Fact Sheet: Acute & Chronic Toxicity Assessments of NY Streams & Rivers

A. Microtox®

1) **Bottom Sediments:** This bioassay method uses bioluminescent bacteria (*Vibrio fischeri*) to assess the toxicity of aquatic bottom sediments. In a method developed by the NYSDEC's Toxicity Testing Unit, sediment samples are first centrifuged to remove the porewater, and then extracted with methanol. A reduction in light levels compared to a control sample following a 15-minute exposure is a measure of the Acute toxicity of the sample, and expressed as an EC50. Results are categorized according to a four-tiered system (non, slight, moderate or severe) per Tables 1-3 below (note that changes in methanol quality over time have necessitated revisions to the rating system). Specific screening test methods follow NYSDEC Standard Operating Procedure: Microtox® Acute Toxicity Test for Sediments, Porewaters and Effluents (SOP#403_V22-1), which is available for download from the agency.

Table 1: Rating system applied to Microtox® analyzed bottom sediments from 2001-12.

15-minute Sediment EC50 (%)	Toxicity Category
< 1.00	Severely Toxic
≥ 1.00 to < 20.00	Moderately Toxic
≥ 20.00 to < 40.00	Slightly Toxic
≥ 40.00	Non-Toxic

Table 2: Rating system applied to Microtox® analyzed bottom sediments from 2013-14.

15-minute Sediment EC50 (%)	Toxicity Category
< 40.00	Severely Toxic
≥ 40.00 to < 60.00	Moderately Toxic
≥ 60.00 to < 80.00	Slightly Toxic
≥ 80.00	Non-Toxic

Table 3: Rating system applied to Microtox® analyzed bottom sediments from 2015-present.

15-minute Sediment EC50 (%)	Toxicity Category
< 20.00	Severely Toxic
≥ 20.00 to < 40.00	Moderately Toxic
≥ 40.00 to < 60.00	Slightly Toxic
≥ 60.00	Non-Toxic

2) **Porewaters:** Microtox® is also used to assess the toxicity of the resulting porewaters. The EC50 results are categorized according to a similar two (toxic or non-toxic) or now four-tiered system (non, slight, moderate or severe) per Tables 4-5 below (note this newer approach provides better toxicity resolution). Specific screening test methods follow NYSDEC Standard Operating Procedure: Microtox® Acute Toxicity Test for Sediments, Porewaters and Effluents (SOP#403_V22-1), which is available for download from the agency.

Table 4: Rating system applied to Microtox® analyzed porewater samples from 2001-2019.

15-minute Porewater EC50 (%)	Toxicity Category
< 100.00	Toxic
≥ 100.00	Non-Toxic

Table 5: Rating system applied to Microtox® analyzed porewater samples from 2019-present.

15-minute Porewater EC50 (%)	Toxicity Category
≤ 33.00	Severely Toxic
> 33.00 to ≤ 67.00	Moderately Toxic
> 67.00 to ≤ 100.00	Slightly Toxic
> 100.00	Non-Toxic

B. ***Water Fleas***

This bioassay method uses water fleas, a freshwater invertebrate, to assess the toxicity of stream and river samples. Reductions in survival and/or reproductive rate compared to a control sample following a 7-day exposure is a measure of the Chronic toxicity of the sample. Results are statistically categorized according to a four-tiered system (non, slight, moderate or severe) per Table 6 below. Specific test methods and conditions follow US EPA's Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, 4th ed., October 2002 (EPA-821-R-02-013), as well as NYSDEC Standard Operating Procedure: *Ceriodaphnia dubia* (*C. dubia*) 7-day Chronic Screening Test for Toxicity of Ambient Water Samples or Effluents (SOP#402_V22-1), both documents which are available for download from each respective agency.

Table 6: Rating system applied to *Ceriodaphnia* from 2001 to present.

Toxicity Category	7-day Statistical Test Definition
Severely Toxic	Statistically significant mortality **AND** reproductive effects
Moderately Toxic	Statistically significant mortality effect
Slightly Toxic	Statistically significant reproductive effect
Non-Toxic	No statistically significant mortality **OR** reproductive effects

GLOSSARY

Acute Toxicity: A short-term lethal or other toxic effect, such as reduced light output or immobilization.

Bioassay: Uses live test organisms to determine the relative strength or toxicity of a sample.

Bioluminescent Bacteria: The production and emission of light by single celled microorganisms. The same phenomenon is also observed in fireflies.

Ceriodaphnia: A small invertebrate, about the size of the head of a pin, that inhabits aquatic freshwater habitats. A popular organism for ecotoxicology studies.

Chronic Toxicity: A long-term non-lethal toxic effect, such as reduced reproduction or growth.

EC50: The effective concentration of a sample that causes an adverse effect to 50% of the test population.

Invertebrate: An animal without a backbone.

Microtox®: A commercially available bacteria-based toxicity detection system.

Porewater: The water located between sediment particles.