



## RESEARCH AREAS

## HIGHER TIER AQUATIC RISK ASSESSMENT

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### FRAUNHOFER IME APPLIED ECOLOGY DIVISION

The overall aim of the Applied Ecology Division is to investigate and assess the risks presented by synthetic chemicals and natural substances towards ecosystems, and towards humans via contaminated food, feed, and consumer products.

#### Our current topics and business areas are:

- Chemical and Product Safety
- Fate and Effect of Agrochemicals
- Uptake and Metabolism of Agrochemicals
- Food and Feed Safety
- Environmental Monitoring
- Soil and Water Protection



# WE ARE YOUR PARTNER FOR AQUATIC HIGHER TIER EFFECT STUDIES OF PLANT PROTECTION PRODUCTS AND OTHER CHEMICALS



Standard risk assessments are designed to be protective and are not necessarily realistic. There are several options to refine these assessments using higher tier studies. We design and execute such studies under GLP conditions, assessing aquatic effects in order to provide more realistic effect data and reduce the uncertainties in extrapolation to a field situation. Necessary fate and exposure analysis is conducted in close co-operation with our chemical departments in-house.

## Tests with standard test species under modified exposure conditions

Standard tests are usually conducted under worst case exposure conditions, e.g. constant concentrations in water-only systems. However, in the field bioavailability might be lower if the toxicant has a high potential to adsorb to organic matter or the exposure pattern is characterized by one of multiple peaks. To address more realistic exposure situations we conduct tests in water-sediment systems and/or with peak exposure patterns. Examples are:

- *Lemna sp.*, *Myriophyllum sp.*, *Daphnia magna* tests in water-sediment systems with exposure periods of different lengths followed by a recovery period
- Specific reproduction tests with *Daphnia magna* exposed to water accommodated fractions, tests with inclusion of sediment, or tests with alternative feed

- Full Life Cycle tests with zebra fish (*Danio rerio*) under static exposure in water/sediment systems: simultaneous exposure of three life stages (fertilised eggs, juveniles, and pre-adults) addressing risk of peak exposure and sediment contamination (high  $K_{oc}$  metabolites). Early life stage tests under static exposure are also conducted with medaka (*Oryzias latipes*), fathead minnow (*Pimephales promelas*) and rainbow trout (*Oncorhynchus mykiss*).

## Testing additional non-standard species

One of the major uncertainties related to standard tests is the variability of the intrinsic sensitivity between species. Depending on the test item's mode of action and the requirements of the relevant guidance documents we can conduct tests with non-standard test species from the following taxonomic groups: algae, macrophytes, crustaceans, insects, molluscs, oligochaetes, and fish. The results are summarized in Species Sensitivity Distributions.

## Micro- and mesocosm studies

Micro- and mesocosms allow testing of populations and communities from different trophic levels and taxonomic groups under realistic exposure conditions. The studies are designed to address a specific problem, e.g. with respect to the simulated exposure pattern and the taxa to be monitored. The following test systems are available:

- 3 x 16 microcosms in a greenhouse located at the IME Schmallenberg (partly transferable outdoors / 1 m<sup>3</sup> volume)
  - Focus on plankton communities and single introduced macroinvertebrate or macrophyte taxa
  - Temperature and light control allowing seasonal or climatic simulations over the whole year
  - Adjustment of trophic conditions by selecting the natural sediment and water introduced into the system
  - Use of radio-labelled test items for detailed fate analysis
- Up to 3 x 18 and 2 x 25 enclosures at Mesocosm GmbH, Homberg (2 m<sup>3</sup> volume) and up to 2 x 15 mesocosms located at gaiac, Aachen (5 m<sup>3</sup> volume)
  - Outdoor systems exposed to natural weather conditions
  - Comprising phytoplankton, periphyton, macrophytes, zooplankton, and macroinvertebrates
  - Recovery based on reproduction of survivors or resting stages and recolonisation by flying insects

## Statistics, modelling, and expert opinions

Our experimental work is supported by state-of-the-art statistics and exposure and effect modeling. We also offer expert opinions regarding the evaluation of studies as well as substance-specific risk assessments based on literature reviews.