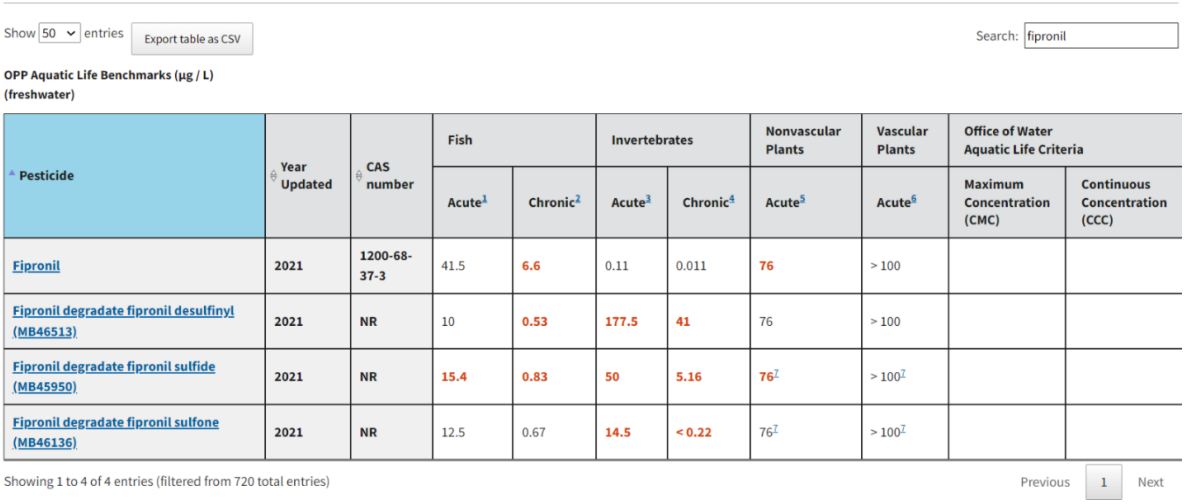
EPA's Aquatic Life Benchmarks: Use for State-Lead Agencies

- **What are aquatic life benchmarks for registered pesticides?**
  - Values set by EPA's Office of Pesticide Program (OPP)
  - Based on scientific studies to estimate the concentrations below which pesticides are not expected to represent a risk of concern for aquatic life
  - Can be used to identify and prioritize sites or pesticides that may require further investigation
  - Find more information here: https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/aquatic-life-benchmarks-and-ecological-risk

- **How can State-Lead Agencies use the benchmarks?**

  - To compare environmental data to the benchmarks, start by searching the table for the pesticide of concern. Associated degradates will also appear.

Below is an example for the active ingredient fipronil.



Show 50 entries Export table as CSV Search: fipronil

OPP Aquatic Life Benchmarks (µg / L) (freshwater)

Pesticide	Year Updated	CAS number	Fish		Invertebrates		Nonvascular Plants	Vascular Plants	Office of Water Aquatic Life Criteria	
			Acute[1]	Chronic[2]	Acute[3]	Chronic[4]	Acute[5]	Acute[6]	Maximum Concentration (CMC)	Continuous Concentration (CCC)
Fipronil	2021	1200-68-37-3	41.5	6.6	0.11	0.011	76	> 100		
Fipronil degradate fipronil desulfinyl (MB46513)	2021	NR	10	0.53	177.5	41	76	> 100		
Fipronil degradate fipronil sulfide (MB45950)	2021	NR	15.4	0.83	50	5.16	76[Z]	> 100[Z]		
Fipronil degradate fipronil sulfone (MB46136)	2021	NR	12.5	0.67	14.5	< 0.22	76[Z]	> 100[Z]		

Showing 1 to 4 of 4 entries (filtered from 720 total entries) Previous 1 Next

  - Determine if it is more appropriate to compare your data to the acute or chronic benchmarks. Acute benchmarks are developed from short-term exposures and chronic benchmarks are developed from long-term exposures. Acute values may be more appropriate for storm events while chronic benchmarks may be useful for long-term monitoring data or dry weather sampling or where a more conservative approach is merited. See the sections below for more information on how these benchmarks are developed.

As an example, assume fipronil has been detected in a surface water sample during a storm event.

  - Compare your environmental data to the appropriate values in the table. Values in the table are presented in units of micrograms per liter or µg/L (unless otherwise noted). Be sure that your environmental data is in the same units. Note that 1.0 mg/L = 1 part per million (ppm), 1.0 µg/L = 1 part per billion (ppb), and 1.0 ng/L = 1 part per trillion (ppt).

This is a storm sample so the data can be compared to the acute benchmarks since it is a short-term event.

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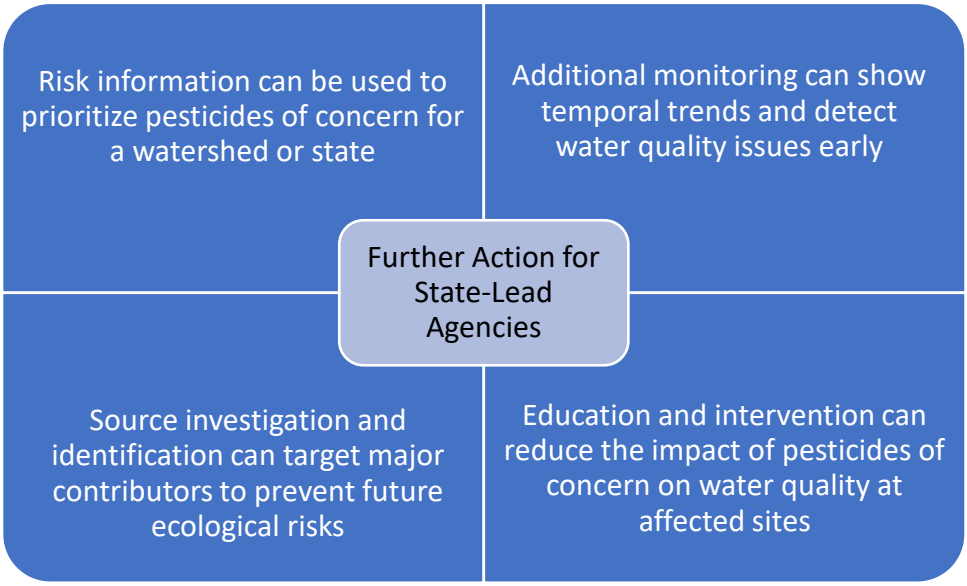
- If the environmental sample data is below the benchmark, risk to aquatic life is not expected. Data above the benchmarks does not necessarily mean that adverse effects would occur but does indicate that further evaluation is needed.
- Click on the hyperlinked chemical name to access the most recent ecological risk assessment to get more information on the species tested, the effects that were observed, and the concentration at which these effects occurred.
- Use this information to characterize potential risk to aquatic organisms in this waterway. Find information from EPA about ecological risk assessment here: https://www.epa.gov/risk/ecological-risk-assessment.
- Affected sites can be flagged for further testing or investigation to determine the source of the pesticides and implement programs to reduce the risk to aquatic organisms and protect ecological health.

If fipronil was detected at a level of 1.0 µg/L in a storm sample, that would exceed the acute benchmark for invertebrates, but not for fish or plants.

According to the fipronil ecological risk assessment, acute toxicity information for freshwater invertebrates is available on at least 25 species. The acute benchmark is based on the acute toxicity to the black fly.

Further review of EPA's ecological risk assessments can provide more information about other species tested and the effect levels. This information is especially useful if there are sensitive, endangered, or protected aquatic invertebrates in the affected waterway.



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- **How does EPA set the benchmarks?**
    - For registered pesticide active ingredients, EPA's OPP conducts ecological risk assessments. In these assessments, EPA reviews data from toxicology studies in a range of fish, invertebrate, and plant species. Generally, OPP chooses the most sensitive endpoint (i.e. the effect that happens at the lowest concentration) in the most sensitive species to protect against risks to aquatic organisms.
        - OPP uses the most recent ecological risk assessments for each active ingredient to determine the Aquatic Life Benchmarks.
        - OPP incorporates an additional "level of concern" (LOC) factor of either 0.5 for acute invertebrate and fish benchmarks or 1 for chronic invertebrate, fish, and plant benchmarks. These LOCs are criteria used by OPP to indicate potential risk to non-target organisms.
    - EPA's Office of Water (OW) sets Ambient Water Quality Criteria which are also values derived from toxicity data designed to protect aquatic life. However, the OW's strategy for developing criteria is accomplished by species sensitivity distribution, which is expressed in terms of percentile of organisms protected. This strategy requires larger datasets which may not exist for certain pesticides. This can create discrepancies between OPP's Aquatic Life Benchmarks and OW's Ambient Water Quality Criteria. Find more information on the different strategies to set water quality criteria here: https://www.cdpr.ca.gov/docs/emon/pubs/ehapreps/analysis_memos/water_quality_criteria_memo.pdf.
    - The EPA develops Aquatic Life Benchmarks for both acute and chronic exposure scenarios.
        - Acute benchmarks can be used in situations where there is short-term exposure (hours-days). Most acute toxicity tests for fish and invertebrates involve exposing animals for 48-96 hours and measuring mortality. Most acute toxicity tests for plants are less than ten days.
        - Chronic benchmarks can be used in situations where there is longer-term exposure (weeks-years) or where a more conservative approach is merited. Most chronic toxicity tests for invertebrates and fish involve exposing animals for a life-cycle or early life stage and measuring a broad range of outcomes, such as reproduction or mobility.

- **Definitions**
    - Acute Exposure – contact with a chemical for a short period of time (ex: hours to days)
    - Acute Benchmark – estimate of the concentration below which the pesticide is not expected to represent a risk of severe effects from short-term exposure. For fish and aquatic invertebrates, this value is usually set as half the LC50 for the most sensitive species. For plants, it is set as the EC50 for the most sensitive species
    - Chronic Exposure – contact with a chemical for a long period of time (ex: weeks to years)
    - Chronic Benchmark – estimate of the concentration below which the pesticide is not expected to represent a risk of concern for long-term exposure. For fish, the chronic benchmark is usually the lowest NOAEC from a life-cycle or early life stage test (usually with Rainbow Trout (*Oncorhynchus mykiss*) or Fathead Minnow (*Pimephales promelas*). For aquatic invertebrates, the chronic benchmark is usually the lowest NOAEC from a life-cycle test with invertebrates
    - Concentration – the amount of a chemical present in a certain amount of water; often expressed as "µg/L" or micrograms of chemical per liter of water

- Degradate – chemical that is produced when another chemical (in this case, the active ingredient) is broken down through abiotic or biotic processes.
- EC50 – the concentration of a chemical that caused adverse effects in 50% of test organisms during toxicity testing
- LC50 – the concentration of a chemical that caused mortality in 50% of test organisms during toxicity testing
- Level of concern (LOC) - criteria used by OPP to indicate potential risk to non-target organisms
- No Observed Adverse Effects Concentration (NOAEC) – the highest concentration of a chemical that produced no adverse effects in test species during toxicity testing