


Division of Water Quality

August 2, 1999

MEMORANDUM

To: Regional Supervisors
Bill Reid
Jimmie Overton

From: Coleen Sullins 

Subject: Whole Effluent Toxicity
Permit Limits and Monitoring Requirements

This communication clarifies the Water Quality Section's positions concerning the application of whole effluent toxicity (WET) limits in NPDES permits.

All NPDES permits issued to "Major" facilities or any facility discharging "complex" wastewater (contains anything other than domestic waste) will contain appropriate whole effluent toxicity limits and monitoring requirements. Minor discharges that fall into the following categories will not routinely be assigned whole effluent toxicity limits unless toxicity screening tests predict a toxic effect under critical design conditions:

- 100 percent domestic wastewater with only chlorine as an additive
- Non-contact cooling water
- Swimming pool filter backwash
- Water filtration backwash
- Mine dewatering
- Sand dredging
- Seafood packing
- Laundromats
- Car Washes
- Aquaculture facilities
- Rock quarries and gem mines

These facilities will be examined on a case-by-case basis by the Environmental Sciences Branch, Point Source Branch, Modelling/TMDL Unit, Regional Offices, or the Section Chief where necessary, prior to the establishment of an NPDES permit requirement. These exclusions are made as a matter of regulatory evaluation resources and do not inherently preclude assessment of any facility's compliance with water quality standards for toxic substances.

Facilities discharging only non-contact cooling water must complete biocide worksheets for any biocides employed and submit these to the NPDES Unit of the Point Source Branch. This worksheet incorporates facility flow data, receiving stream flow data, aquatic toxicity and half-life data of the biocides and amounts of the biocides used to determine potential impacts to the receiving stream. If an impact is predicted, the facility may adjust its application of current biocides, choose to employ a less toxic biocide, or perform toxicity testing to document the absence of toxicity. Aquatic Toxicology Unit personnel review each submitted worksheet for numerical accuracy and appropriateness of all input data.

Whole effluent toxicity limitations and monitoring requirements will be based upon the instream waste concentration (IWC) during conditions of maximum permitted effluent flow and 7Q10 receiving stream flow. The IWC will be calculated using the following formula:

$$\text{IWC (\%)} = (\text{Qw} / (\text{Qw} + \text{Qu})) * 100$$

where: Qw = NPDES maximum permitted wasteflow

Qu = Upstream stream flow during 7Q10 conditions

The use of maximum permitted wasteflow for the term Qw assumes the facility has the right to discharge this volume of waste under the permit at any time.

All calculated IWC values should be rounded to the nearest percent except where the IWC is <5%. For IWC values between 1 and 5 percent, round to the nearest tenth of one percent, and for IWC values <1%, round to the nearest one hundredth of one percent. If it is known that the discharge has a water supply intake upstream of the outfall, then the IWC should be calculated as : Qw / Qu , to avoid underestimation.

The objective of whole effluent toxicity limits placed in NPDES permits is to prevent discharge of toxic substances in amounts likely to cause chronic or acute toxicity to wildlife in the receiving stream and represents the only feasible method of evaluating the combined effects of constituents of complex waste streams. EPA has indicated that chemical-specific limitations do not consider all toxicants present and that interactions of mixtures are not accounted for [1]. Participants of the 1995 SETAC Pellston WET workshop support that indication by recognizing that chemical monitoring alone does not predict or measure biological effects in receiving water bodies [2], and does not cover all toxicants and mixtures threatening biotic integrity [3]. The type of test employed to meet this objective is based upon the magnitude of the facility's IWC. In general, the following criteria are followed:

- 1) If the facility's IWC is greater than or equal to 0.25 percent, the facility will perform the "North Carolina *Ceriodaphnia* Chronic Effluent Bioassay Procedure," Revised February 1998, or subsequent versions or "North Carolina Phase II Chronic Whole Effluent Toxicity Test Procedure," (Revised February 1998) or subsequent versions on a quarterly basis. The limit will be stated as "shall at no time exhibit observable inhibition of reproduction or significant mortality" at the effluent concentration equivalent to the facility's IWC. The maximum permit limit will be 90%.
- 2) If the facility's IWC is less than 0.25 percent, a 24-hour fathead minnow acute "No Significant Mortality" limit will be applied. The procedure employed will be "Pass/Fail Methodology For Determining Acute Toxicity In A Single Effluent Concentration," Revised July 1992.
- 3) If the facility discharge is episodic and/or only occurs in response to storm events, acute toxicity monitoring is required for the first five discharge events during the first year following permit issuance, with an annual monitoring requirement thereafter. This requirement will be a 24 hour fathead minnow acute test employing the procedure defined as "definitive" in *Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms, Fourth Edition*. EPA/600/4-90/027 September 1991. Upon permit renewal, if five tests have been performed, an annual monitoring requirement will be applied unless

the previous monitoring has indicated potential toxic impacts to the receiving stream. These situations will be examined on a case-by-case basis and a limit or monitoring requirement placed in the permit based on the best professional judgment of the Environmental Sciences Branch, Point Source Branch, Modelling/TMDL Unit, Regional Offices, or Section Chief where necessary

- 4) If the discharge is to a tidally influenced receiving water, the same criteria as above should be applied using the estimate of 7Q10 flow into the discharge zone. If no 7Q10 flow estimate is available, a 24 hour acute "No Significant Mortality" limit will be applied. This requirement may also be applied where flow estimates are available, if in the best professional judgment of the Point Source Branch these estimates are not applicable in the "real world." If the tidal zone is well flushed, the fathead minnow should be employed as the test organism, otherwise, in a poorly flushed zone, a Daphnid should be used.
- 5) If the discharge is to a lake or lake arm where 7Q10 estimates are not meaningful, a 24 hour acute "No Significant Mortality" limit will be applied with the fathead minnow as the test organism.
- 6) If a facility discharges to a receiving stream classified as "High Quality Waters" as per North Carolina Administrative Code T15: 02B .0201(d), any whole effluent chronic toxicity limit will be established at an effluent concentration equal to twice the IWC. If the IWC is greater than or equal to 45%, the chronic limit will be 90%. All dischargers to such waters will have acute limits of "No Significant Mortality" as determined by the "Pass/Fail Methodology For Determining Acute Toxicity In A Single Effluent Concentration."

Freshwater organisms may be substituted in permit requirements for dischargers to estuarine and salt receiving waters where an evaluation has been made by Aquatic Toxicology Unit staff that the freshwater organism provides the same level of protection as saltwater organisms.

Generally, twenty-four hour composite sampling will be the preferred sampling method for whole effluent toxicity monitoring. Depending on consideration of exposures, grab samples or other special sampling regimes may be appropriate based on the best professional judgment of the Regional Water Quality and Point Source personnel. Appropriate sampling regimes other than grabs would be based on time of occurrence and duration of predictable intermittent discharge events.

Permittees with acute toxicity requirements may request the use of a test organism other than that specified by the permit upon documentation that the alternate test organism would be a more sensitive indicator of toxic substances in the facility's discharge. Such documentation would consist of:

- 1) A demonstration that viable and standardized culture techniques are available for that organism and standardized testing methodologies have been developed and validated. This demonstration should meet guidance provided by EPA.
- 2) Three consecutive "side-by-side" tests with results indicating that the alternate organism is as or more sensitive to the facility's effluent. Each test series would consist of two separate toxicity tests conducted on the same sample of effluent with the length of exposure specified by the permit, the only difference between tests being the organism used.

Any facility which has been assigned a chronic limit with *Ceriodaphnia dubia* as the test organism may request a permit modification that specifies the EPA full range chronic methodology. Major differences between this methodology and the "North Carolina Phase II Chronic Whole Effluent Toxicity Test Procedure" are the use of a minimum of three samples instead of two and daily test solution changes as opposed to two changes over the seven day test period.

Minor facilities which discharge only domestic waste applying for renewal of their permits may be given an option of a new lower ammonia limit based on a mass balance calculation or performing a whole effluent toxicity test.

Should a quarterly toxicity limit be waived in favor of a "monitoring only" requirement as in the case of a special order, it is recommended that the frequency of the analysis be increased to monthly. In the case of a pass/fail limit, the use of a multiple concentration test for the monitoring requirement in a special order will allow tracking of toxicity reductions.

All whole effluent toxicity tests performed to meet NPDES monitoring must be conducted by laboratories certified to perform the specific analysis required as specified by Administrative Code Section: 15 NCAC 2H .1100, Biological Laboratory Certification.

Toxicity testing results will be filed with the Environmental Sciences Branch no later than 30 days after the end of the reporting period for which the report is made. The results will be recorded on the monthly monitoring report form MR-1. Facilities will also be required to complete one of the three toxicity test report forms, AT-1, AT-2, or AT-3, and submit these to the Environmental Sciences Branch. No test result will be considered valid until reviewed by Aquatic Toxicology Unit personnel.

All permits that specify quarterly evaluation of acute toxicity will be written to require monthly monitoring upon any single failure to meet specified limits, until such time as those limits are met. Additionally, if a test result is determined to be invalid for any reason, monthly monitoring will be required until the limit is met. All permits that specify quarterly evaluation of chronic toxicity will be written to require monitoring at least once during each of the two months following a noncompliance. The facility may perform as much additional monitoring as it desires.

Any single failure to meet established limitations will be considered a non-compliant event. Following this initial non-compliance, each subsequent single failure will be considered an additional non-compliant event.

The following is offered as pertinent information concerning the quality assurance of submitted toxicity data:

- 1) No effluent sample shall be over 72 hours old at the time of its use to initiate a chronic toxicity test or renew solutions of a chronic toxicity test. No effluent sample shall be over 36 hours old at the time of its use to initiate an acute toxicity test. Sample ages will be calculated beginning from the sampling time of a grab sample or from the time of the last sub-sample of a composite sample. "Use" is defined as placement of organisms into the test solutions.
- 2) Composite samples shall be cooled during collection and all samples iced during shipment such that they arrive at the laboratory at temperature between 0 and 4

degrees Celsius. The only exception shall be that of a grab sample used for testing within four hours of collection. Again, "use" will be defined as introduction of the organisms to the test solutions.

- 3) At times, facilities "split" effluent toxicity monitoring samples between two or more laboratories. If such analyses produce differing results, a "paper trail" investigation of all of the analyses by the Aquatic Toxicology Unit will ensue. Critical components of such an investigation will include sample chain-of-custody, sample preparation, test protocols, and health of the organism cultures of the subject laboratories at the time of the analyses.

Appropriate standardized permit language is attached. If there are any questions concerning any of the above policies or issues, please contact Matt Matthews or Kevin Bowden at 733-2136.

REFERENCES

1. **U.S. Environmental Protection Agency.** 1991. Technical Support Document For Water Quality-Based Toxics Control. EPA/505/2-90-001. Office of Water, Washington, DC, p. 21.
2. **Dorn, Philip B.** 1996. An Industrial Perspective on Whole Effluent Toxicity Testing. In DR Grothe, KL Dickson, and DK Reed-Judkins, eds., *Whole Effluent Toxicity Testing: An Evaluation of Methods and Prediction of Receiving System Impacts*. SETAC Pellston Workshop on Whole Effluent Toxicity; 1995 Sep 16-25. SETAC Press, Pensacola, FL, USA, p. 16.
3. **Heber, Margarete A., Donna K. Reed-Judkins, and Tudor T. Davies.** 1996. USEPA's Whole Effluent Toxicity Testing Program: A National Regulatory Perspective. In DR Grothe, KL Dickson, and DK Reed-Judkins, eds., *Whole Effluent Toxicity Testing: An Evaluation of Methods and Prediction of Receiving System Impacts*. SETAC Pellston Workshop on Whole Effluent Toxicity; 1995 Sep 16-25. SETAC Press, Pensacola, FL, USA, p. 10.

Attachments

cc: Matt Matthews
Kevin Bowden
Kristie Robeson
David Goodrich
Shannon Langley