

Direct toxicity assessment

CSIRO provides specialist capability for assessing the bioavailability and toxicity of chemicals, effluents and wastewaters in freshwater and marine systems.

The Centre for Environmental Contaminants Research has a range of tools to assess whether chemicals, effluents or wastewaters discharged into water will be toxic to aquatic biota. These tools include sensitive chemical analyses and toxicity tests (bioassays) to determine cause-effect relationships between contaminants discharged and resulting biological effects. These tools were pioneered from sound scientific research conducted over many years by CSIRO researchers within the Centre.

Applications of aquatic toxicity testing

The Aquatic Contaminants Group at CSIRO Land and Water, Sydney, has extensive experience applying toxicity tests to assess contaminants from industrial, sewage, mining, oil and gas, chemical, pulp and paper and port activities in temperate and tropical ecosystems nationally and internationally.

Toxicity tests are used at CSIRO to:

- assess the toxicity of waters, groundwaters and sediments
- assess the toxicity of specific chemicals for risk assessments
- determine the required safe dilution of effluents, or an individual contaminant, to protect a larger range of species in receiving waters

- monitor the toxicity of effluents, impacted receiving waters and sediments using selected sensitive species
- assess mixture toxicity (multiple contaminants)
- identify specific contaminants causing toxicity.

Aquatic toxicity tests

CSIRO offers a comprehensive range of sensitive toxicity tests including: bacteria (Microtox®), microalgae and invertebrates (e.g. copepods, amphipods, bivalves). Toxicity tests provide a rapid assessment of waters/effluents and the sensitivity required to monitor changes in toxicity and contaminant bioavailability over time.

Marine and estuarine toxicity tests available include:

- 15-min acute bacterial luminescence inhibition test (estuarine/marine bacterium *Vibrio fischeri*)
- 48-h acute copepod survival test (tropical *Acartica sinjiensis*)
- 4-d chronic copepod early life stage test (tropical *Acartica sinjiensis*)
- 72-h chronic microalgal growth inhibition tests with temperate (*Nitzschia closterium* and *Phaeodactylum tricornutum*) and tropical (*Isochrysis galbana* and *Nitzschia closterium*) species

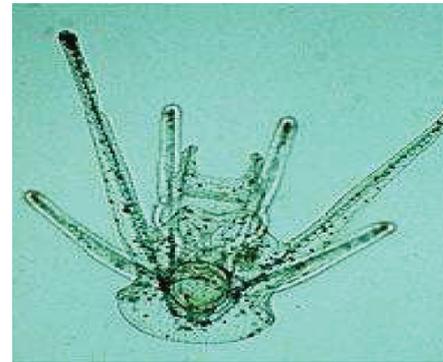
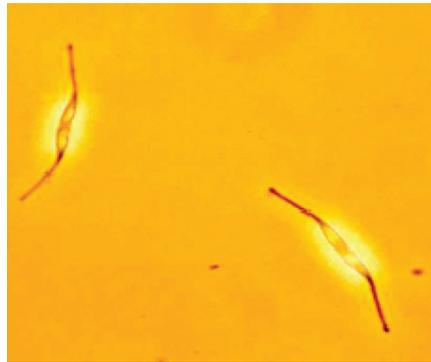
- 1-h fertilisation and 72-h chronic sea urchin larval development test (temperate *Heliocidaris tuberculata*)
- 96-h acute amphipod survival test (temperate amphipod *Melita plumulosa*)
- 7-d acute bivalve survival test (temperate juvenile bivalve *Tellina deltoidalis*).

Freshwater toxicity tests available include:

- 4-h acute bacterial glucose uptake inhibition test (temperate *Erwinia persicinus*)
- 48-h chronic bacterial growth inhibition test (temperate *Erwinia persicinus*)
- 24-h chronic bacterial growth inhibition test (Microbial Array Risk Assessment, MARA)
- 72-h chronic microalgal growth inhibition test (temperate *Chlorella vulgaris*, *Pseudokirchneriella subcapitata* and tropical *Chlorella* sp. and *Monoraphidium arcuatum*)
- 7-d chronic duckweed growth and biomass inhibition test (temperate *Lemna minor*)
- 48-h acute cladoceran immobilisation test (temperate *Ceriodaphnia dubia*)
- 7-d chronic cladoceran reproduction test (temperate *Ceriodaphnia dubia*)
- 96-h acute shrimp survival test (temperate *Paratya australiensis*).

Through our associates at CSIRO in Adelaide, we also provide bioassays such as shrimp survival, frog embryonic toxicity tests and fish early life stages tests (Murray Rainbowfish, Eastern Rainbowfish, Murray Cod, Mosquitofish, Zebrafish).





We also partner with other laboratories to provide complete toxicity test suites tailored to particular applications and regions e.g. Papua New Guinea, SE Asia. Our CSIRO laboratories in Sydney are Quarantine Approved Premises (QQAP) and are fully equipped with temperature-controlled environmental chambers and culture facilities. These facilities are co-located with NATA-accredited laboratories for chemical analyses that includes a Class 100 clean room for ultra-trace metals analyses.

CSIRO also provides specialist capability in ecotoxicology assessment of contaminated sediments using whole sediment bioassays with benthic species (e.g. algae, copepods, amphipods, bivalves). For details of available tests, see the companion *Whole-sediment ecotoxicology* brochure.

Toxicity identification evaluation

When the cause of toxicity in a sample is unknown, toxicity identification evaluation (TIE) protocols have been developed and applied to determine the causative chemicals and to permit targeting of appropriate management actions. TIE uses toxicity tests in combination with chemical and physical manipulations of effluents or sediments to identify the cause of the observed toxicity. CSIRO has developed TIE protocols using Microtox, marine, estuarine and freshwater microalgae, and invertebrates (marine copepod, freshwater cladoceran and benthic amphipods). These have been applied to the identification of toxicants in sewage effluents, mine tailings liquor, produced formation waters, ground water leachates and sediment pore waters.

Applications of aquatic ecotoxicology data

Scientists at the Centre for Environmental Contaminants Research, CSIRO Land and Water co-developed the Australian and New Zealand water and sediment quality guidelines and continue to be at the forefront of international ecotoxicological research. Data from the above toxicity tests are used by CSIRO in species sensitivity distributions to determine safe dilutions of individual chemicals and effluents from industrial, mining and urban activities, and as part of ecological risk assessments. For the development of site-specific water quality guidelines, results from eight or more toxicity tests can be used in species sensitivity distributions to determine contaminant concentrations that are protective of a larger range of organisms in an ecosystem.

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We do this by using science and technology to solve real issues. Our research makes a difference to industry, people and the planet.

FOR FURTHER INFORMATION

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