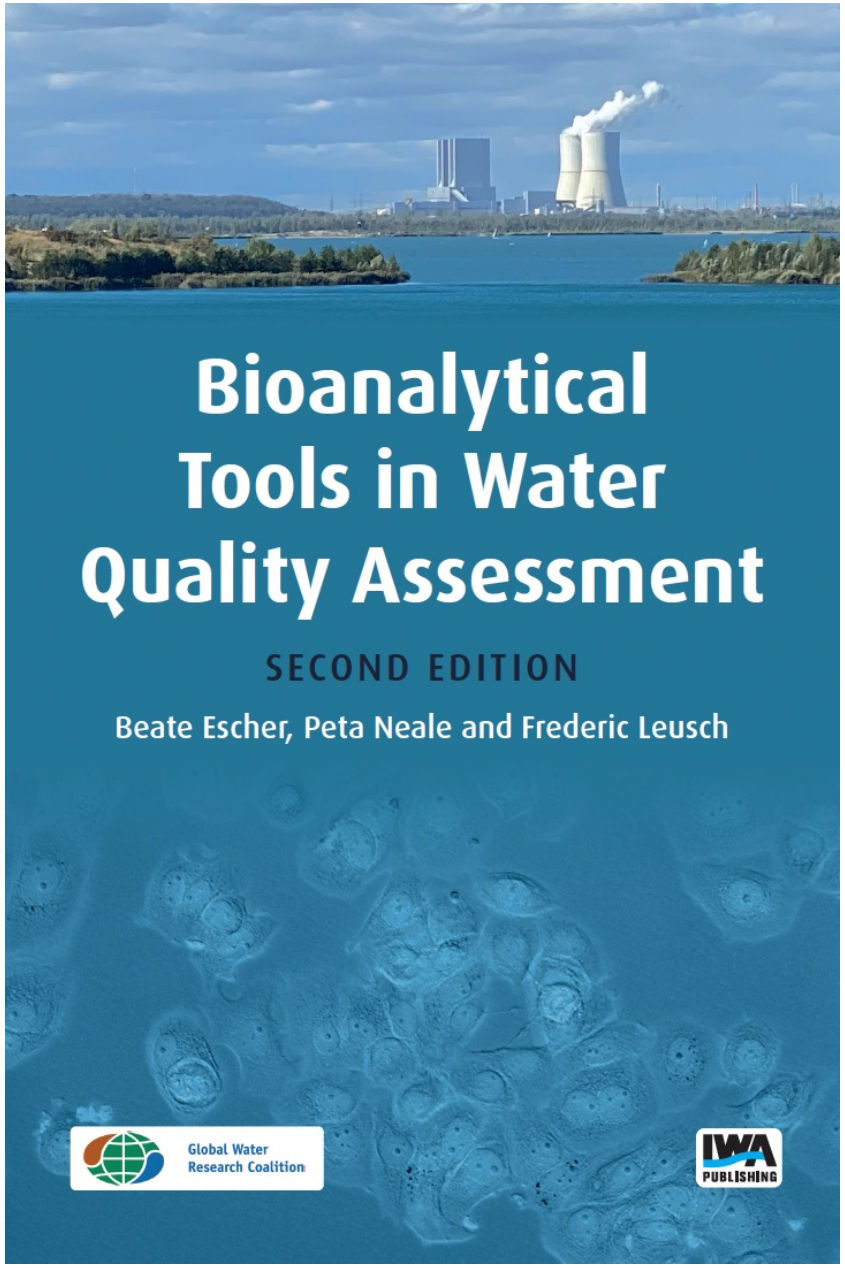
Chapter 2
Risk assessment of chemicals

This presentation accompanies Chapter 2 of
“Bioanalytical Tools in Water Quality Assessment”
https://www.iwapublishing.com/books/9781789061970/bioanalytical-tools-water-quality-assessment-2nd-edition

Exercises can be found at www.ufz.de/bioanalytical-tools

Questions? please send an e-mail to bioanalytical-tools@ufz.de

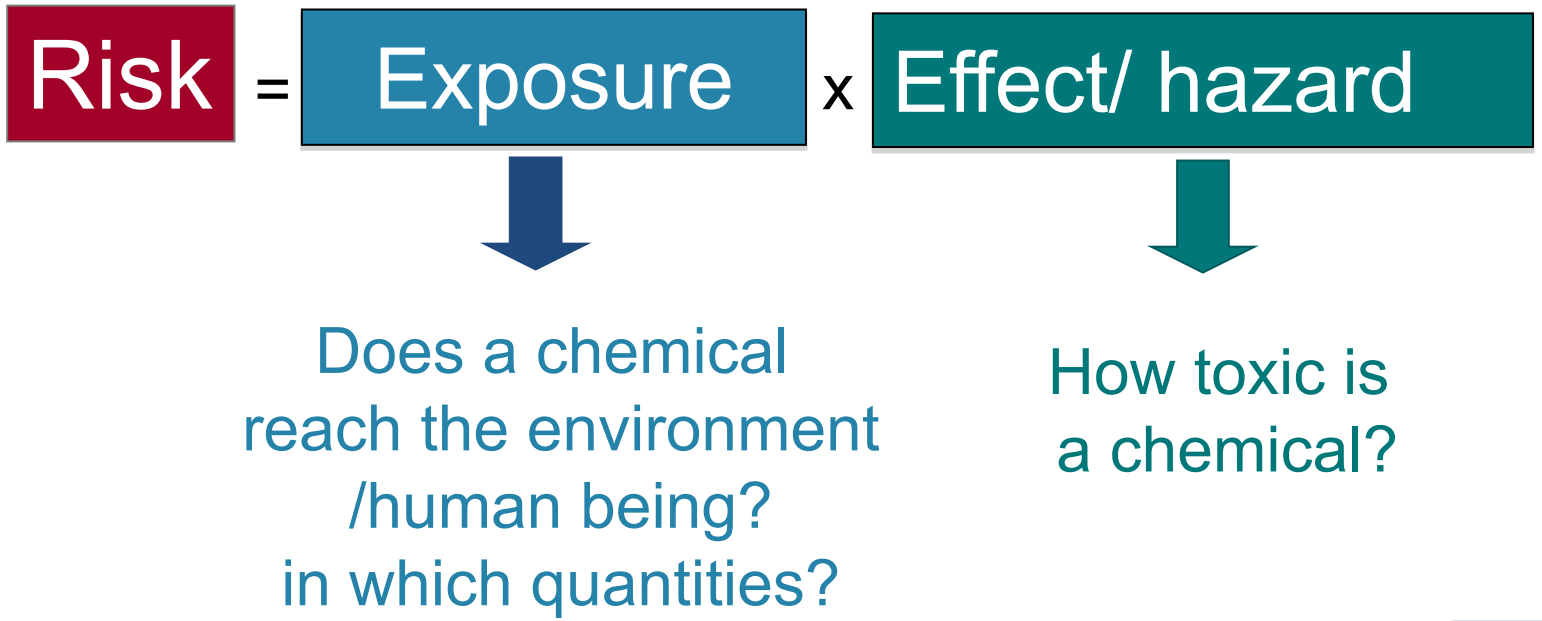


Learning goals

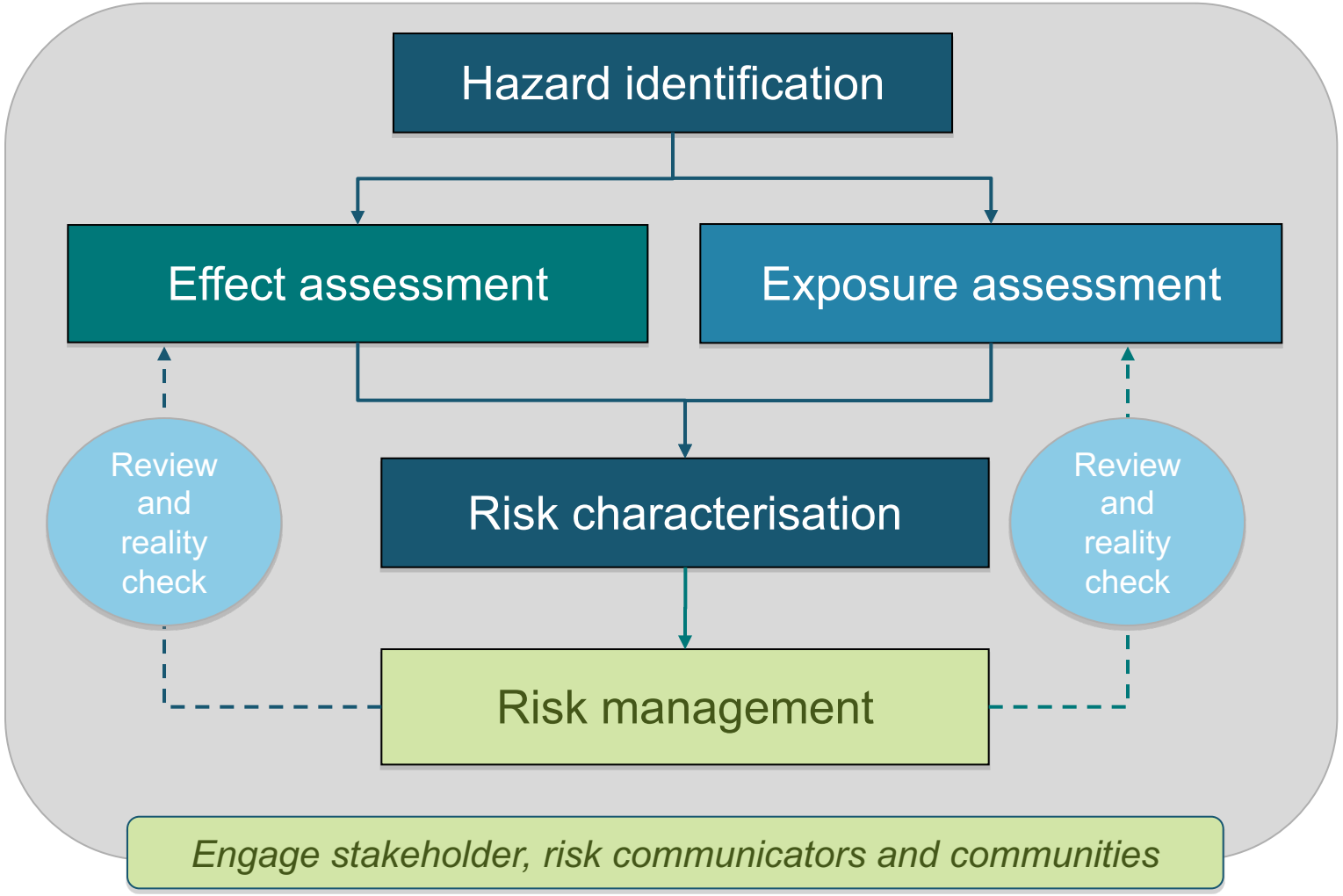
- This chapter give a summary of current international regulations of chemicals to better understand and set a context for the application of *in vitro* assays in modern risk assessment
- Primer for chapter 9: *In vitro* assays for the risk assessment of chemicals

Risk assessment of chemicals

- ERA = environmental (or ecological) risk assessment
- HHRA = human health risk assessment
- Hazard is a substance or event that has the potential to cause harm
- Risk is the probability or likelihood that harm will occur



Risk assessment of chemicals

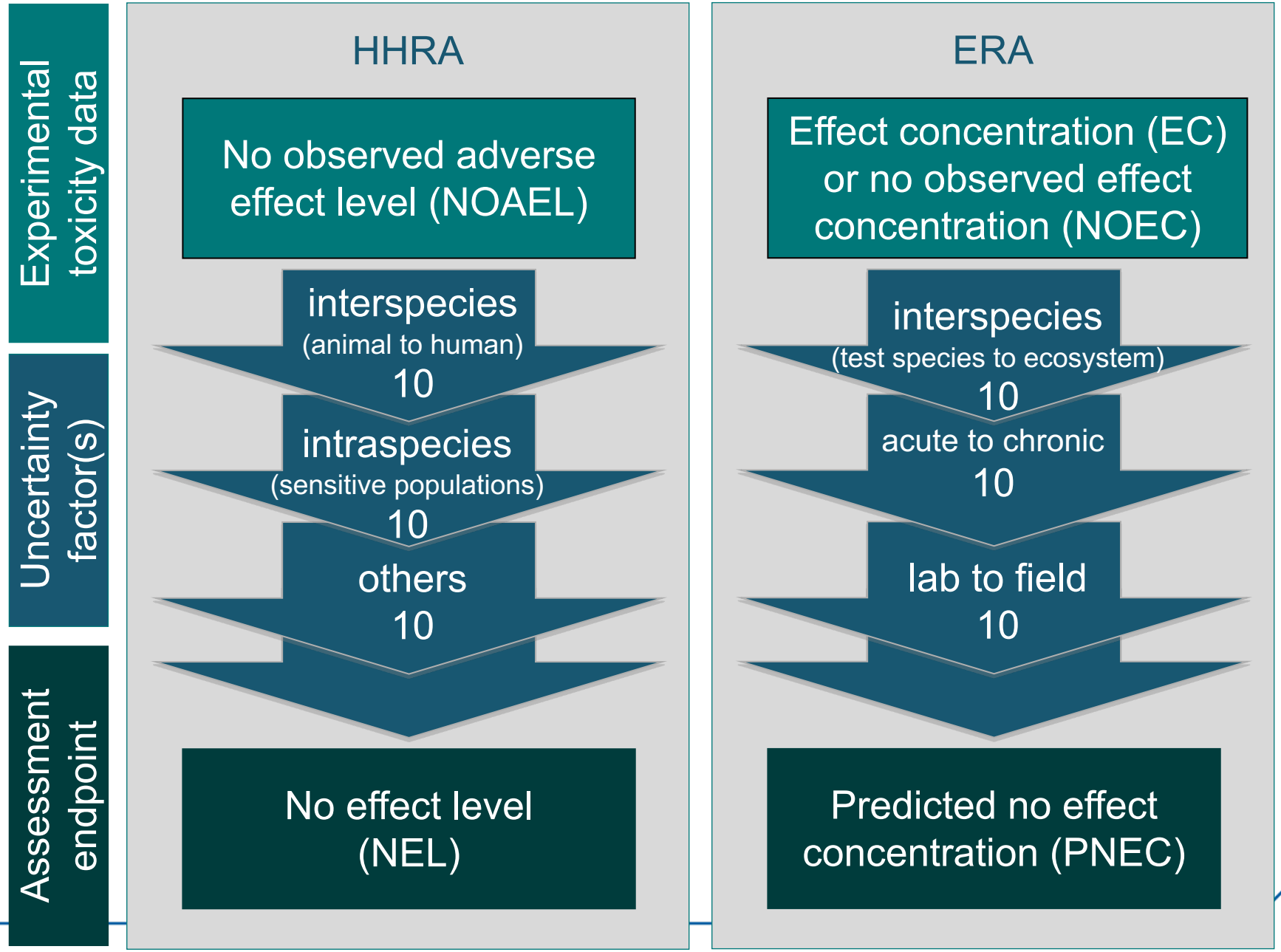


Generic risk assessment framework including feedback loops

Hazard identification

- **Inherent potency** of a chemical to cause harm to humans or the environment
- Evaluation of data on
  - harm to humans:
    - health hazards (also birth defects, cancer, ...), diseases
  - harm to the environment
    - lethal effects (LC_{50} values for representative test organisms)
    - sublethal effects (growth and reproduction of populations)
- Classification and labelling
  - **hazard and precautionary statements** under the Globally Harmonized System (GHS)
  - hazard symbols

Effect assessment of chemicals



Risk quotient

$$RQ = \frac{\text{exposure level}}{\text{acceptable effect level}}$$

RQ < 1 ↓ Risk acceptable, no action

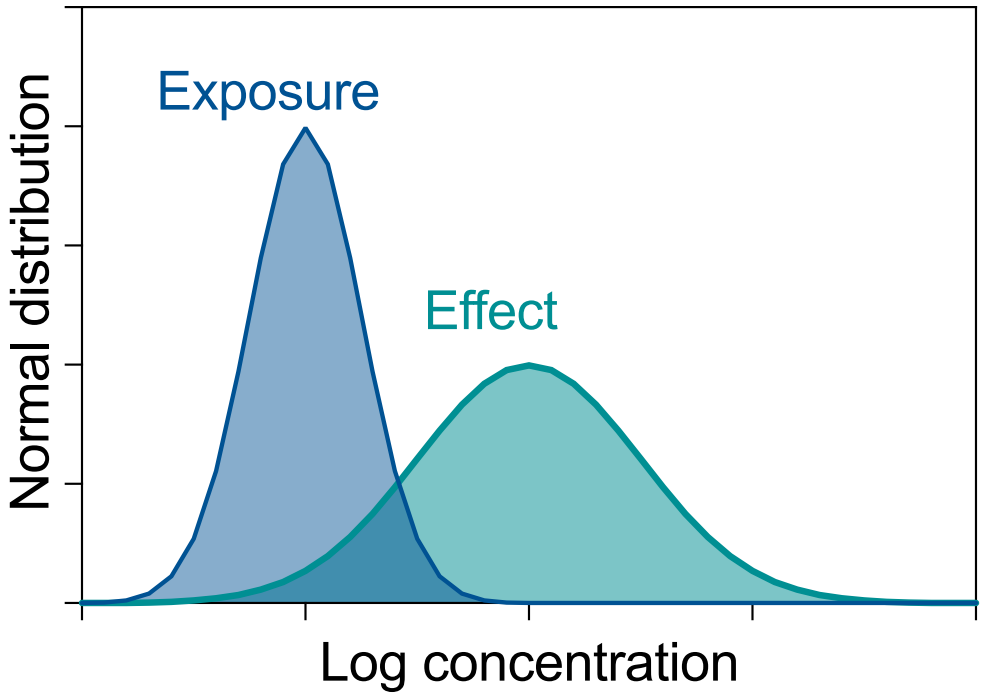
RQ≥ 1 ↓ further investigations and refined risk assessment or risk reduction measures

Uncertainty analysis

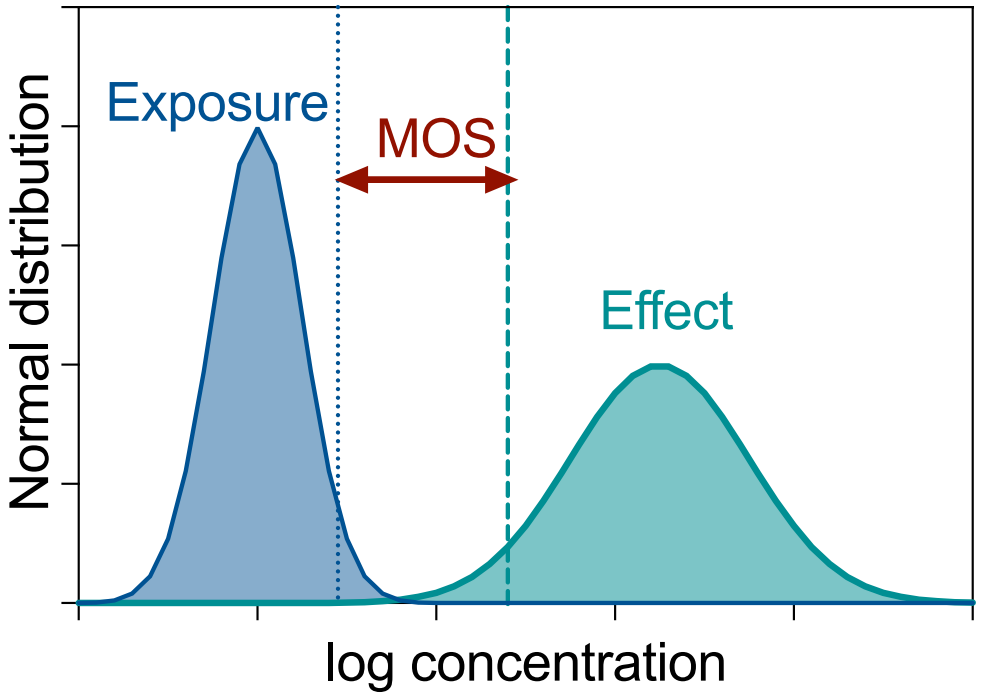
- indeterminacy: ´true value of a parameter is not known
- Variability: parameters cover a range, such as temperature, system homogeneity and species' and organisms' sensitivity

Probabilistic risk assessment

A. Overlap of exposure and concentrations→ risk

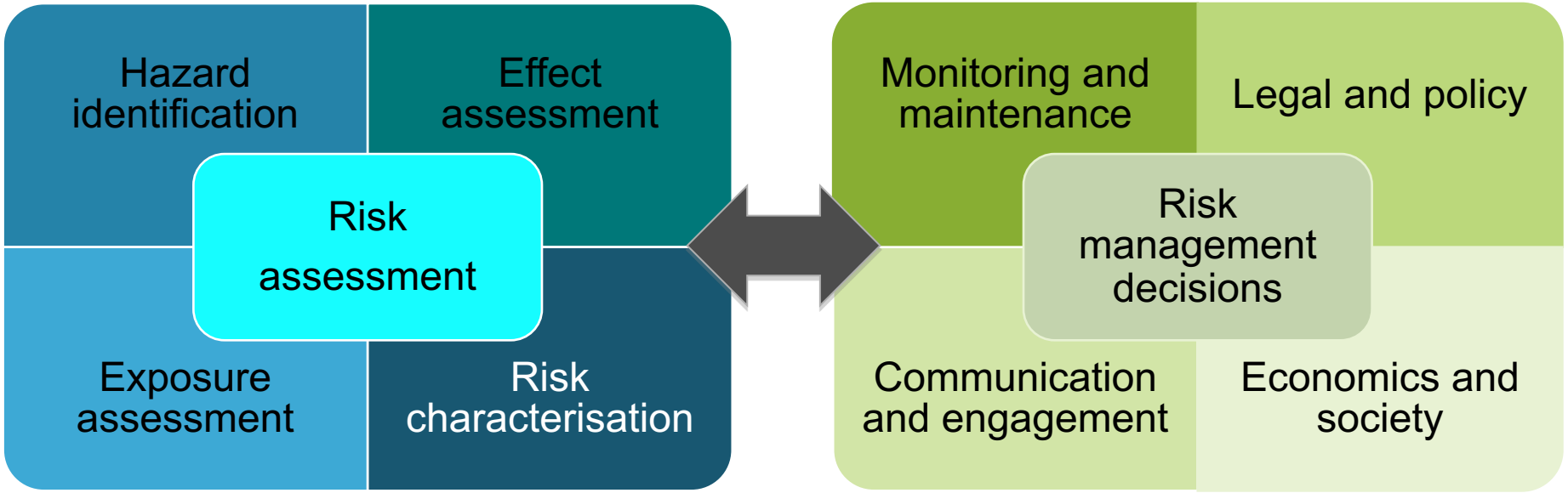


B. No overlap of exposure and effect → margin of safety



Risk assessment vs. risk management

Risk assessment and risk management are informed by each other and work towards ongoing improvement in the process



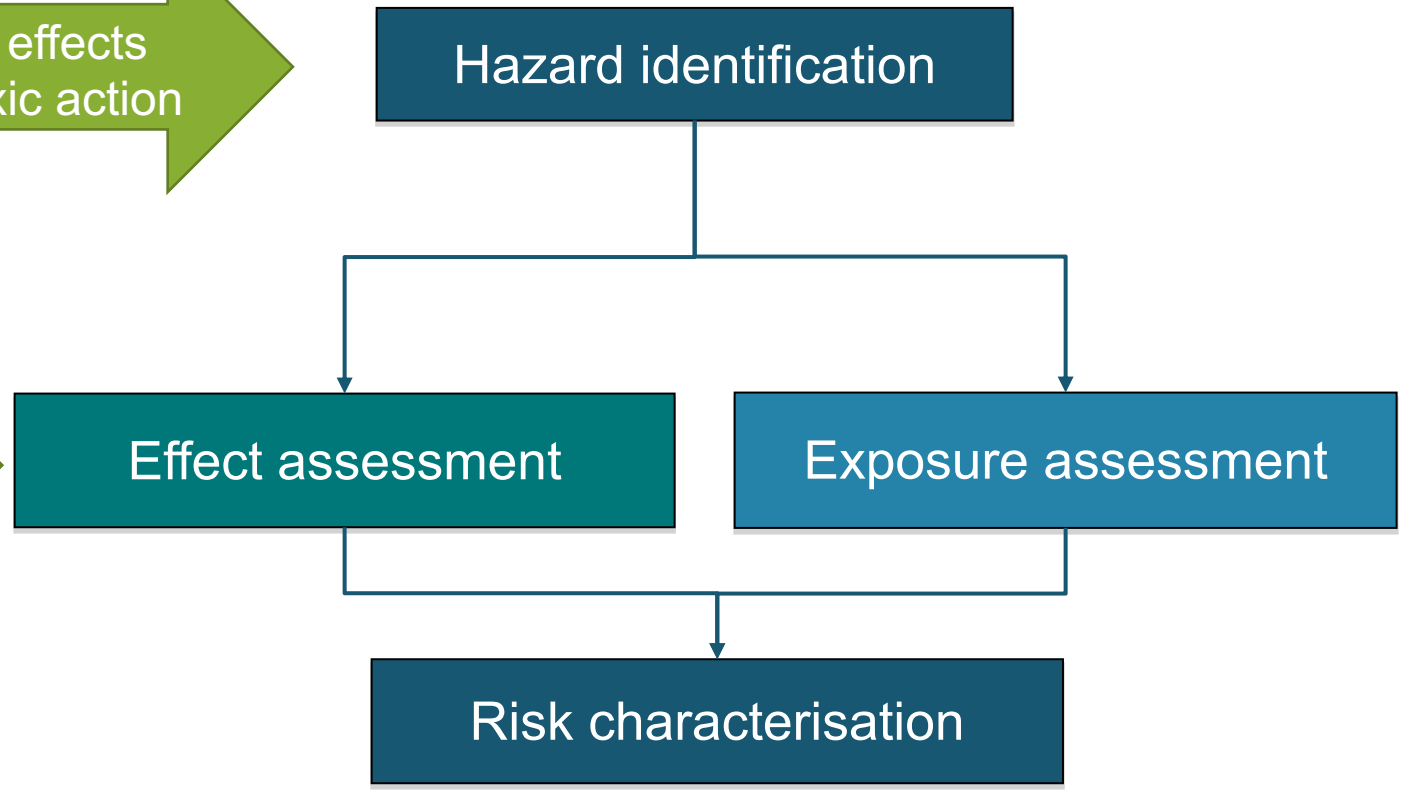
Application of bioanalytical tools in chemical risk assessment

In vitro assays

Initial screening of potential toxic effects and classification of modes of toxic action

(1) identify mechanisms of chemically induced biological activity, (2) prioritise chemicals for more extensive toxicological evaluation, and (3) develop predictive models of *in vivo* biological response

More details in Chapter 9



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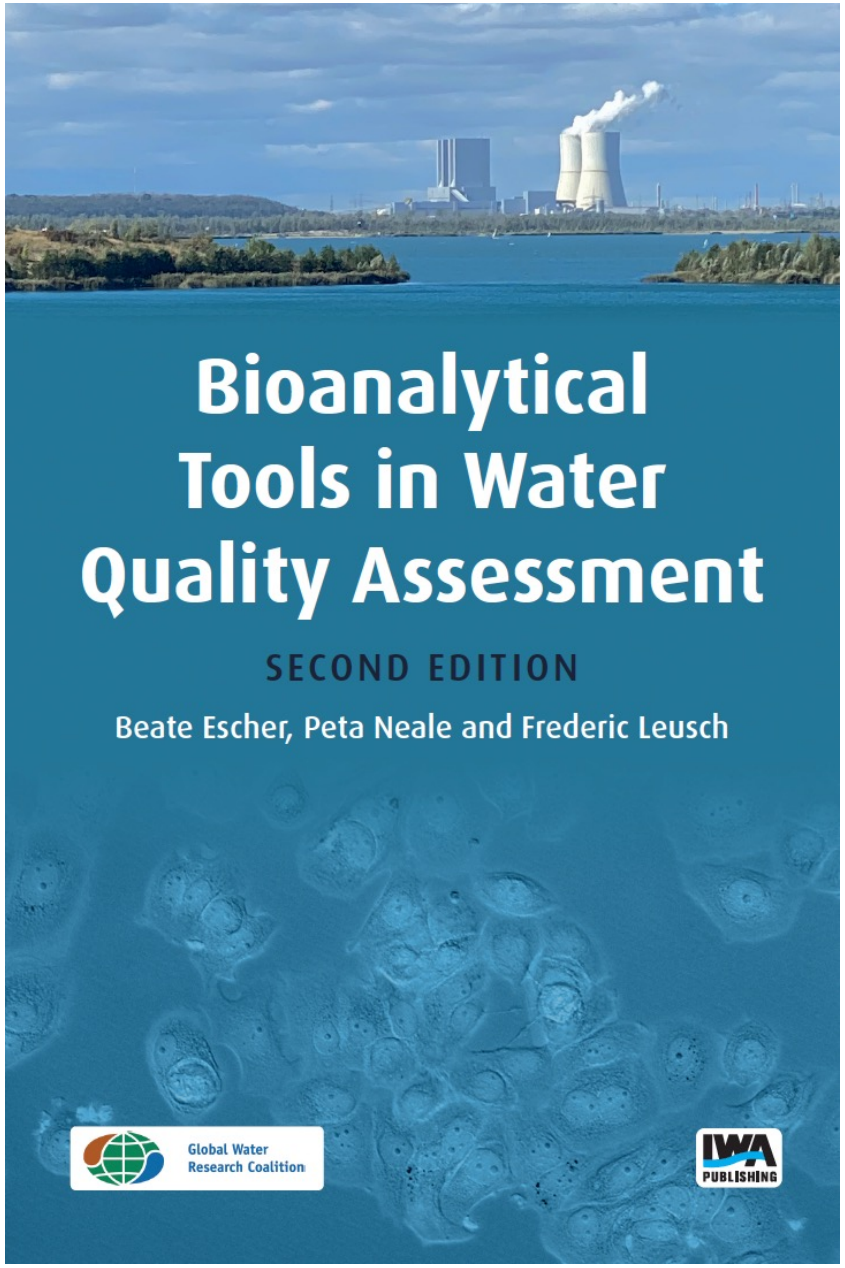

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