

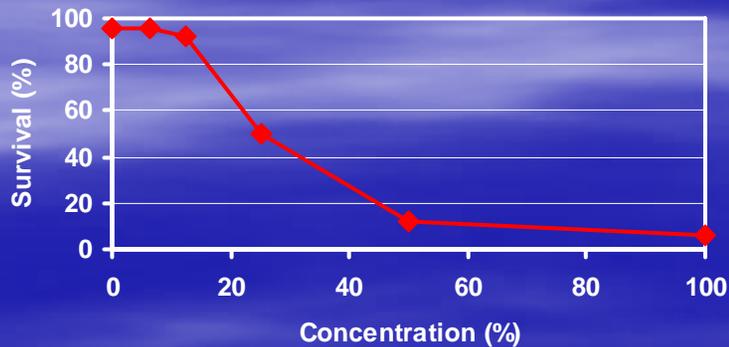
WET WATER QUALITY STANDARDS and PERMITTING

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WHY WET?

- Implements National Policy “discharge of toxic pollutants in toxic amounts be prohibited”
- Directly implements States’ numeric or narrative criteria “no toxics in toxic amounts”
- Whole effluent approach to toxics control for protection of aquatic life uses acute and chronic toxicity tests to measure toxicity of effluents
- Permittee’s in compliance with chemical limits - effluent still toxic
- Cost effective approach in controlling toxic discharges

HOW IS A TOXICITY TEST CONDUCTED?



EARLY EPA WET PROGRAM

- 1974, Region 4 conducted on-site acute tests
- 1976, selected industrial facilities conducted acute tests
- 1982, SETAC workshop evaluated EPA WET testing
- 1983, began use of short-term chronic testing
- 1983, WET as a predictor of receiving water toxicity evaluated
- 1984, EPA policy recommended use of WET limits in NPDES permits
- 1985, EPA TSD for toxics control
- 1991, EPA revised the TSD for toxics control

WET TESTING FOR AQUATIC LIFE PROTECTION

- EPA promulgated test methods and guideline test methods
- Acute and short-term chronic tests
- Surrogate fresh and marine test species using trophic level approach for sensitivity evaluation
 - fish
 - invertebrates
 - plants
- Measures aggregate toxic effect of effluents or receiving waters

TOXICITY TESTING TOOL USES

- Toxicity testing is applicable and been successful to assess or develop:
 - municipal and industrial effluents
 - ambient waters (assessing for 303 impairment)
 - stormwaters
 - WQC development

TIERED APPROACH TO AMBIENT TESTING

- Initial surveys intended to characterize watershed or waterbody sites over several years or hydrologic cycles - sampling may be monthly
- Focused follow-up studies may include:
 - Increased number of sites and frequency of sampling
 - TIEs conducted
 - Evaluation monitoring to assess toxicity reduction/remediation efforts

FACTORS TO CONSIDER WHEN SELECTING SAMPLING SITES

- Significant source of flow or loads into the watershed?
- Representative type of drainage (agriculture, urban, mining, etc.)?
- Receives runoff from particular land use?
- Predicted or suspected toxicity?
- “Integrator” site indicative of inputs and/or of waterway (e.g., near mouth of river)
- Previously identified toxicity?













INTEGRATED APPROACH TO WATER QUALITY-BASED TOXICS CONTROL

- **Chemical-specific approach**
- **Whole effluent toxicity approach**
- **Biological criteria approach**

WATER QUALITY STANDARDS AND WET

WATER QUALITY STANDARDS

THREE PARTS

- Designated uses
- Criteria (narrative and numeric) to protect designated uses
- Antidegradation policy

WATER QUALITY CRITERIA COMPONENTS

- Magnitude: maximum allowable concentration of WET
- Duration: period of time over which the receiving water concentration is averaged
- Return frequency: designation of how often the criterion may be exceeded without impacting the organisms in the water body

EPA TDS RECOMMENDATION FOR ACUTE TOXICITY

- Magnitude = 0.3 TUa
- Duration = one hour
- Frequency = once in three years

EPA TDS RECOMMENDATION FOR CHRONIC TOXICITY

- Magnitude = 1.0 TUc
- Duration = 4 days
- Frequency = once in three years

WET in PERMITS

Permit Conditions for WET

- Chronic or acute tests
- Test species and methods
- Monitoring frequency
- Sample collection
- Test type and duration
- Statistical endpoint
- Selection of dilution water / series
- Reference toxicant testing
- Other QA conditions
- Test review
- Steps to address toxicity
- Re-opener condition

METHOD MANUALS

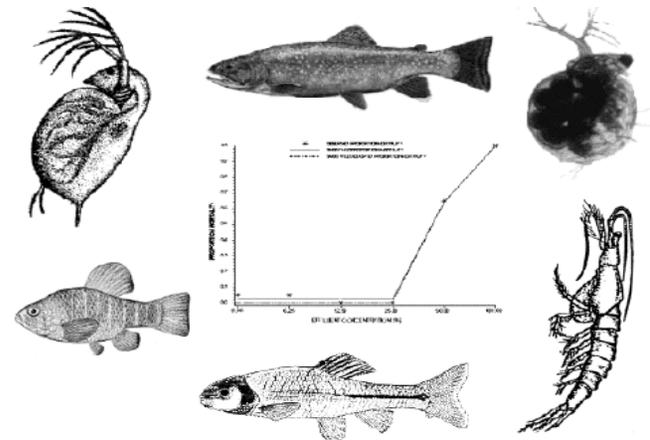
- Health and safety
- Quality assurance
- Facilities, equipment, supplies
- Test organisms
- Dilution water
- Effluent sampling and handling
- Test methods
- Report preparation



Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms

Fifth Edition

October 2002



Test Species and Methods

- Choose EPA test methods
 - Acute freshwater and marine - 5th edition
 - Chronic freshwater – 4th edition
 - Chronic marine East Coast – 3rd edition
 - Chronic marine West Coast – 1st edition
- Recommend multi-species screening with a fish, invertebrate, and alga for chronic testing
- Recommend multi-species screening with a fish and invertebrate for acute testing
- Continue testing with most sensitive species

SHORT-TERM CHRONIC FRESHWATER TEST METHODS

	SPECIES	TEST TYPE	TOXICANTS	ENDPOINTS
Fish	Fathead Minnow <i>Pimephales promelas</i>	7-day renewal	Ammonia Chlorine	Growth Survival
Invertebrate	Water Flea <i>Ceriodaphnia dubia</i>	7-day renewal	Pesticides Surfactants	Reproduction Survival
Plant	Green Alga <i>Selenastrum capricornutum</i>	96-hour non-renewal	Metals Herbicides	Growth



SHORT-TERM CHRONIC WEST COAST MARINE TEST METHODS

	SPECIES	TEST TYPE	TOXICANTS	ENDPOINTS
Fish	Topsmelt <i>Atherinops affinis</i>	7-day renewal	Ammonia Chlorine	Growth Survival
Invertebrate	Red Abalone <i>Haliotis rufescens</i>	48-hour non-renewal	Metals, Surfactants	Larval Development
	Mussel and Oyster <i>Mytilus/Crassostrea</i>	48-hour non-renewal	Metals, Chlorine	Larval Development
	Urchin/Sand Dollar <i>S. purpuratus</i> <i>D. excentricus</i>	<1-hour 48-96-hour non-renewal	Metals, Chlorine	Fertilization Larval Development
	Mysid <i>Holmesimysis costata</i>	7-day renewal	Metals Insecticides	Growth Survival
Plant	Giant Kelp <i>Macrocystis pyrifera</i>	48-hour non-renewal	Metals Herbicides	Growth Germination

ACUTE TEST METHODS

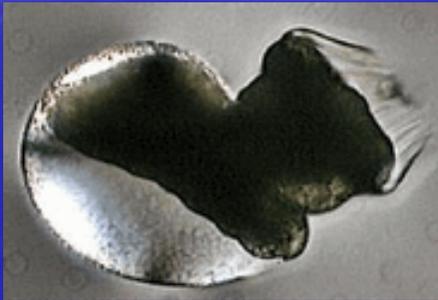
	WATER TYPE	SPECIES	TOXICANT	SALINITY
Fish	Freshwater	Fathead Minnow <i>Pimephales promelas</i>	Ammonia, Chlorine	1-6‰
	Freshwater	Rainbow Trout <i>Oncorhynchus mykiss</i>	Ammonia, Chlorine	1-2‰
	Marine	Silverside <i>Menidia beryllina</i>	Ammonia, Chlorine	1-36‰
	Marine	Topsmelt <i>Atherinops affinis</i>	Ammonia, Chlorine	5-36‰
Invertebrate	Freshwater	Water Flea <i>Ceriodaphnia dubia</i>	Pesticides	1-3‰
	Freshwater	Water Flea <i>D. pulex</i> and <i>D. magna</i>	Pesticides	1-6‰
	Marine	Atlantic Mysid <i>Mysidopsis bahia</i>	Metals, Insecticides	15-36‰
	Marine	Pacific Mysid <i>Holmesimysis costata</i>	Metals, Insecticides	32-36‰

LARGE VOLUME TESTS

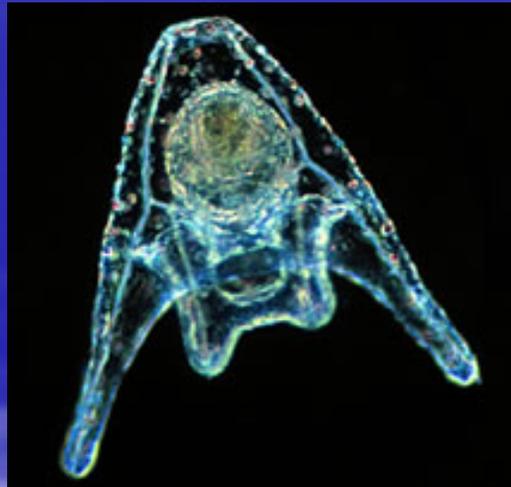
(Fathead Minnow, Mysids, Topsmelt)



SMALL VOLUME TESTS



Abalone veliger
larva

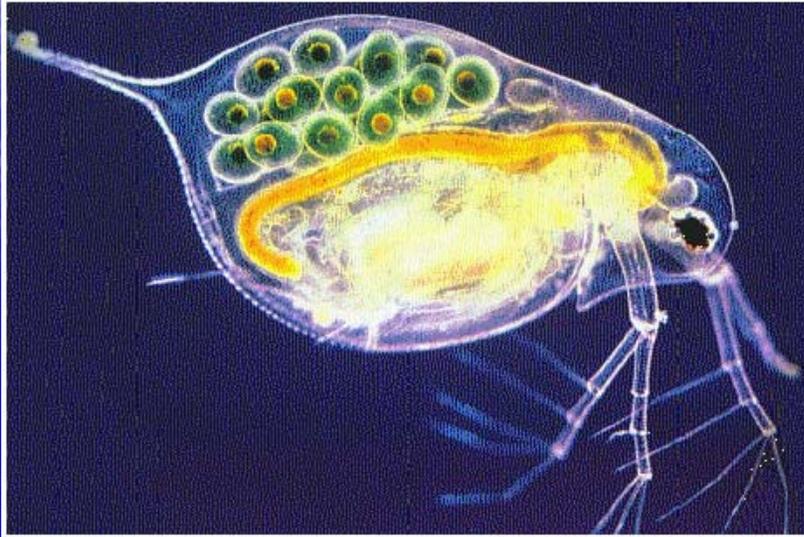


Urchin pluteus
larva

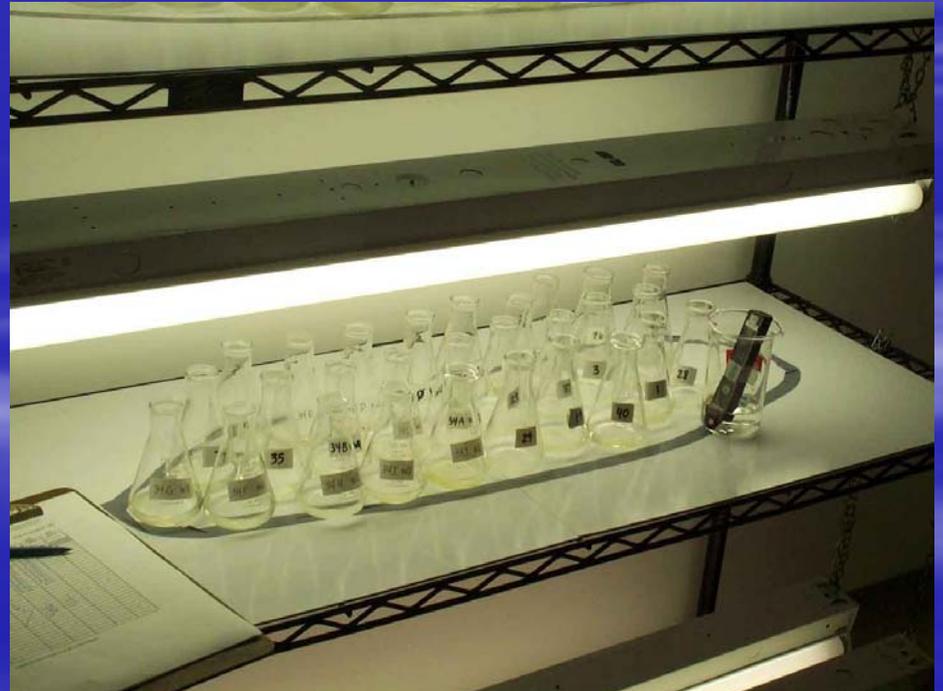


Giant kelp
sporophyte

Ceriodaphnia TEST



Selenastrum TEST



RELATIVE SENSITIVITY

	Ammonia EC ₅₀ (mg/L)		Copper EC ₅₀ (ug/L)
Urchin Development	0.07	Mussel Development	8
Abalone Development	0.08	Abalone Development	9
Mussel Development	0.19	Urchin Development	15
Topsmelt Survival	0.56	Pacific Mysid Survival	17
Fathead Survival	0.61	Urchin Fertilization	28
Pacific Mysid Survival	0.84	Ceriodaphnia Survival	35
Kelp Germination	1.33	Fathead Survival	44
Kelp Growth	1.35	Kelp Growth	90
Urchin Fertilization	>1.40	Kelp Germination	91
Ceriodaphnia Survival	1.49	Atlantic Mysid Survival	178
Atlantic Mysid Survival	2.30	Topsmelt Survival	238

EPA METHOD HISTORY

- On October 16, 1995, EPA promulgated WET test methods and added them to the list of EPA methods approved under Section 304(h) of the CWA (40 CFR 136).
- These methods were subsequently challenged and under a settlement agreement, EPA conducted a round-robin study which evaluated 12 of the test methods.
- EPA also prepared a WET test methods guidance document test method variability guidance document.
- November 19, 2002, EPA promulgated revised WET test methods. [67 FR 69952, November 19, 2002]

EPA METHOD HISTORY (cont)

- In *Edison Electric Institute et al. v. EPA*, 391 F.3d 1267 (D.C. Cir. 2004), the Court found that:
 - EPA reasonably validated the standardized testing procedures, including their precision and bias, as well as their high rates of successful test completion.
 - The methods did not produce unacceptably variable results.
 - The method procedures (i.e., replication and comparison to controls) adequately compensated for the inability to determine a method detection limit, and
 - The results produced with methods were representative of receiving water toxicity, including receiving waters of the arid West.

Monitoring Frequency

Possible Testing Frequency	Volume of Discharge
Monthly	> 1 MGD
Quarterly	≤ 1 MGD

- Other considerations:
 - Intermittent discharge
 - Compliance record
 - Effluent variability

Sample Collection and Handling

- Composite or grab sample
 - Effluent variability
 - Continuous or intermittent discharge
 - Logistics
- Handling and shipping
 - Chill
 - Measure TRC immediately
 - 36 hr holding time

Test Type and Duration

- Acute tests are conducted as:
 - Static non-renewal, static renewal, or flow-through test
 - Test duration - 24, 48, or 96 hours
- Chronic tests are conducted as:
 - Test type specified in methods manual
 - Test duration - 9 days or less

Statistical Endpoints

- Acute
 - LC/EC50
 - NOAEC
 - Pass/fail
- Chronic
 - EC/IC25
 - NOEC
 - Pass/fail

Dilution Series Selection

- Effluent testing
 - Multi-concentration test:
5 test concentrations + control
 - Single concentration test:
Critical test concentration + control
- Stormwater & ambient water testing
 - Single concentration test

Reference Toxicant Testing

- Reference toxicant testing should use same reference toxicant over time and same test conditions, dilution water, data analysis as used with the effluent.
- Outside culture: concurrent testing
- In-house culture: monthly testing

Other Permit Conditions

- Must meet “required” Test Conditions and TAC for test method
- Multi-concentration tests must be reviewed following EPA/821-B-00-004 (2000)
- Chronic tests must achieve PMSD when using NOEC as statistical endpoint

Steps to Address Toxicity

- 1-2 page TRE “fire plan”
- Accelerated testing language
 - accelerated monitoring consist of six WET tests conducted at approximately 2-week intervals over a 12-week period. During this accelerated monitoring phase, if more than one sample demonstrates an unacceptable level of toxicity, the permittee must initiate the TRE work plan.
- Include TRE / TIE language

CONCLUSIONS

- WET program highly successful in controlling toxic discharges
- Useful tool in water quality control programs – watershed assessment
- Statutory and regulatory basis for WET is well established
- The context WET of NPDES permitting is defensible

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