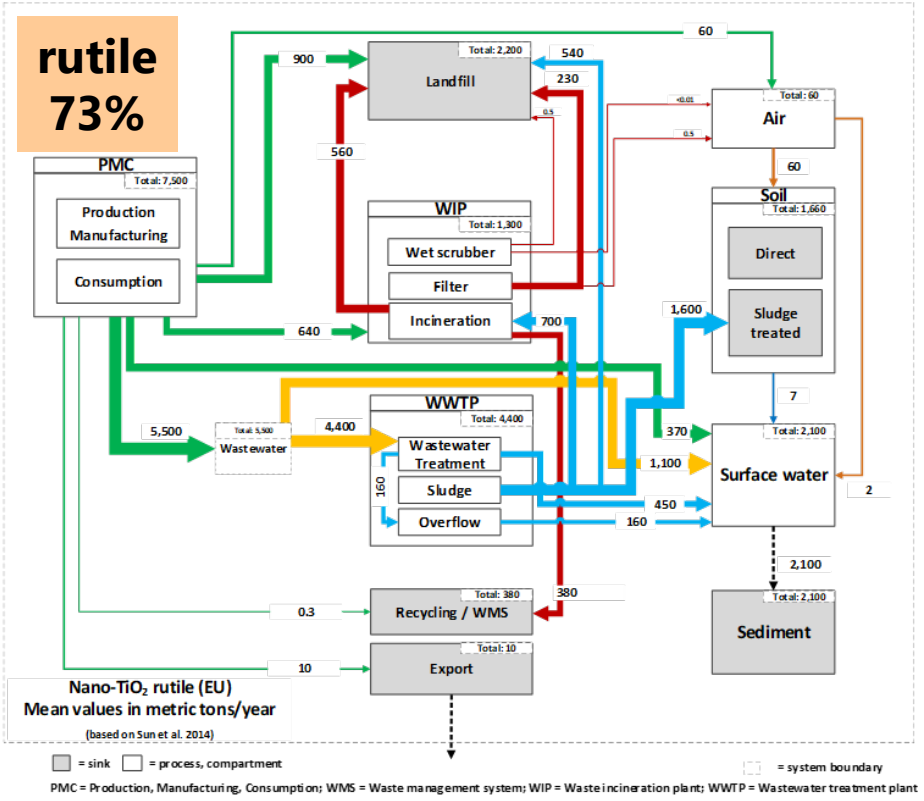
ENM	TiO_2		Al_2O_3		CNT	
Form	anatase	rutile	alpha	gamma	MWNT	SWNT
Key property	photo-catalytic	photo-stable	hardness	<thermally conductive	structure reinforcing	>electrically conductive
PEC	✓	✓	✓	✓	(✓)	(✓)
PNEC	✓	✓	(✓)	(✓)	✓	✓

Results: Material flows of nano-TiO_2 forms in Europe (1/2)



Results: Material flows and PEC of nano-TiO_2 forms in Europe (2/2)





$PEC_{surface\ water}$ = 0.08 µg/l (mean)

$PEC_{surface\ water}$ = 0.9 µg/l (mean)

PEC = predicted environmental concentration

Approach and data availability for PSSD calculations

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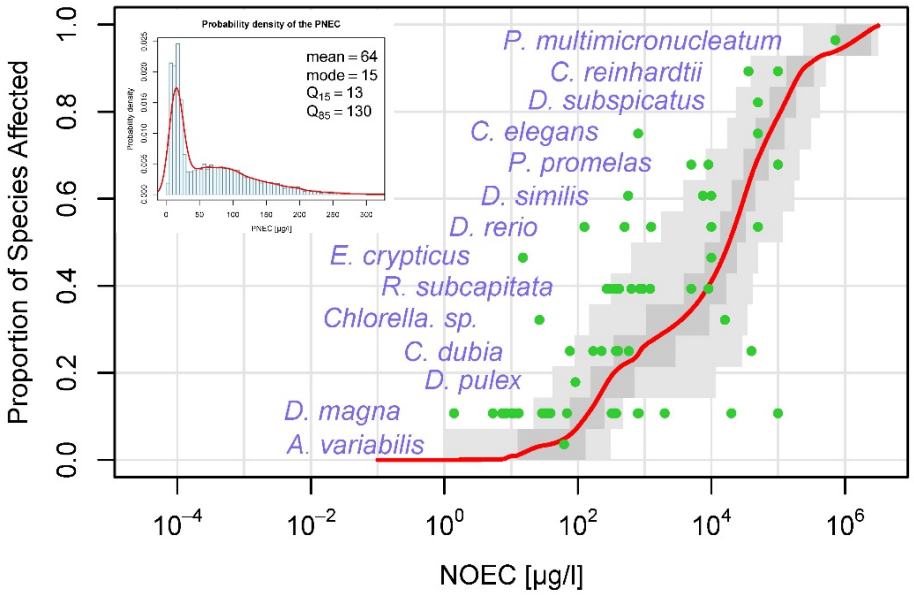
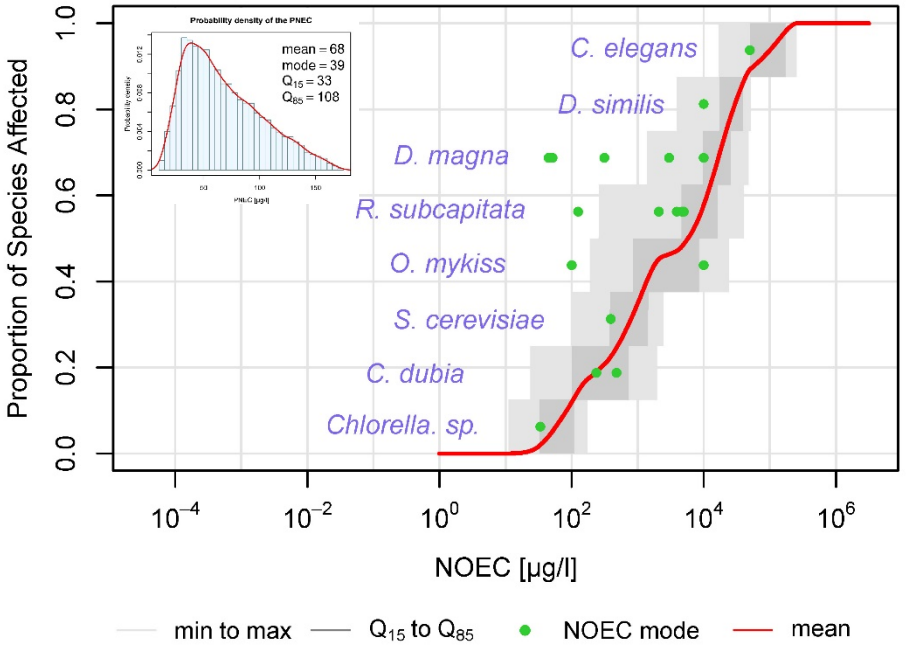
- Focus on the freshwater compartment
- endpoints considered
  - survival
  - growth
  - reproduction
  - relevant metabolical processes (photosynthesis)
- data quality assessed according to DANA 2.0 criteria list
  - nano-TiO_2
- data converted to chronic NOECs
- data grouped by crystal form or morphology

nano-form	number of data points	number of species
α-Al_2O_3	1	1
γ-Al_2O_3	7	4
SWNT	12	10
MWNT	51	11
TiO_2 anatase	70	14
TiO_2 rutile	25	8
TiO_2 P25	69	17

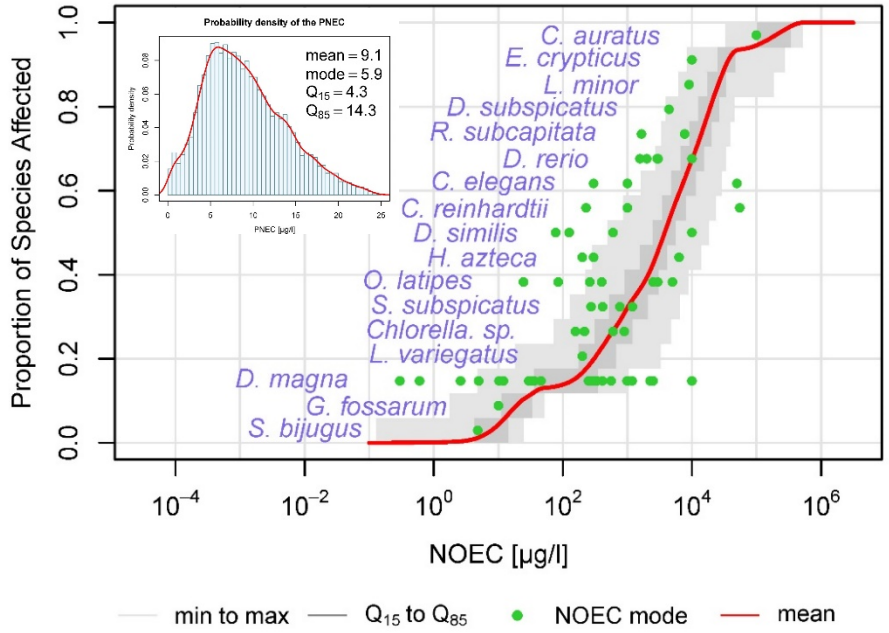
Nano−TiO_2 (anatase) in the freshwater compartment



Nano−TiO_2 (rutile) in the freshwater compartment



Nano−TiO_2 (P25) in the freshwater compartment

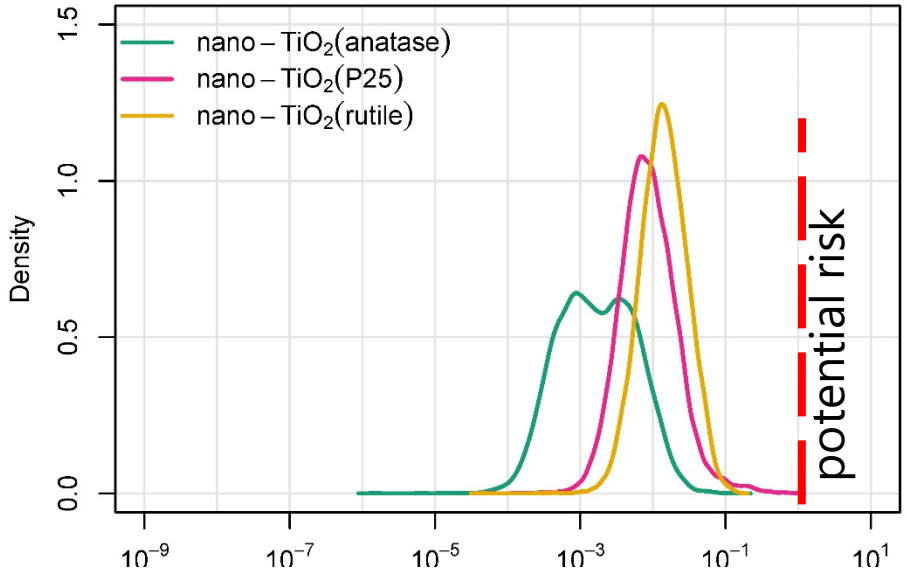


$PNEC_{anatase}$ = 64 µg/l (mean)

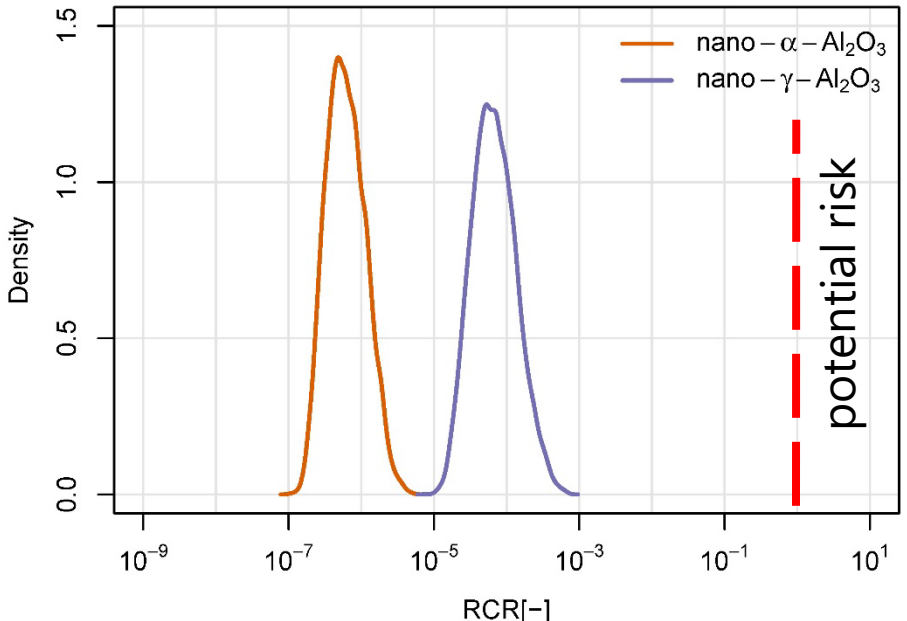
$PNEC_{P25}$ = 9.1 µg/l (mean)

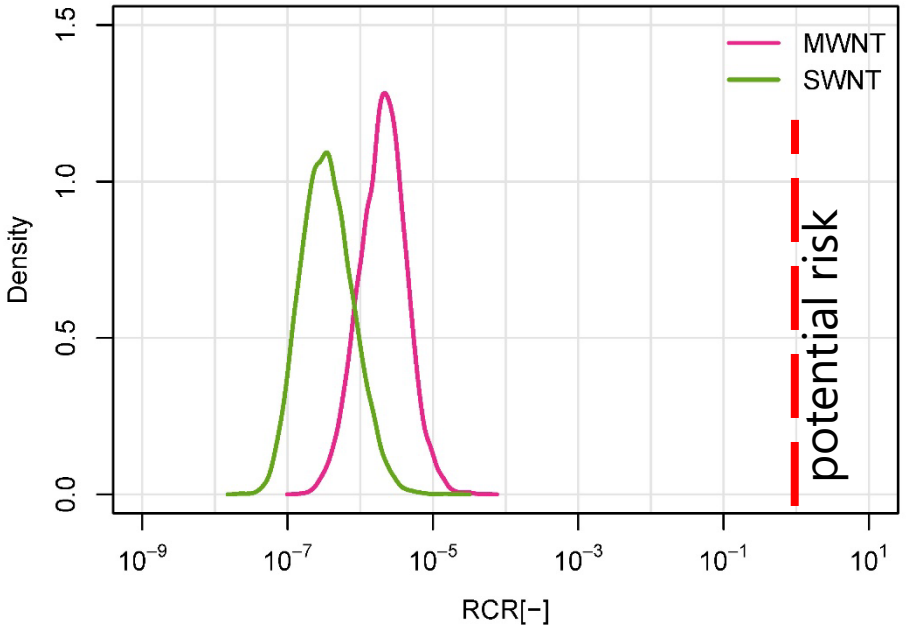
$PNEC_{rutile}$ = 68 µg/l (mean)

Preliminary RCRs for different nano-forms in surface water



- RCR = PEC/PNEC
- nano-TiO_2 (rutile)
  - higher RCR although a lower PNEC than P25
- nano-Al_2O_3
  - different RCRs
- MWNT and SWNT
  - similar RCRs





Conclusions & limitations

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Conclusions

- It is ***possible*** to use ***functionalities of ENM-forms*** to differentiate applications and product categories
- This allows to estimate environmental release of specific ENM-forms
- Nano-form specific risk characterization is required

Limitations

- Separation of different forms only possible for some ENMs
- No environmental fate included in current model (form-specific fate processes)
- No spatial resolution included

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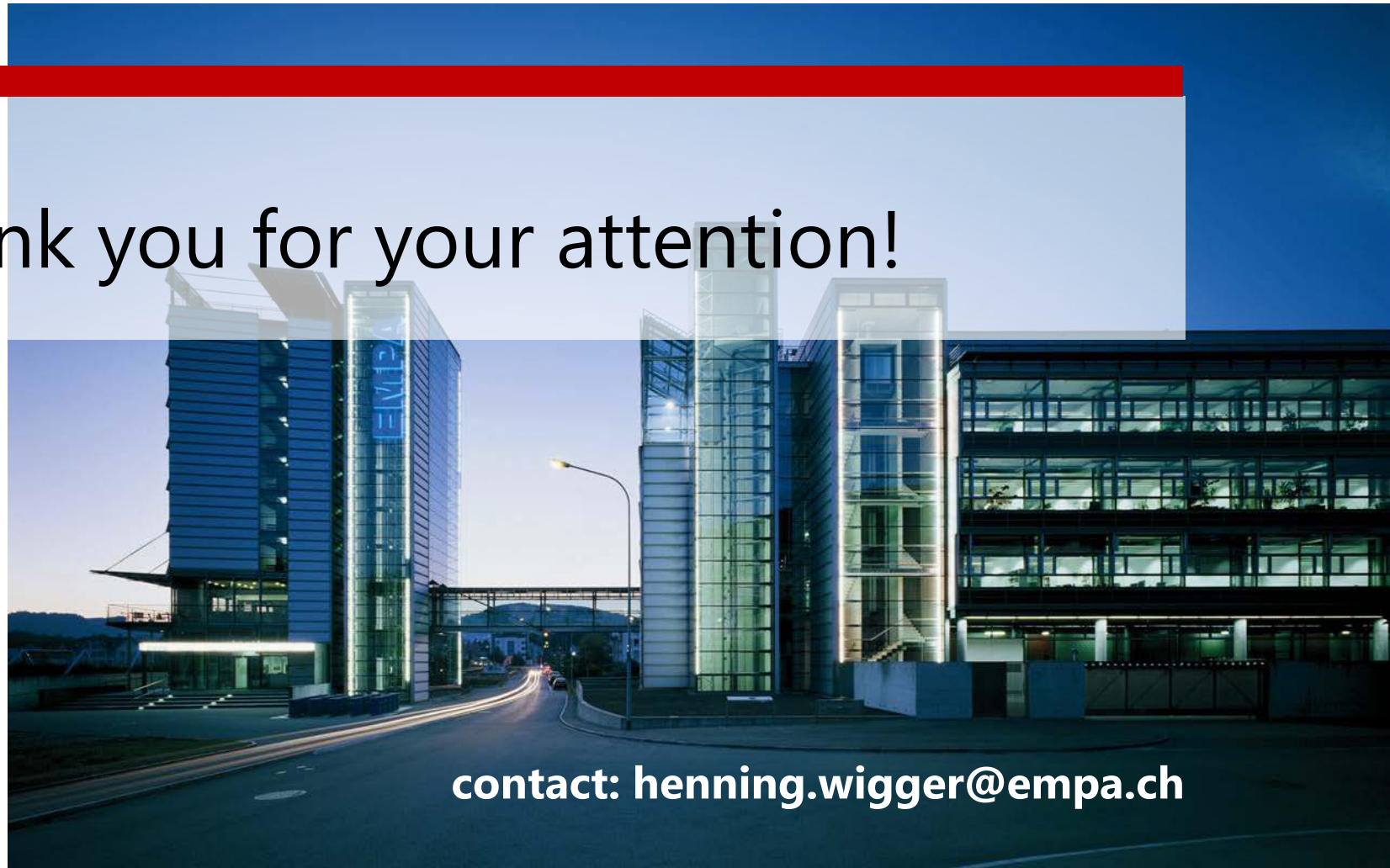
Thank you for your attention!



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References

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