

# Derivation of Aquatic Life Benchmarks and Quality Assurance

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## ABSTRACT

Aquatic life benchmarks, developed by US EPA's Office of Pesticide Program (OPP), are toxicological reference values below which pesticides are not expected to harm aquatic life. The benchmark values are extracted from the most recent publically available OPP risk assessment for the pesticide, and are based on the most sensitive acute and chronic toxicity data for each taxon represented. Those acute and chronic toxicity values are available for freshwater fish and invertebrates, and aquatic vascular and non-vascular plants. This poster demonstrates the processes of extracting toxicity values and the multiple quality assurance steps which are conducted by federal and state agencies including California Department of Pesticide Regulation. OPP initially launched the on-line database with benchmarks for 71 pesticides and degradates. Currently, benchmark values are posted for some 331 pesticides and degradates. State agencies use the aquatic life benchmarks to inform regulatory decisions for pesticides, and to interpret water monitoring data.

## BACKGROUND

The aim of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) is to provide federal control of pesticide distribution, sale and use. All pesticides used in the United States must be registered by EPA. Registration assures that pesticides will be properly labeled and will not cause unreasonable adverse effects on human health and the environment if used in accordance with specifications. In the development of a risk assessment for a pesticide, EPA evaluates toxicity data provided by the registrant and those obtained from other sources. EPA incorporates measures of exposure and effects for the pesticide active ingredient in the risk assessment process for all regulatory decisions. The typical assessment endpoints for pesticide ecological risk assessments are reduced survival for aquatic animals from direct acute exposures and survival, growth, and reproductive impairment for aquatic animals from direct chronic exposures. The assessment endpoint for aquatic plants (vascular and non-vascular) typically focus on growth rates and biomass measurements. Aquatic life benchmarks are estimates of toxicological concentrations below which effects to aquatic organisms are not considered likely to occur and above which there is an increasing likelihood of effects. The benchmarks can be used as interim measures of whether pesticide residues detected in surface water are sufficient to warrant additional regulatory action, or to refine monitoring efforts.

OPP published a website with benchmarks for 71 pesticides and degradates in 2007, and updated them to 148 in 2009 and expanded to 240 pesticides in 2010. Currently, the website contains aquatic benchmarks for 331 pesticides and degradates. California Department of Pesticide Regulation has contributed to benchmark derivation and quality assurance processes since 2009.

## OBJECTIVES

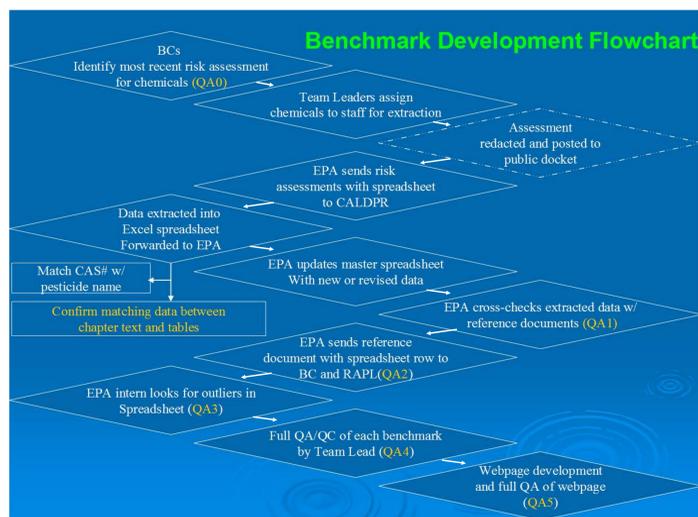
- To expand the number of pesticides with available benchmarks and update the benchmarks as new risk assessments become available.
- To ensure that the benchmarks are technically sound, consistent with EPA risk assessment evaluation and methods.

## DATA SOURCES

- ECOTOX data base (<http://cfpub.epa.gov/ecotox/>)
- Study submissions for registration
- Public literature

## PROCEDURES FOR DATA EXTRACTION

- Identify most sensitive species with lowest toxicity values in each taxa
- Calculate benchmarks:
  - Acute Freshwater Vertebrate and Invertebrate*  
= most sensitive toxicity value x Level of Concern (e.g., 96-hr LC<sub>50</sub> x 0.5)
  - Chronic Freshwater Vertebrate and Invertebrate*  
= most sensitive toxicity value x Level of Concern (e.g., NOAEC x 1.0)
  - Aquatic Plants (vascular, nonvascular)*  
= most sensitive toxicity value x Level of Concern (e.g., EC<sub>50</sub> x 1.0)
- Estimate toxicity values for a species by using acute-to-chronic ratios (ACR = LC<sub>50</sub>/NOAEC) of other species



## USE OF BENCHMARKS

- As a reference concentration to evaluate potential risks of pesticide residues detected in surface water
- As one of the indicators to prioritize pesticides for urban and agricultural environmental monitoring in California

## HARMONIZATION BETWEEN OPP & OW

EPA Office of Pesticide Programs (OPP) and Office of Water (OW) are working in an effort to harmonize on the data used to derived aquatic life benchmarks and water quality criteria. The purpose is to provide a common dataset for the characterization of aquatic effects of pesticides under the CWA and FIFRA resulting in effects assessments that are consistent with both statutes

## SIMILARITIES IN WATER QUALITY CRITERIA AND BENCHMARKS

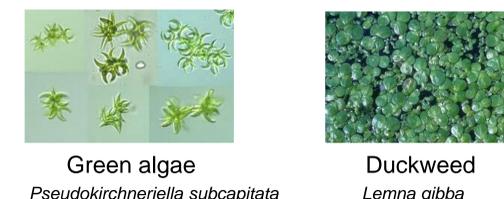
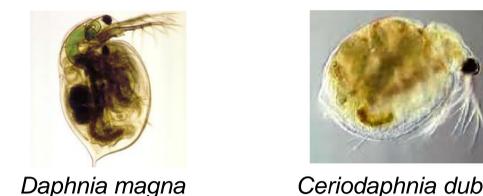
- Use all available reliable aquatic toxicity data, including data from public literature
- Peer reviewed data, with transparent data quality standards
- Use same assessment endpoints (survival, growth, reproduction, development)
- Use ACRs to estimate chronic values
- Focus on sensitive aquatic species

## DIFFERENCES IN BENCHMARKS AND WATER QUALITY CRITERIA

Aquatic Life Benchmarks	Water Quality Criteria
Multiple toxicity values representing different taxonomic groups	One toxicity value integrates results from different taxonomic groups
Based on most sensitive species tested within taxonomic groups	Based on lower 5 <sup>th</sup> percentile of species-sensitivity distribution
Lowest toxicity value is used within a taxonomic group (e.g. fish, invert.)	Individual toxicity values are averaged within genera to form distribution of genus means
Freshwater: fish, invertebrates, vascular and non-vascular plants	Freshwater: 8 animal families, 1 plant family
Developed for all registration actions	Developed according to national priority

\*cited from EPA OPP/OW risk assessment harmonization meeting

## SPECIES COMMONLY USED



## REFERENCES

- Stephan, C.E, D.I. Mount, D.J. Hanson, J.H. Gentile, G.A. Chapman, and W.A. Brungs. 1985. Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses. EPA PB85-227049.
- US EPA. 2012. Office of Pesticide Programs' Aquatic Life Benchmarks. [http://www.epa.gov/oppefed1/ecorisk\\_ders/aquatic\\_life\\_benchmark.htm#benchmarks](http://www.epa.gov/oppefed1/ecorisk_ders/aquatic_life_benchmark.htm#benchmarks)
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