United States
Environmental Protection
Agency

Permits Division
(EN-336)
Washington DC 20460

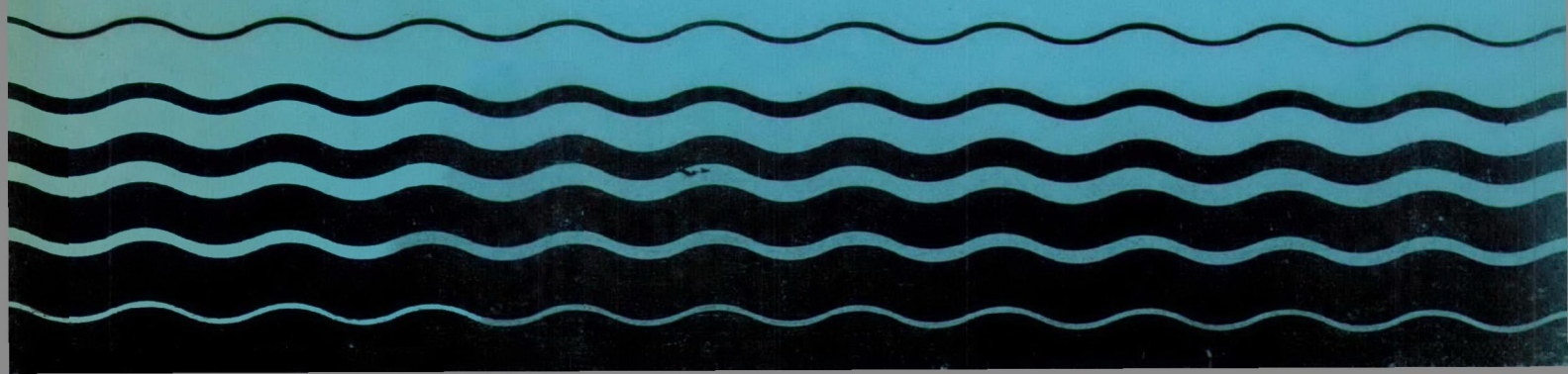
OWEP 83-01
January 1983

Water

EPA

Proceedings of the Workshop on Biomonitoring and Water Quality-Based Limitation Derivation Techniques

Atlanta, Georgia
November 30 - December 1, 1982



OWEP 83-01
January 1983

PROCEEDINGS OF THE WORKSHOP ON BIOMONITORING AND WATER QUALITY-BASED LIMITATION DERIVATION TECHNIQUES FOR TOXIC POLLUTANTS

Atlanta, Georgia

November 30 - December 1, 1982

prepared by

William F. Brandes

Bruce J. Newton

NPDES Technical Support Branch

Permits Division (EN-336)

TABLE OF CONTENTS

Executive Summary iii

Session I

- Introduction 1
- Historical Perspective 1
- Legal Issues 2
- Comments by Rebecca Hanmer 3
- Regional Presentations 4
- Observations by Dr. Mount 9
- Probablistic Approach to Water Quality 12

Evening Session 13

Session II

- ORD Test Methods 16
- HQ Presentations 16
- Policy Questions 17
- Summary 19

Executive Summary

Purpose of the Workshop

This document summarizes a workshop on effluent biomonitoring attended by EPA headquarters and Regional water staff and ORD scientists. The purpose of the worksnop was to discuss current uses of biomonitoring by Regions and States and to discuss what should be included in a national policy on biomonitoring.

General Observations

A notable difference between this meeting and similar meetings of prior years is that there is now much greater use of biomonitoring in the States and Regions. Most of the industrial states have biomonitoring programs and the meeting representatives related many success stories. Another significant point is that the science of effluent testing has advanced significantly. Several new methods were reported as well as field studies which showed very good correlation between effluent bioassay results and actual instream effects.

Major Points from the Regional Presentations

1. Each Region's approach to using biomonitoring in NPDES permitting is strongly influenced by the types of permittees and the types of receiving waters in the Region.

2. Although each Region employs biomonitoring differently, the overall structure of testing is similar. Major differences involve the degree of application, the use of toxicity data, and the degree of importance placed on bioaccumulation problems and the discharge of potential carcinogens. Biomonitoring is used in conjunction with chemical data and chemical specific criteria; not as a sole data source to set permit conditions.

3. The main uses of toxicity data are to determine whether existing treatment technology is adequately reducing toxicity and to identify water quality problems and trigger further analysis including in-stream biosurveys. EPA does not generally use the data to set water quality-based controls (e.g. toxicity-based permit limits). However, some States have applied the data in setting toxicity-based permit limits. This application has been limited.

4. Studies on reducing toxicity are conducted by some States and Regions. However, toxicity reduction evaluations are ultimately the responsibility of dischargers and should not rely on State or Federal resources. These evaluations can include process evaluations, process substitutions, in-plant toxicity testing, treatability studies, and best management practices; in short, anything which identifies and controls sources of toxicity in effluents.

5. Screening or identification of which permittees will be required to conduct biological testing is a complex process involving different data sources.

6. When biomonitoring is used to assess impacts, in general, each permittee is directly involved in a negotiating process with the Region and State permitting authorities regarding what tests to do, how the data is used, and what control options are feasible.

Consensus on National Policy

All of the participants agreed that a national policy is needed. The policy should address the need for biomonitoring and how it will be used but not specify tests and criteria. The participants also agreed that a technical paper separate from the policy discussing the pros and cons of specific tests and the details of their use is needed.

The biomonitoring policy should:

1. Institutionalize biomonitoring recognizing its current use and instruct the Regions and States to use it where it is not in use or is used in a limited way;

2. Address industry concerns about why testing is needed and how the data will be used;

3. Provide flexibility for tailoring the testing and its implementation to the individual situation;

4. Discuss the roles of the State and discharger in general terms but not dictate specific procedural requirements; and

5. Make clear that appropriate testing will depend on the complexity of the discharge situation, the degree of impact, and the degree of certainty desired; and that the margin of safety for evaluating data and setting limits is inversely proportional to the quantity and quality of data.

The technical paper should:

1. Identify the available testing methods and their advantages/ disadvantages;

2. Provide a general framework for determining appropriate testing programs;

3. Provide guidelines and advice on interpreting testing results.

Minutes of the Workshop on Biomonitoring and Water Quality Limitation Derivation Techniques for Toxic Pollutuants

Atlanta, Georgia

Session I, November 30, 1982

Introduction

Paul Traina, Director, Water Management Division, Region IV, opened the meeting by describing the increasing importance of biomonitoring in NPDES permit issuance. Region IV's experience with dischargers of toxic pollutants has shown that, in many cases, the only practical and implementable means for assessing water quality impact by NPDES permittees is through the use of whole effluent toxicity tests. Mr. Traina then turned the floor over to Bill Jordan, Chief, Technical Support Branch, Office of Water Enforcement and Permits.

Historical Perspective and Approaches to Water Quality Permitting

Mr. Jordan began by explaining that Eric Eidsness, Assistant Administrator for Water, had requested that a national policy on the use of biomonitoring in NPDES permit issuance be drafted. A uniform approach for the use of biomonitoring in NPDES permitting would provide consistency and ensure that testing requirements are technically valid and legal. The purpose of this workshop is to obtain input from the Regions to serve as the basis for that policy.

The history of biomonitoring in NPDES permitting was discussed briefly. Permits Division had drafted national biomonitoring policies in May, 1978 and again in January, 1981. Significant comment was received on these drafts from industry and the States. However, disagreement over uses of the data coupled with overly specific testing requirements resulted in the policy statements remaining in draft form. Surveys by Permits Division on the use of biomonitoring in permits show that only a few hundred EPA-issued permits have toxicity testing requirements and that uses of the data were varied. Several States have much better developed programs than EPA.

Mr. Jordan then presented a flow chart (Attachment 1) which outlined available approaches to water quality-based permitting. The chart shows two methods for dealing with identified water quality problems. The focus of this workshop will be 1) identifying (screening) a water quality problem (1st step), and 2) confirming impact and developing controls under the water quality-based solution approach.

Finally, Mr. Jordan presented a list of questions (Attachment 2) to be discussed during the workshop.

Legal Issues

Karen Wardzinski, Office of Legal and Enforcement Counsel, next discussed the legal basis for biomonitoring in NPDES permitting. She addressed two questions. First, does the Clean Water Act authorize EPA to collect information of this type? Second, what can be done with the data once it is generated and can it be used to set permit limits directly? In response to the first question, Ms. Wardzinski said that the Clean Water Act, specifically §308, does authorize EPA to require the collection of a broad range of data, specifically including biomonitoring and treatability data. The data can be considered necessary to insure compliance with CWA requirements under §402. However, there are limits to §308. A rule of reasonableness applies. Any data requirement must be reasonable. As an example, Ms. Wardzinski pointed out that a Region or State could not require detailed biomonitoring from every permittee. Some indication of need must be present.

In response to the second question, Ms. Wardzinski responded that the Act does provide the authority to set toxicity-based limits for effluents based both on technology requirements and on water quality standards. Where an effluent guideline doesn't address a specific problem (an example might be PCB discharges on the Fox River, Wisconsin) technology limits can be set based on biomonitoring data, provided the factors specified in §304(b) of the Act (definition of BAT) are addressed. Water quality standards, both specific LC50 standards (one-tenth the LC50 at the edge of a mixing zone) or the more general narrative standard (no toxic discharge in toxic amounts) form the basis for water quality-based limits. Where an LC50 standard is specified, the permit can be written to reflect the toxicity standard. Few of these specific standards exist. Therefore, the more universal narrative standard will be the legal basis for most toxicity limits.

Ms. Wardzinski pointed out that the major legal question when issuing a permit containing biomonitoring requirements would involve how the permitting authority interprets what is meant by the State's narrative "free from" water quality standard. EPA nas entered into a litigation settlement which dissuades individual permit writers from making this interpretation until the Agency decides how to do it in a national policy. The settlement does not in any way reduce EPA's authority to use biomonitoring or set toxicity-based limits. The reason for the settlement was industry's concern that the technical basis for relating toxicity data to water quality standards or BAT requirements and developing permit limits was poorly understood. Thus, §125.3(c) was deleted from the Consolidated Permit Regulations. The workshop's goal is to decide how to best use biomonitoring in permitting and address this issue.

Glenn Pratt, Region V, asked if EPA had the legal authority to go "up-the-pipe" to establish in-plant biomonitoring requirements to be used in determining the source of toxic problems. The response was yes, the legal authority exists although some litigation on this subject is ongoing. Mr. Pratt then stated that without this authority the toxicant limitation approach used in Region V will be severely limited. Lee Tebo, Region IV, suggested that this in-plant evaluation step is the permittee's responsibility and that the permitting authority should be concerned only with identifying receiving water impact. Mr. Pratt pointed out that there are some situations where analysis of the receiving water would miss some problems such as low levels of bioaccumulative pollutants which show up far downstream or in a lake. In such an instance, up-the-pipe biomonitoring analysis would be necessary to identify and correct the problem. Region V's experience is that some permittees argue that they don't have the capability to conduct such an evaluation and that if EPA didn't do it or outline the data needs it wouldn't get done. However, without the legal authority to go up-the-pipe to seek the source of water quality problem toxicants, Mr. Pratt believed that the water quality approach to toxics control is very weak.

Comments by Rebecca Hanmer, Deputy Assistant Administrator for Water

Rebecca Hanmer, Deputy Assistant Administrator for Water, next spoke on the importance of the workshop. EPA can implement a water quality based toxics permitting program. A uniform approach is needed which answers questions on what tests to do and where and when to do them. Eric Eidsness wishes biomonitoring to be used in an institutional context. The Continuing Planning Process should be the vehicle for determining where to pursue water quality-based permitting and for emphasizing coordination with the States. The Regions and States should focus on planning activities as the basis for setting priorities, particularly in the face of diminishing resources. When determining the proper role of biomonitoring, the emphasis should be on planning. This approach hopefully will lead to a lessening of adversarial actions which have, in some cases, clouded the permit issuance process.

Later discussion on this point by the Regions led to several conclusions. In most cases, biomonitoring requirements are decided upon through a non-adversarial process. The requirement is often a preliminary data generating tool used prior to the development of any permit condition. Sometimes a 308 letter is used to set the testing requirements for the permittee; however, in most cases the permittees agree to perform biomonitoring voluntarily. Further, some Regions pointed out that even when biomonitoring data is generated voluntarily, if it is not required in a permit, the permittees sometimes refuse to give the data to the regulatory authority. Therefore, most Regions felt that some vehicle (permit, administrative order, or 308 letter) should be used to document the mutually agreed upon biomonitoring requirements.

Regional Presentations on Current Biomonitoring Procedures

Lee Tebo, Region IV, chaired this session. Each Region, except Region VII, presented their Region's current approach to biomonitoring in the NPDES permitting process.

Mr. Tebo began with some definitions of terms so that all workshop participants were able to follow the discussions:

1. Three ways to control toxics:

   a. technology - BAT only
   b. chemical-by-chemical - using State standards
   c. total effluent - toxicity measurement of actual discharge

2. Bioassay:

   A toxicity test using living aquatic organisms. Short term tests (24 to 96 hours) are acute bioassays. Longer term tests (life-cycle, growth, or embryo/larval) are chronic bioassays.

3. LC_{50}:

   Concentration of a chemical or an effluent which is lethal to 50% of the test organisms. Both acute and chronic bioassays can produce LC_{50} values.

4. Application Factor:

   Ratio between the "no effect level" and the LC_{50}

$$\frac{NEL}{LC_{50}} = A.F.$$

Region I

Mr. Tebo then introduced Alan Ikalainen, Region I. Mr. Ikalainen provided a handout (Attachment 3) which detailed Region I's uses of biomonitoring in four steps in the permitting process. In Step 1, characterize wastes, Region I has been screening specific dischargers using acute toxicity tests. Results of these tests will be used to further analyze specific industrial categories. To date, thirty permits in five categories have been screened. The major problem has been batch dischargers where toxicity results fluctuate. For Step 2, characterize receiving waters, the Region is using data from many sources. Massachusetts has begun a research project to compare effluent toxicity to instream community response. In Step 3, defining limits in toxics based on water quality, toxicity tests are used to evaluate the effectiveness of treatment and for developing limits. In Step 4, monitoring, Region I does not now require toxicity monitoring in permits. Mr. Ikalainen also mentioned that the New England Interstate Water Pollution Control Association (a funded toxics control coordinating body) is interested in dedicating their next meeting to biomonitoring.

Glenn Pratt, Region V, asked Mr. Ikalainen whether long term problems such as bioaccumulation or chronic toxicity were addressed through biomonitoring techniques in Region I's strategy. To date Region I has only used acute toxicity with application factors.

Region II

Mr. George Pavlou, Region II, next presented a synopsis of their current approach to biomonitoring (Attachment 4). Beginning in 1979, acute toxicity tests were required of certain industries suspected of causing toxic impact to receiving waters. Twenty-five of 75 permits were found to have acutely toxic effluents (defined as LC50s less than 50%) in violation of standards. Once identified, these permittees were required, through a negotiated agreement to try to identify the source of the toxicity and possibly correct it. No toxicity-based permit limits were set but monitoring requirements involving bioassays were required. Mr. Pavlou was asked if the companies involved asked what EPA was planning do with the data. He answered yes, the companies were asking this question and Region II's answer was that the toxicity must be reduced. It is considered the permittee's responsonsibility to determine how to do it. In response to a question on identifying permits for biomonitoring, Mr. Pavlou said that Region II's criteria for selecting candidates for toxicity testing is based on three data sources:

1) Environmental Service Division bioassay data and site specific chemical analyses.

2) Target Industries of known toxicity potential.

3) State water quality data.

The State of New Jersey has an effluent standard of no effluent more toxic than a 96-hr. LC50 of 50% by volume and a water quality standard of no exceedance of one-hundredth or one twentieth (depending on persistence) that of the LC_{50} at the edge of the mixing zone. The flow conditions for this requirement are not specified. New Jersey has very concentrated groupings of industrial dischargers and must set very stringent permit limits at low dilutions to protect against multiple discharge impacts.

Region II also presented their suggestions for a national biomonitoring policy statement:

1) Outline a framework for information gathering but do not require specific tests.

2) Provide technical guidance on how to set a toxicity limit.

3) Provide testing procedures for determining the presence or absence of bioaccumulative pollutants.

Region III

Mr. Larry Benning, Region III, pointed out that, since West Virginia took over the NPDES program, Region III no longer issues permits except four in Washington D.C. Mr. Benning provided a description of Region III NPDES State approaches (Attachment 5). Twenty-three permits in West Virginia currently have biomonitoring requirements. GC/MS scans are also required to identify components of the effluent. Sometimes treatment plans are negotiated with industry. Pennsylvania concentrates on chemical specific water quality permitting and does not require toxicity testing. Delaware, Maryland and Virginia all use biomonitoring in their permitting programs. The specifics of these programs were not discussed in detail by Mr. Benning because they are described in Attachment 5.

(Region IV presentation scheduled later)

Region V

Mr. Pete Redmon, Region V, presented Region V's approach. All states in the Region have a biomonitoring program including in-stream evaluations. The States in the Region have experience in this area and most have been active in biomonitoring for some time. Water quality problems have long been identified by the States. Program planning agreements (§106 State-EPA agreements) have been worked out by Region V with the States on which facilities are of importance in water quality problem areas. Approaches to using biomonitoring in acting on these problems vary with each state program. (Several lengthy assessment protocols from Region V were presented but are too long to be attached). Overall, considerable acute toxicity testing, particularly by Michigan (initially about 100 tests were conducted per year), has indicated that acute toxicity from industrial sources, due to corrective measures, is not a widespread problem.

In Region V, the focus is on long term chronic toxicity problems including bioaccumulation. The States use chemical specific water quality standards where available. However, for more complicated water quality problems involving large dischargers, the "free from" narrative criteria is employed both to generate data and to set limits. Very few permits limit toxicity directly, but many toxic discharges have been corrected using water quality standards (both chemical specific and general toxicity). Once monitoring data is generated the State or Region (using a team of experts) analyzes the situation and recommends action. If a toxics problem is identified, a negotiated toxicity reduction plan is implemented. This plan or analysis is conducted by the permittee with the input of the Region. Where needed, long term monitoring requirements are put in the permit to analyze for bioaccumulation problems. Already a number of long term bioaccumulation studies have been initiated. The Region is often asked to write or assist in writing water quality permits of a particularly complex nature.

Rebecca Hanmer asked if the Region had used basin planning and set wasteload allocations (WLA) and TMDL's in any permitting situations. Mr. Redmon responded that the States focus on specific problems rather than entire basins. The Great Lakes are the focus for many long range planning organizations. WLAs are used but generally only for simpler pollutants such as ammonia, BOD, and a few metals. Ms. Hanmer then asked what the relationship was between the Regions and the States. Mr. Redmon answered that the relationship was generally good and that some of the States asked for assistance in the most complex permitting situations. The Region works to assist in cases involving complex testing and bioaccumulation. Each case is different and the States and Region V employ a very site-specific, problem solving approach using various data and assessment techniques. Lee Tebo commented that water quality permitting is of necessity a site-specific procedure geared toward problem solving.

Mr. Redmon ended his presentation by saying he believed modeling procedures for complex dischargers involving organic pollutants are not sufficiently developed and our knowledge of the fate and dynamics of these pollutants is too inadequate for models to be a meaningful part of the permit program in the near term.

Pollutant-by-Pollutant Fate Models

Scheduling required a change in the agenda. The Headquarters presentation on the status of fate models was given at this point. Tim Stuart, Chief, Monitoring Branch, Office of Water Regulations and Standards introduced Mike Slimak and Charles Delos of OWRS. Mr. Slimak explained that his section is developing a document describing the use of models in performing wasteload allocations for toxic pollutants. The document will proceed from simple to more complex models. This should be available in draft by March 1983. Mr. Delos presented an overview of the various types of models currently under development. The range of model sophistication includes simple dilution, simple decay, steady state water/sediment, and various dynamic multi-phase models. Mr. Delos then described in detail the compartments and processes involved in a simple steady state water/sediment model.

Region VI

Oscar Cabra presented Region VI's approach to biomonitoring. Mr. Cabra first described the specific permitting situation existing in the Texas, Louisiana area. Most dischargers there are organic chemical/plastics and synthetics plants clustered in high density multiple use waters like the lower Mississippi River and the Houston ship channel. Impairment of the designated uses are known and are caused by toxic pollutants. However, actual data on this situation is sketchy and very few standards are available. Region VI employs a technology-based approach to reduce toxicity in these areas. The permit is written using technology to achieve permit limits for toxics and acute toxicity

tests are required to monitor the effluent for the effectiveness of the technology in reducing toxicity. The data is passed on to the water quality people in the States and Region. The bioassays are quarterly requirements set for two years. They are put into permits as they are issued. Currently, the requirement is being applied only to Region VI's priority permits since these are the ones being issued.

Region VIII

Bob Burm, Region VIII, presented his Region's approach to biomonitoring. The water quality problems in the Region are much more limited than in the eastern Regions. Ore mining discharges to headwaters are of primary concern. Metals and cyanides are primarily responsible for toxic problems. Biomonitoring is of lesser use where problems are simple and identifiable. The states apply their water quality standards and thus effluent standards equal water quality standards for these permits. Region VII has required toxicity testing for one hard rock mining facility. This data was used to establish a very stringent effluent limit. The permittee is being required to put in state-of-the-art treatment. In the future, bioassays may be used to justify downgrading uses in situations where no more treatment can be reasonably required but impact is still being measured.

Region IX

Jerry Klug, Region IX, discussed California's use of biomonitoring. The State has been requiring toxicity testing in permits issued to industrial and municipal dischargers which potentially contain toxic polluants. They also use toxicity permit limits extensively. Bioassays are being used on drilling muds and for 301(h) determinations. California has very stringent standards for metals and some organics (e.g. pesticides and PCBs). Toxicity tests are used to assess impacts of organic-type effluents. The narrative criteria form the basis for permit conditions. California also uses tissue analyses to monitor for bioaccumulation. Mr. Klug said that once California has identified a problem they have been able to negotiate a toxics reduction plan with the affected permittees.

Region X

Ms. Marsha Lagerlof presented Region X's approach. The Region has only used biomonitoring in three permits in Alaska and Idaho. Oregon and Washington have more experience in the application of biomonitoring in permit issuance. Both States employ toxicity-based limits in NPDES permits based on both technology (for Pulp and Paper) and water quality standards. The Region also is planning to use bioassays to test the toxicity of drilling muds. A status report on the current application of biomonitoring is attached (Attachment 6).

Region IV

John Marlar presented Region IV's approach to water quality-based permitting. He passed out two flow charts (Attachments 7 and 8) showing the general procedures which are followed. Region IV also uses a standard approach and permit language in those permits requiring biomonitoring (Attachment 9). The studies are usually required of known potential toxic dischargers such as organic chemical plants and are designed on a case-by-case basis. Once a toxics problem is identified, a toxicity control plan is negotiated with the permittee. Region IV has had much experience in this area.

Lee Tebo had previously provided some statistics on Region IV's biomonitoring program. Of a total of 598 facilities, 65% exhibited acute toxicity. Of those, one-third had LC_{50}'s of less than 20%. Once acute toxicity has been identified, confirmatory monitoring is required. If unacceptable toxicity is still present, a toxicity reduction plan as mentioned above is required.

Observations by Dr. Donald Mount, ERL-Duluth

Dr. Mount began his discussion by identifying four reasons why biomonitoring should be an integral part of water quality permitting.

1) The purpose of controlling water quality is biological. The goal of the Clean Water Act is to maintain the proper water quality for aquatic organisms and thus, indirectly, human health.

2) Effluent toxicity testing is the only practical way to assess the effects of complex mixtures. Chemical data does not relate directly to water quality because the right chemical forms are not measured and not all pollutants can be assessed.

3) The efficacy of treatment systems in controlling toxicity can be examined. It is the only method for making this assessment.

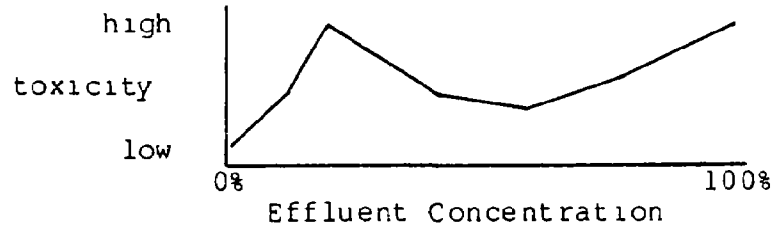
4) Biomonitoring, including effluent toxicity tests, can cheaply and quickly measure receiving water impact.

Dr. Mount divided his comments into the topics listed below:

o Effluent Toxicity Testing

Using bioassays to test the toxicity of effluents is most cost effective where the complexity of the discharge is great. When using effluent toxicity tests the permitting authority must consider the persistence of toxicity. We have methods to address this problem which should be an integral part of any assessment protocol.

Another factor in the application of effluent toxicity testing is that these tests may not focus on equilibrium conditions in the receiving waters and require very careful analysis. He also stressed that biomonitoring must be used intelligently. For example, the graph shows a case where it might be concluded that toxicity test results aren't representative of what is actually happening in the receiving water.



This is an example of what pH differences between test dilution water and receiving water would do to toxicity data.

Two limitations were pointed out by Dr. Mount. First, effluent toxicity tests do not measure carcinogenicity or bioaccumulation. These effects must be handled in other ways. Second, EPA has not established the relationship between treatment systems and toxicity reduction.

Dr. Mount concluded that with effluent toxicity tests, you get what you pay for. With quick, cheap tests you get similar quality data. This brings up a problem in dealing with smaller companies who may not be able to afford to conduct proper testing.

o Screening/Recognizing Problems

The screening step involved in tiered testing should be re-examined. Why do acute toxicity testing if it probably doesn't exist? Rather than lock EPA into tiered testing (progressively more accurate tests required) we should move toward a problem-oriented approach. Screening should answer the question is there a strong potential for instream toxicity? This can be answered relatively quickly and cheaply. For example, if historical field survey data is available, the question might be easily answered without screening tests and better testing can be initiated.

o Policy Issues

EPA must develop a policy on the application of biomonitoring in permitting. A policy should not rigidly require specific methods, or detail a rigid testing

protocol. A policy should address these questions:

1) Should EPA recommend analyzing the assimilative capacity of a water body?

2) How should mixing zones be handled?

3) Is zero toxicity a goal or should some degradation be allowed?

4) Should the regulatory authority strive to protect everything or concentrate on specific uses?

5) Can all dischargers be handled in a biomonitoring program or should a policy/guidance apply only to some subset of dischargers (e.g. all majors)?

6) How should we cover toxic conditions involving carcinogenicity potential and bioaccumulation?

7) Will we truly use data which shows no impact to let some plant off from treatment or should we focus only on data showing definite impact which leads the regulator to clamp down on permittees.

Based on his experience with industry groups, Dr. Mount also listed points which he believes should be contained in an EPA biomonitoring policy statement.

1) A policy must have procedural options to provide flexibility to the permittee and the regulatory authority. For example, if permittees want to test a resident species, let them. (He suggested they would be foolish to do so and would get more stringent results).

2) EPA must be willing to accept conclusions of insignificant impact. There should be frequent rejection plateaus. For example, where no acute toxicity is detected or expected and a large dilution factor exists 99% of the time, no further testing may be necessary, particularly in cases where bioaccumulation or carcinogencity is known to be no problem.

3) The use of the data must be clearly stated. Is it to check technology or assess water quality? Will toxicity reduction evaluations be required where warranted?

4) Let the complexity of analysis vary and make sure that it is understood that the margin of saftey in

evaluating data and setting permit conditions is inversely proportional to the quantity and quality of data available.

Dr. Mount stressed that, in any assessment of a water quality problem, the procedures should be tailored to the situation. If an effluent varies in composition and volume, don't run complex and detailed toxicity tests on a single grab sample. In such a case it would be much better and more scientifically valid to run simple toxicity tests on many grab samples.

The use of effluent toxicity testing to identify water quality impact in both single and multiple discharge situations is scientifically sound. The application of the procedures in actual discharge situations has proven very valuable in analyzing the impact or lack of impact to receiving waters by NPDES permittees. In developing guidance on what testing to perform the permitting authority should consider degradation/fate of effluent toxicity, flow and mixing characteristics, and the representativeness of effluent samples.

Finally, Dr. Mount stressed that any argument based on a lack of effluent toxicity testing methods is invalid. The methods to assess toxicity and water quality impact are available. However, we must remember that these methods and the data they generate are not ends in themselves. Rather, they are additional tools to be used properly in the issuance of NPDES permits.

Probablistic Approach to Water Quality

Mark Morris next introduced Hiramay Biswas of his staff to discuss their efforts in determining critical design flow, and accounting for effluent and streamflow variability for performing wasteload allocations. Mr. Biswas presented the approach being developed and some preliminary results. Several Regions commented that this effort will yield useful results but that there were several assumptions that need to be tested using real data before conclusions are made.

Session I was adjourned for dinner and participants were invited to the hotel for an evening session. This session was a discussion by Dr. Mount of actual sites analyzed by ERL-Duluth through the Complex Effluent Testing Program. A synopsis of this discussion follows.

Evening Session. November 30, 1982

To supplement the more formal presentations of the workshop, an informal evening session was held to discuss the practical application of state-of-the-art biomonitoring techniques in assessing water quality impact. The discussion centered on a complex discharge situation located in Lima, Ohio. Dr. Don Mount presented the results of this study which was part of the Complex Effluent Testing Program being conducted by Permits Division and ERL-Duluth.

Discussion of Complex Effluent Testing Program

The overall goal of the Complex Effluent Testing Program is to develop valid and practical biological assessment techniques to be used in the NPDES permits program. A comprehensive analysis is conducted at each site to determine the type of biological testing needed to accurately assess a site in a cost-effective, implementable way. Field studies are a part of this analysis to verity the toxicity data.

Lima, Ohio

The Ottawa River, flowing through the city of Lima, Ohio has a long history of water use impairment. Currently designated a limited warmwater fishery, the Ottawa is severely impacted from river mile 37.7 (at Lima) to river mile 8 0 near Kalida, Ohio. Three NPDES permittees discharge to the Ottawa directly below the city between river mile 37.4 and river mile 36.3. These discharges are the City of Lima Sewage Treatment Plant, a 16 mgd POTW with significant industrial wasteload; SOHIO Corporation, a petroleum refinery (SIC 2911); and VISTRON Company, a specialty chemicals plant owned by SOHIO.

The EPA study at this site consisted of two parts. First, a detailed in-stream biosurvey was conducted which included benthic sampling, periphyton analysis, caged fish in-stream toxicity and bioaccumulation analysis, and a fish population survey. Also, a dye study and time of travel analysis on the flow and mixing characteristics was performed. Second, acute and chronic toxicity testing was performed on each effluent using a water flea, Ceriodaphnia reticulata and a fish, Pimephales promelas. Also, river water samples from 13 sampling stations were tested for toxicity persistance.

Dr. Mount presented preliminary results of the toxicity tests. The field data is not yet available. However, the toxicity testing was very successful and certain conclusions can

already be reached regarding the impact to the Ottawa River by the dischargers. Below is a brief synopsis of some of these findings:

- All three effluents were toxic at some concentration to Ceriodaphnia. The entire site is a complex mixing of toxic effluents. A further complication occurred on Day 5 when the tests picked up a slug of toxic materials discharged from a source upstream of the three permittees (now known to have come from an illegal discharger in Lima).

- Although complex, the toxicity data is clearly interpretable and relative impact from the effluents can be determined. The data can be used in making permitting decisions to reduce toxicity and thus reduce the severe impact to the Ottawa River.

- In-stream toxicity persistence tests showed a pattern of declining toxicity downstream. This is expected to correlate well to biosurvey results showing gradual in-stream biological recovery. The toxic slug was followed downstream during this procedure. This indicates that in-stream toxicity testing can be easily used to assess the persistence of effluent toxicity.

- The Lima STP is an exemplary plant and had been presumed to produce a non-toxic effluent. However, the effluent was very toxic to Ceriodaphnia. Both chlorinated and un-chlorinated effluent gave the same results. Toxicity is probably due to some indirect discharge.

- The SOHIO effluent was much less toxic to Ceriodaphnia than the STP but more toxic to fathead minnow larval stages. It is apparent that two species, an invertebrate and a vertebrate should be used to perform a complete toxicity analysis.

- The effluents were not acutely toxic. This suggests that in other permitting situations, screening steps must be carefully conducted so that false negative screening results are limited. For Lima, dilution analysis alone would point to the need for further toxicity testing.

The preliminary results of the testing procedures conducted at Lima were very positive. Dr. Mount concluded that the

procedures employed are very useful in analyzing water quality impacted discharge situations. Both single and multiple discharge situations can be analyzed using these techniques. Two ancillary benefits arose from the Lima site. First, an illegal discharge was discovered which indicates that this type of testing can serve many purposes. Second, the State of Ohio enthusiastically participated in this study and learned a good deal from the EPA toxicologists. At least three more sites in other Regions are currently planned.

Session II December 1, 1982

ORD-Test Methods

The meeting resumed with Dr. Cornelius Weber of ORD discussing the development of standard test methods. The chronology of methods for effluent testing is as follows. (See Attachment 10)

1978 - Standard Acute Effluent Tests (EPA-600/4-78-012)
1981 - Daphnia/Mysid screening procedure (to support 1981 draft policy)
1982 - Revision of 1978 Manual (currently in draft)

Future work will concentrate on chronic toxicity tests, especially short and inexpensive tests. Three tests will be standardized and evaluated: a 9-day embryo/larval Fathead minnow test; a 7-day Ceriodaphnia test; and a 7-day larval Fathead test. Dr. Weber handed out a few copies of the revised 1981 manual. Several people complained that not having standard methods approved under section 304(h) was a problem. Dr Weber explained that the ORD labs and the HQ enforcement office has been trying to get test methods proposed for about 4 years. The ORD HQ office has not acted. The discussion concluded with the need to develop marine and estuarine tests.

Don Wruble from the Las Vegas lab then described some of the work they have been doing in the metal criteria modification area. He stressed the importance of local acclimation to toxicants and that methods need to be developed for using local organisms. However, Lee Tebo and other experienced biologists were quick to point out the difficulties with trying to work with resident organisms.

HQ Presentations

The next part of the Agenda called for presentations of HQ activities. Tim Stuart opened the session with a short description of the Pelston Conference on biomonitoring held this summer in Cody, Wyoming. He called attention to a write up of the meeting that had been handed out and said the proceedings would be published as a book in the Spring. Tim Stuart then introduced Jim Plafkin of his staff who discussed the Standing Workgroup on Monitoring and Wasteload Allocations and the various standing sub-workgroups. Jim described research they are supporting on metalothienine, a protein that apparently functions to sequester metal ions and protect the organism. He expressed enthusiam about the new chronic tests and that the Complex Effluent Testing Program has demonstrated that toxicity-based wasteload allocations for multisource situations are feasible. Jim also urged Dr. Weber to begin work on the development of inexpensive chronic bioassays for marine organisms.

Bill Jordan next introduced Rick Brandes of his staff who discussed the Complex Effluent Testing Program, a joint OWEP/ORD-Duluth biomonitoring field studies project. The Lima, Ohio study discussed in the evening session is part of this project. Procedures worked out at this and other sites are expected to serve as the basis for future procedural guidance on biomonitoring in the NPDES permit program. Rick asked the Regions to nominate additional candidate sites and discussed the requirements for a good test site. At least three additional sites in three different Regions will be investigated this fiscal year. Several Regions immediately expressed willingness to participate.

Bill Jordan then introduced Bruce Newton of his staff who discussed toxicity reduction evaluations (TRE) and the HQ and ORD efforts to support their use. Permits Division prepared a draft manual in 1980 on how to conduct a TRE (which was never issued in final), has sponsored research, will be documenting case histories, and plans to conduct case studies in conjunction with the biomonitoring field studies under the Complex Effluent Testing Program. ORD is conducting research on industry-specific toxicity and toxicity treatability. The Leather and Textile industries are done while Petroleum, Pulp and Paper, Organic Chemicals, and Iron and Steel are still being studied. Bruce then briefly described the status of the effluent toxicity data system (CETIS) being developed. User data retrievals should be possible in early 1983.

Policy Questions

The next session concerned the policy HQ is drafting. Bill Jordan presented several major questions (see Attachment 2) in order to provide a context for the discussion. Because discussion was far ranging and disjointed, the following summary is organized by the questions Bill Jordan presented.

1. When to require biomonitoring

- There was little discussion on why testing is done because there was immediate agreement that it is used to assess use impairment and the effectiveness of technology-based limits.

- Region VI emphasized that the policy should address implementing the second round policy and not center on the planning process. One Region said their planning people don't know the first thing about the practical applications of biomonitoring. Typically, the process engineering and aquatic toxicology knowledge necessary to deal with biomonitoring issues and toxicant control is not found in the planning staffs at the State or local levels.

- Concern was expressed about a "State blessing" procedural requirement being inferred in the policy.

- The policy should provide flexibility for using either permits or 308 letters to require testing.

- Virtually all the Regions said it would be inappropriate for a policy to specify when and exactly how to use biomonitoring. More appropriate would be why it needs to be done, how it will be used, under what circumstances it might be required, etc.

2. Standard protocols vs case-by-case requirements

- All Regions vigorously argued against incorporating specific procedures into the policy. Flexibility was stressed. Several Regions (I, II, VII) did say generalized guidance on the type of testing available and recommended for different needs with flexibility and options would be useful.

- Lee Tebo stressed that the development of an appropriate testing requirement most logically should come from structured negotiation between permit writer, industry, and State. Region VI said their industries are reluctant to negotiate any kind of study. Region V said they had had considerable success in developing EPA/State/industry negotiated studies.

- Region X added that the policy should not specify those aspects of a protocol which are the State's responsiblity (e.g., mixing zones). Region V said that establishment of mixing zones, risk factors, etc. is clearly a State responsibility which must be an integral part of the toxicant control process.

3. Role of State

- Several Regions said the role of the State should not be defined in a policy on biomonitoring. The consensus was that States should be involved as early as possible and should take an active role in defining their standards and determining testing requirements.

4. Role of Discharger

- Region X noted that the reaction of a discharger depends on whether they see benefits coming from data generation. It is important to stress in the policy that biomonitoring results could "clear" a discharger.

- Several Regions supported Region IV's permit language (Attachment 9) which requires negotiations to develop testing. However, Region I said that the role of the discharger probably should be part of the policy.

- Region IV said the role of the discharger really can't be defined in a policy.

5. General Comments

- There is a pressing need for a national policy to counter resistance to using biomonitoring.

- A policy should legitimize biomonitoring and instruct Regions to use it where appropriate. The policy should not lock in specific protocols without any flexability to tailor testing to the permitting situation.

- A policy should respond to industry concerns about no allowance for assimilative capacity, using information to indicate no further treatment, flexibility in designing programs, etc.

- A policy should discuss the legal basis for requiring biomonitoring and include a section which addresses the litigation settlement.

Summary

Bill Jordan then summarized the comments on how a national policy should be structured and asked for volunteers to prepare wording alternatives for two of the more difficult aspects of the policy: how EPA will use biomonitoring data and when will it be required. Representatives from Regions III, IV, V and VI will send in their ideas. Martha Prothro also asked for comments on the draft appendix that had been handed out. She asked if it was appropriately flexible and contained the type of recommendations that would be useful.

The workshop adjourned at 3:00 pm.

APPENDIX

APPROACHES TO WATER QUALITY-BASED PERMITTING[1/]

ANALYSIS OF WATER QUALITY IMPACT	INTERPRETATION OF EXISTING DATA		SETTING PERMIT LIMITS OR CONDITIONS
IDENTIFICATION OF WATER QUALITY PROBLEM (WHERE TECHNOLOGY-BASED CONTROLS ARE NOT SUFFICIENT TO PROTECT THE USE)	TECHNOLOGY-BASED SOLUTION -DATA NOT AVAILABLE TO DEVELOP WQ-BASED EFFLUENT LIMITS		- FOR PROBLEM POLLUTANTS, ESTABLISH BPJ LIMITS (USE 304(B) FACTORS) - CONTINUE TO ESTABLISH COOPERATIVE MONITORING PROGRAMS WITH STATES AND DISCHARGERS - USE MONITORING REQUIREMENTS IN PERMIT TO ASSURE WQ STANDARD COMPLIANCE
	WATER QUALITY-BASED SOLUTION -DATA AVAILABLE TO DEVELOP WQ-BASED EFFLUENT LIMITS USING WQ STANDARDS	POLLUTANT BY POLLUTANT	- SET POLLUTANT-SPECIFIC LIMIT TO MEET WQ STANDARDS (I.E. PROTECT DESIGNATED USE) E.G. APPLY LIMIT AT EDGE OF MIXING ZONE
		BIOMONITORING	- BIOASSAY[2/ 3/] * USE TO DEVELOP LIMIT WHERE EFFLUENT TOXICITY CAN BE RELATED TO WQ STANDARD VIOLATION (I.E. USE IMPAIRMENT) * NPDES SETTLEMENT REQUIRES EPA ESTABLISH A UNIFORM POLICY FOR TOXICITY LIMITS * COMPLEX EFFLUENT TESTING PROGRAM - TOXICITY REDUCTION EVALUATION * USE TO REDUCE TOXICITY IN ORDER TO MEET WQ STANDARDS * PERMITS CONDITION DEVELOPED TO CONTROL OR MODIFY SOURCES OF TOXICITY * USE BMPS, CHANGE OR ALTER PROCESSES, OR ALTER TREATMENT TO REDUCE IMPACT

1/ THE APPROACHES OUTLINED ARE STEPS INVOLVED IN A WATER QUALITY PERMITTING PROCESS. SINCE THEY CANNOT BE MUTUALLY EXCLUSIVE, FOR PERMITTING SITUATIONS, A COMBINATION OF THESE APPROACHES MAY BE REQUIRED.

2/ BIOSURVEYS CAN BE USED TO DETERMINE EXTENT OF WQ STANDARD VIOLATION (I.E. BIOLOGICAL IMPACT ASSESSMENT)

3/ IN SOME STATES TOXICITY-BASED LC_{50} LIMITS ARE BEING USED TO MEET WQ STANDARDS

Attachment 1

Questions to be Resolved for Biomonitoring Policy

When To Require Biomonitoring:

- Prior to Permit Reissuance (Prior to Final Limitation Derivation)
- In the Final Permit (i.e., Monitoring Requirement)

Standard Protocols vs Case-By-Case Requirements.

- Should Standard Protocols Be Developed?

Specific Tests/Procedures:

- For Screening/Assessing (e.g., water quality assessment, technology assessment, priority setting, etc.).
- For Permit Limitation Derivation

Role of the State:

- Defining Biomonitoring Requirements
- Interpreting Standards
- Incorporate Biomonitoring Policy in Continuing Planning Process

Role of the Discharger

- Conducting Biomonitoring Surveys/Studies

10/20/82

- Region I

- Different Effluent Limitation Development

and State Procedures - Individual Pollutant Approach

Where Pretreatment is Utilized

Approach

Waste Characterization

A. EPA - Permit application
NPDES application
Discharge Monitoring Reports and/or Compliance Sampling
Effluent Guideline Development Data
Facility Inspection

I. Waste Characterization
A. EPA

Categories of industries are tested for acute toxicity of effluents after treatment (EP)

B. Delegated States:
Connecticut - focuses on appropriate treatment for industrial categories with water quality conditions analysis after treatment for identification of toxics problems.

B. Connecticut

Evaluates toxicity of sediments in waters receiving metals discharges with EPA assistance

Vermont - Nine (9) major primary industries only.

Vermont - not utilized

I. Receiving Water Characterization
A. EPA - Information sources
Water Quality Standards
304(b) B data
Data from state agencies
Water quality and biomonitoring plan fixed station monitoring
Flow list
Water Quality Management Plans
B. Delegated States - Same as (1)

II. Receiving Water Characterization

Maine: research project to evaluate effluent toxicity to in stream macroinvertebrate community and metals concentrations-EPA is participating.
Connecticut attempting to develop TMDL's for metals and effluent toxicity for discharges to stream segments.

III. Developing BAT Limits for Toxic Substances
A. EPA
1. Selecting toxics to be limited
Pretreatment - continuous, batch, as "contaminants" - from waste characterization
Concentration
Detectability
Critical parameter for the area (ex: PCB's)
2. Establishing limitations
Existing removals
Effluents guidelines applicability
BPJ of appropriate technology and corresponding limitations
Receiving waters impacts (dilution, criteria use)
Water quality criteria versus in stream concentrations due to discharge (acute, chronic, human health vs Water use)
Achievability of needed improvement - cost, technology
B. Delegated States
Connecticut - Effluent limitations are based upon state determination of needed treatment for individual industrial catagories
Vermont - minor toxics problems

III. Developing BAT Limits
A. EPA

For toxic effluents water quality criteria are used as limitations (acute and chronic) depending on stream uses. Post-treatment acute bioassays used to verify toxicity reduction.

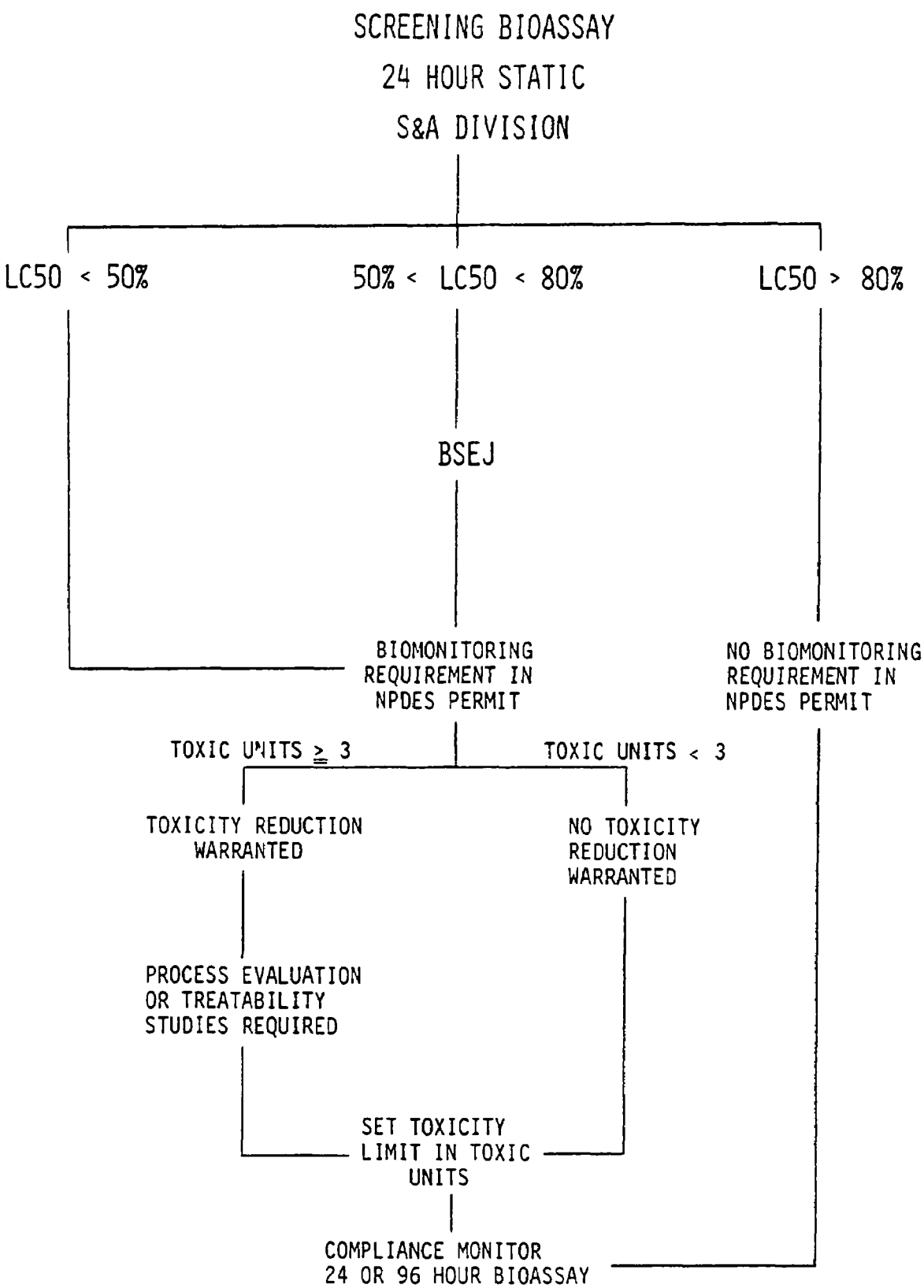
B. Connecticut - not utilized at present

IV. Developing Monitoring Requirements
A. EPA
Frequency is consistent with types of limits (monthly ave., daily max., 24 hour average) volume of discharge significance of pollutants, detection limits and methodology are considered, plus sample type
QA requirements are not specified beyond 40 CFR 136
B. Delegated States - Same as EPA

IV. Monitoring
A. EPA - not required as a permit condition by EPA
-Maine has required bioassays
B. Connecticut - Bioassays not required

Maine DEP has required acute bioassays in state licenses to verify toxicity reduction over time

Region II Approach



REGION III

I. Regional and State Procedure Using the Pollutant by Pollutant Approach for Toxics

A. Region III

1. A bioassay test has been required of selected permittees. When these test have shown toxicity, a GC/MS is then requested on the effluent stream in an attempt to determine the toxic components and possible treatment. We have had excellent cooperation with these selected West Virginia industries who discharge to the Kanawha River in an around Charleston.

B. Delaware

1. Industrial dischargers in Delaware are required to complete the consolidate application Form 2C. If there is a need the State Compliance Monitoring Section of the DNREC will do additional sampling on a case by case and pollutant by pollutant basis.

The State develops permit limitations for toxics based on the following in order of preferance. 1) Water quality limitations, 2) Promulgated EPA guidelines (whichever provides a lower limitation). 3) Proposed EPA quidelines, 4) EPA development documents, 5) Other studies. Of course limitations derived from the last three options are developed utilizing BPJ (Best Professional Judgement). Concerning water quality limitations, there are seven (7) toxics parameters regulated directly by the State: they are:

Pollutant	Criteria(non-tidal)	Criter(tidal)
DDT	0.001mg/l	0.001mg/l
Toxaphene	0.013mg/l	0.7 mg/l
Endrin	0.0023mg/l	0.0023mg/l
PCB's	0.014mg/l	0.030mg/l
Lindane	0.01mg/l	0.0040mg/l
Methoxychlor	0.03mg/l	0.03mg/l
Total Residual Chlorine	0.01mg/l	0.01mg/l

There is also a general criteria in the State water quality regulations. It states that "no toxic substances shall be discharged in concentrations harmful (synergistically or otherwise) to humans, fish, wildlife, and aquatic life. The Environmental Protection Agency's Water Quality Criteria Series published in October of 1980 shall be used as guidelines for determing harmful concentration levels".

C. Maryland

1. In Maryland industries are required to submit the EPA consolidated permit application and to do the required testing for the application. The state also uses inspections to gather data on potential toxic dischargers.

The pollutants are regulated on a case by case basis. There are, however, 5 toxics that are restricted in the state's water quality regulations. They are as follows: PCBs 0.001 microgram/liter, Endrin 0.004 micrograms/liter, Toxaphene 0.005 micrograms/liter, DDR 0.001 micrograms/liter, Benzidine 0.1 micrograms/liter. These standards apply to all waters in the state.

All other toxics are regulated by either EPA guidelines or proposed guidelines, or by use of development documents and other research data. The limitations are developed using Best Professional Judgement and the resulting permits are generally of excellent quality.

D. Virginia

1. The Virginia State Water Control Board is regulating toxics (to date) in 4 manners. These are bioassays (to be discussed this afternoon), water quality studies for specific pollutants, direct limitation (as promulgated in effluent guidelines) and the use of indicator pollutants. It is difficult to assess which approachs will be incorporated by the SWCB since our data is based on discussions with SWCB personnel and review of BAT permits issued to date. At present less than 10% of the primary industrial major permits have been reissued at the BAT level.

There are 3 water quality studies of toxics ongoing in Virginia at present:

1) mercury pollution of the north fork of the Halston River
2) mercury pollution of the South River
3) kepone pollution of the James River

Direct limitation and the use of indicator pollutants for control of toxics has been minimal as the State Water Control Board has developed a "wait and see" attitude towards the EPA (yet) promulgated BAT effluent guidelines.

In one case (of the few BAT permits developed to date) the SWCB developed a toxic wasteload model for the New River and then back calculated to determine the toxics limits for a specific discharger.

It is anticipated that the SWCB will limit toxics not covered by the promulgated effluent guidelines by the use of periodic or continuous bioassays.

E. Pennsylvania

1. Pennsylvania does not use biomonitoring. They require that the permittee (require) perform streams studies to show or demonstrate lack of environmental harm.

F. West Virginia

1. No track record. Delegated NPDES program March, 1982.

II. Regional Approaches to Utilizing Biomonitoring in Permits

A. Region III

Biomonitoring for general toxicity has been included in approximately 22 WVA NPDES permits written by Region III.

This special condition may vary somewhat according to permit writer, type of treatment system and receiving stream (see attached samples A&B).

Biomonitoring data ~~returned~~ reported has at times shown toxicity. A GC/MS is then requested on the effluent stream in an attempt to determine the toxic component and possible treatment.

B. Delaware

State regulations (Section 8.02(a)) provide that effluent limitations may be determined through biomonitoring techniques. The method is also specified as that set forth in the latest edition of Standard Methods utilizing indigenous species of fish. Whole effluent static tests are utilized. Also noted in State regulations are methods of determing the NPDES limitation from the biomonitoring results. For example, for non-cumulative or non-persistant pollutants (those having a half life of 96 hours or less), the limitation should be based on 1/20 LC_{50}. For persistant or cumulative pollutants (half life greater than 96 hours), the limitation should be based on $\frac{1}{100}$ LC_{50}.

Some permittees in Delaware have already been doing biomonitoring for ten (10) years. As permits come up for renewal, if few or no problems have been found with biomonitoring results, the State considers discontinuance or a reduction in the frequency of biomonitoing. Of course, as toxics are discovered in effluents through Form 2C, the question of biomonitoring requirements are again considered.

C. Maryland

To date Maryland has not placed a lot of emphasis on biomonitoring, but new permits with toxic potential (identified by inspection or the application process) will be required to do bio-testing as a permit conditions.

The tests are "whole effluent" not restricted to a single compound in the plant's discharge and are generally not instream but are static bench-type bioassays. A flow through bioassay may also be required to "fine tune" the results of the static tests. An important difference between Maryland's approach to bioassay testing and EPA's approach is the use of "locally important species" rather than the standard daphina to test for ranges of toxicity. A list of the "locally important species" to be used in testing is published in the state's water quality regulations.

As far as 1983 permit issuance plans are concerned, the state plans to use biomonitoring more extensively and to that end has recently published a manual for use by industrial dischargers for biomonitoring testing. Biomonitoring will be used as part of the permit conditions where toxicity is suspected. Currently there are two draft permits by the state which contain biomonitoring requirements (Mineral Pigments MD3425, and Tenneco Chem Co. MD 345). Maryland expects to issue more permits in the coming years with biomonitoring requirements.

D. Virginia

It appears that the Virginia State Water Control Board (SWCB) will rely extensively on biomonitoring to control toxics not limited in the promulgated BAT guidelines. To date, the SWCB has issued at least 5 permits which limit (control bioassays. In all the cases noted to date the SWCB has utilized general toxicity controls (whole effluent) as opposed to in-stream biosurvey techniques.

The SWCB approach has been to allow the discharger to conduct the bioassays on a periodic or continuous basis. In the event the test organisms die, the discharger is required to re-run the bioassay immediately to determine if toxicity was the cause. If the second bioassay proves toxic then the discharger must initiate immediate measures to eliminate the discharger of these toxics and immediately notify the SWCB.

During FY 83 it is projected that this bioassay approach will be used frequency as opposed to the SWCB developing limitations for toxics will no national BAT effluent limitations. The frequency of the bioassay incorporation into Virginia permits will be determined to a large extent by the adequacy and completeness of the promulgated BAT guidelines.

E. Pennsylvania

No know program other than previously stated.

F. West Virginia

No track recored exist.

STATUS OF INDUSTRIAL EFFLUENT BIOMONITORING IN REGION 10 (1982)

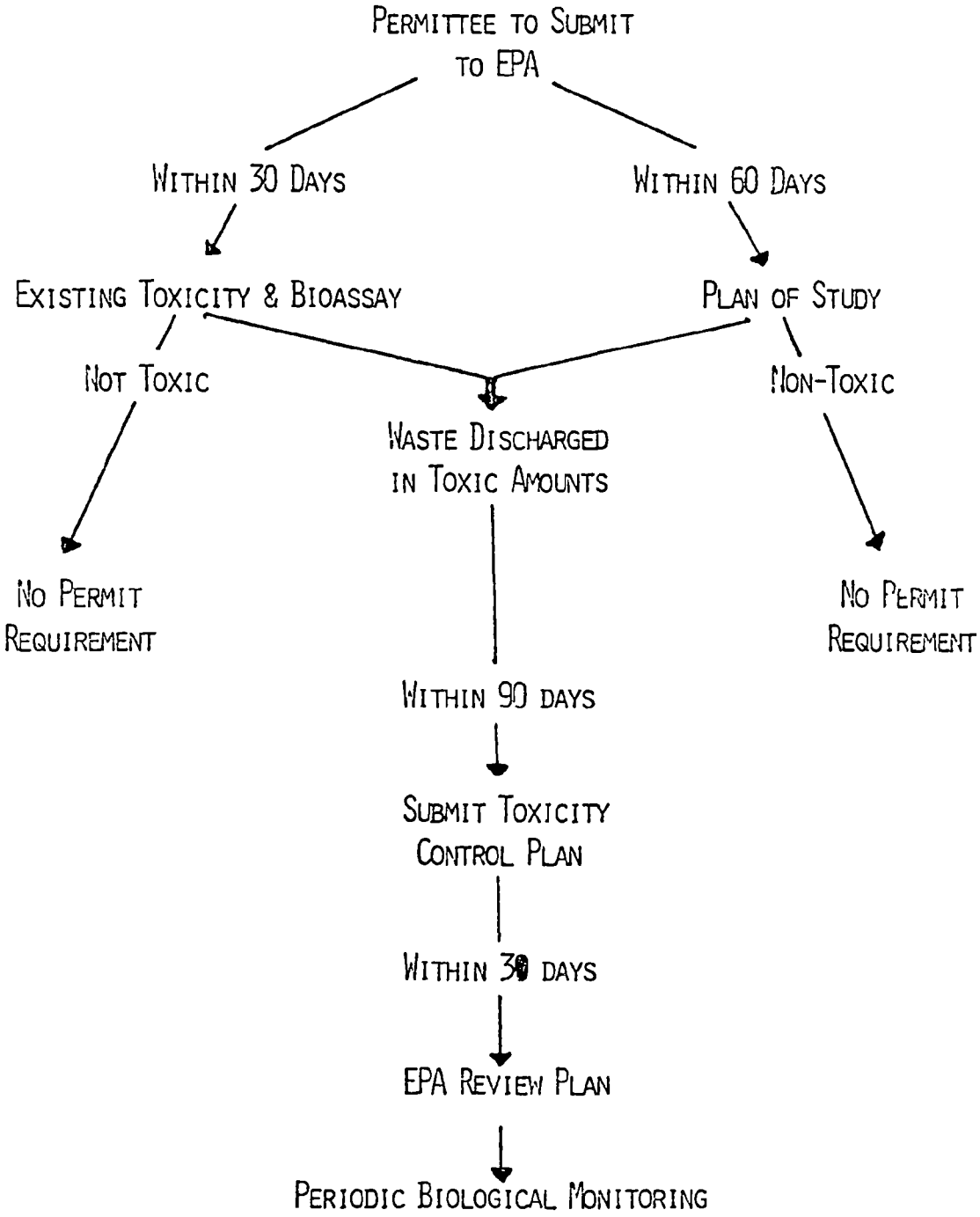
State	No.* of Discharge Permits with Effluent Bioassay Requirements / No. of Major Industrial Effluent Permits	Type of Bioassay Requirement
Alaska	2/42	Biomonitoring
Idaho	1/26	Biomonitoring
Oregon	9/27	Biomonitoring
Washington	26/~~47~~ 37	Effluent Toxicity Limitation[a] With Some Biomonitoring

[a] Criterion: Fish (salmonid) survival not less than 100% (old permits) or 80% (new permits) in 65% effluent during 96-hr. static bioassay.

* APPROXIMATE #'s

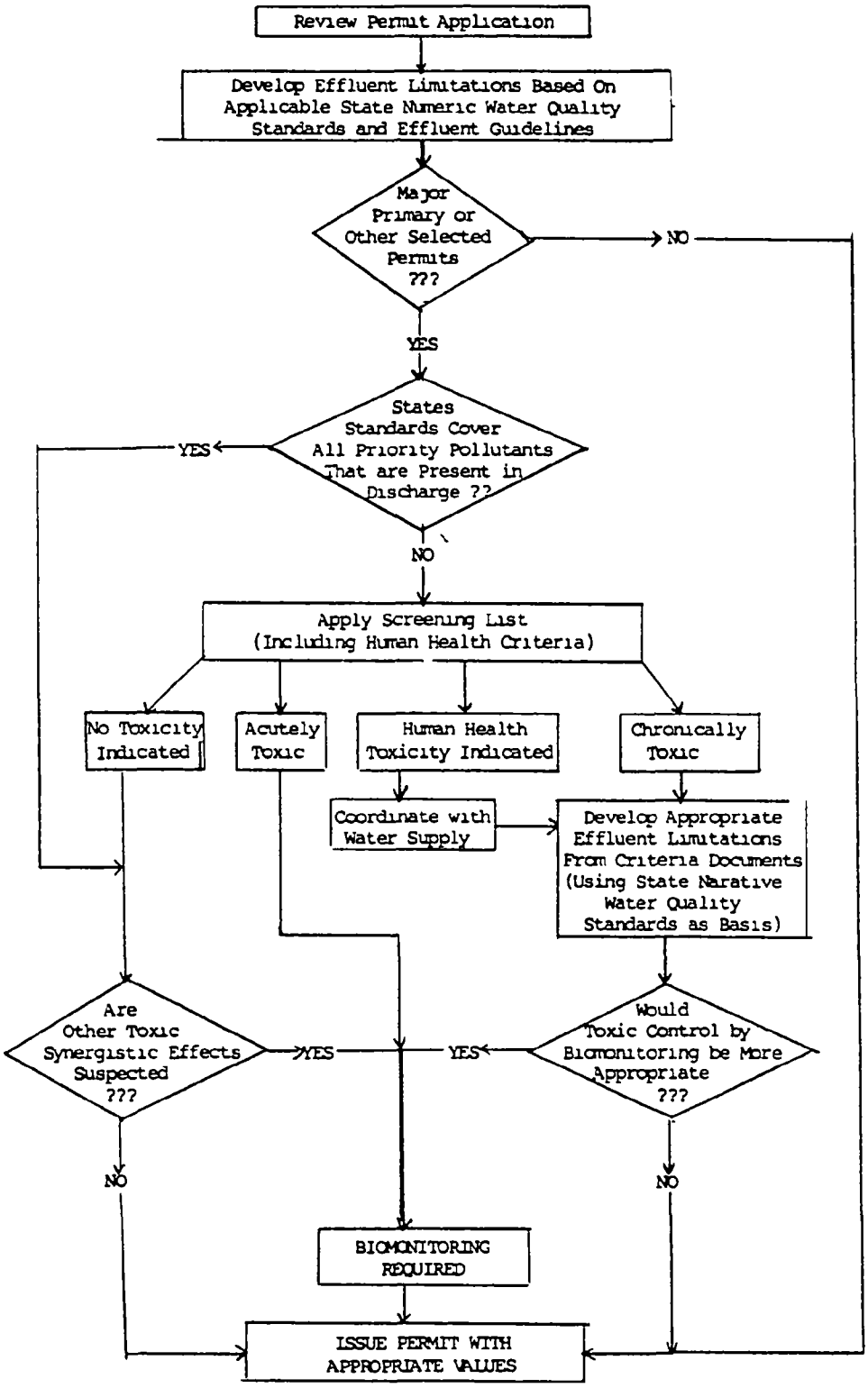
11/30/82

BIOMONITORING APPROACH REGION IV



Item IV

DEVELOPMENT OF TOXIC LIMITATIONS
IN NPDES PERMITS



PROPOSED APPROACH FOR CONTROL OF TOXIC INDUSTRIAL/ WASTEWATER DISCHARGES

BACKGROUND

As stated in Sec. 101(a)(3) of the Water Act, "it is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited."

The "in toxic amounts" clause would appear to indicate that a control program should consider the toxicity of a waste in the receiving waters.

There are several approaches to controlling waste toxicity, including:

- Technology Approach - This industry-wide approach involves applying best available technology toward treating or controlling a relatively small number of toxic substances specific to each industry type. Control has no relationship to receiving water effects, thus this approach is not consistent with policy enunciated in the Act.

  This approach may not be cost-effective for at least two reasons. First, it may be unnecessary to require all plants of the same industrial type to treat beyond BPT to control toxics. Second, BAT may be ineffective in controlling waste toxicity.

  Development of effluent guidelines for this approach is proving to be a costly and intractable task. This should have been anticipated since development of effluent guidelines for "conventionals" was resource intensive but only involved a few well studied parameters. Toxics control involves literally thousands of substances with new ones developed as each day passes.

- Individual Chemical Approach

  This is a site specific approach which provides limits on the amounts of individual toxic chemicals discharged. This requires a knowledge of the composition of waste and the toxicity of each component.

  For simple wastes, discharging one or two well studied substances, this may be a cost-effective approach. Monitoring of compliance is straight-foward and may or may not be inexpensive (dependent on parameters and frequency of sampling).

- Whole Waste Approach

  This is a site specif c approach which ideally involves control of toxicity, or potential for toxicity, of the whole waste stream in the receiving waters. It is a tailored approach which integrates site specific variables such as: interactions within the waste stream and between the waste stream and receiving waters; waste variability; waste complexity; persistence; bioaccumulation and biomagnification; size and character of receiving water.

  The "technology approach" and the "individual chemical approach" commit the permittee to a two step program -- "control" and "monitoring." The whole waste approach involves the permittee in a third step -- "evaluation."

  A whole waste approach is cost-effective because added treatment or control beyond that required for conventional pollutants is only required in cases where the discharge is shown to be toxic in the receiving water, and if applied on a site specific basis, the treatment can be tailored to the specific problem(s) detected. It is environmentally effective, and consistent with the Act, since the treatment eliminates the discharge of "toxic amounts" of waste.

As mentioned previously, the whole waste approach is a tailored, site specific methodology involving three steps: "evaluation," "control" and "monitoring."

Because toxicity is a biological phenomenon, the "evaluation" step must involve a determination of the effect of the whole waste on living organisms using site water as the diluent in all evaluations. There are essentially three levels of biological testing (all with acceptable methods) available for evaluating waste toxicity. These include acute tests, chronic tests and receiving water studies.

Acute tests generally involve an evaluation of lethality and calculation of an LC50 (percent concentration of waste lethal to 50% of test animals) over a time interval ranging from 24-96 hours. These tests are relatively inexpensive ranging from $200-300 for static jar tests to several thousand dollars for flow-through tests. Because we are interested in controlling chronic toxicity, the LC50 data is only useful if the relationship between acute and chronic toxicity is available. This acute/chronic relationship can be established on a site specific basis, or standardized ratios (based on studies of a wide range of chemical compounds) are available in the literature. Once the relationship is established, the acute test provides an inexpensive means of screening or monitoring toxicity.

Chronic tests are designed to measure the long term effects of continuous or intermittent exposure on growth, reproduction and survival. These are life cycle tests (egg to egg) which require from several weeks to several months to complete. There are presently available some short term chronic tests (embryo-larval) which provide a satisfactory measure of chronic toxicity at considerably lower cost.

Receiving water studies may range from biotic surveys aimed at evaluating the quality and productivity of the biota to simple chemical determinations to detect the uptake and concentration (bioaccumulation) of pollutants in fish tissues and organ systems. The need for bioaccumulation studies are highly site specific and dependent on the constituents in the waste.

Although biotic surveys provide our best source of data for trend monitoring of system quality, they are of little value for evaluating the impact of toxicity from a point source. In the simplest situations (small stream, one source), such studies may provide a measure of gross changes. However, rapid recruitment of both invertebrates and fish into and through even a simplified system make the true impact of sublethal effects difficult to detect. In larger rivers and open coastal systems, it is impossible to sort out the impact of a single source from a multiplicity of natural and man-induced perturbations affecting the biota. For example, natural variations in year class strength of fish populations may be greater than an order of magnitude.

The attached generic permit language is based on a site specific, whole waste control approach. It is structured on the belief that the individual industrial discharger has the fullest knowledge of the character of his waste discharge and local receiving waters. Thus, the discharger should initiate and fully participate in the development of a program for evaluation, control and monitoring of toxicity.

PERMIT LANGUAGE

OTHER REQUIREMENTS

In accordance with Sec. 101(a)(3) and pursuant to the authority of Sec. 308 of the Clean Water Act, an evaluation of the toxicity of wastewaters discharged from Outfalls _____ shall be conducted to determine if there is a need to develop a toxicity control and monitoring program. The required evaluation shall be accomplished by providing existing bioassay or toxicity data or performing bioassay studies that provide information on the toxic and bioaccumulation potential of the identified discharges.

1. As a minimum, any plan of study to evaluate waste toxicity must develop information on the chronic toxicity of the whole waste expressed as an LC_{50} value. Using whole waste from the discharge and site waters as a diluent, this can be accomplished with some combination of life cycle tests [1,2,3,4,5,6]; available short-term chronic (embryo-larval) tests [7,8,9,10]; and lethality tests [11,12] with an appropriate application factor [13]. The plan of study for evaluating toxicity should also include an implementation schedule; a consideration of waste variability; an evaluation of waste dispersion and persistence in the receiving water; an assessment of accumulation and/or concentration of toxic components in the receiving water body and the biota.

2. If the study results in a determination that wastes are discharged in toxic amounts, the permittee will then be required to submit a toxicity control plan (including an implementation schedule) within 90 days of the determination. The control plan should include appropriate measures such as in-plant controls, process and/or raw material/product changes, or additional wastewater treatment to reduce the toxicity of wastewater discharges to acceptable levels. Depending on the complexity of the problem, the timing of the plan submitted and the implementation schedule may be negotiable.

3. Once the control program has been fully implemented, periodic biological monitoring may be required to assure continued control of toxicity.

4. See the attached schedule.

SCHEDULE FOR EVALUATION OF TOXICITY OF WASTEWATERS

1. The permittee shall submit any existing toxicity or bioassay data for review by the EPA within 30 days of the effective date of this permit.

2. If such data are unavailable, the permittee shall submit a plan of study within 60 days of the effective date of this permit to evaluate waste toxicity. The EPA will review the plan of study within 30 days of its receipt and upon approval, the plan of study will become a part of this permit.

3. The permittee shall submit data concerning wastewater and production variability with the plan of study.

   a. If the permittee can demonstrate that wastewater characteristics do not change on a seasonal basis or otherwise do not vary, the waste toxicity study shall be completed within 6 months of EPA approval of the plan of study.

   b. If the wastewater characteristics do change on a seasonal basis or otherwise vary, the waste toxicity study shall be completed within 12 months of EPA approval of the plan of study.

4. If the study results indicate that the wastes are discharged in toxic amounts or are bioaccumulative, the permittee shall submit to the EPA a toxicity control plan and accompanying implementation schedule within 90 days of the finalization of the study results.

   a. The EPA will review the toxicity control plan within 30 days of its receipt. Upon approval of the toxicity control plan, this permit shall be modified, or alternatively, revoked and reissued, in order to reflect appropriate permit conditions and a compliance schedule.

REFERENCES

1. Brungs, William A. 1969. Chronic Toxicity of Zinc to the Fathead Minnow, Pimephales promelas Rafinesque. In Transactions of the American Fisheries Society, Vol. 98, No. 1969, pp. 272-279.

2. Mount, Donald I. and Charles E. Stephan. 1969. Chronic Toxicity of Copper to the Fathead Minnow (Pimephales promelas) in Soft Water. Journal of the Fisheries Research Board of Canada. Volume 26, No. 9, pp. 2449-2457.

3. Weber, C. I. 1973. Biological Field and Laboratory Methods for Measuring the Quality of Surface Waters and Effluents. EPA-670/4-73-001.

4. Geiger, J. G., A. L. Buikema, Jr. 1982. Hydrocarbon Depressed Growth and Reproduction of Daphnia Pulex (Cladocera). Canadian Journ. Fish Aquatic Science, Vol. 39, pp. 830-836.

5. Winner, W. R., M. P. Farrell. 1976. Acute and Chronic Toxicity of Copper to Four Species of Daphnia. Journ. of Fisheries Research Bd. of Canada, Vol. 33 (8), pp. 1685-1691.

6. Biesinger, K. E., G. M. Christensen. 1972. Effects of Various Metals on the Survival, Growth, Reproduction and Metabolism of Daphnia Magna. Journ. of Fisheries Research Bd. of Canada, Vol. 29, pp. 1691-1706.

7. Macek, K. K. and B. H. Sleight, III. 1976. Utility of toxicity tests with embryos and fry of fish in evaluating hazards associated with chronic toxicity of chemicals to fishes. In Aquatic Toxicology and Hazard Evaluation, ASTM STP 634, F. L. Mayer & J. L.

8. Birge, W. J., J. A. Black, J. E. Hudson and D. M. Bruser. 1979. Embryo-larval toxicity tests with organic compounds. ASTM, Spec. Tech. Pub. 667, pp. 131-147.

9. Birge, W. J., J. E. Hudson, J. A. Black and A. G. Westerman. 1981. Embryo-larval bioassays on organic coal elements and in situ biomonitoring of coal-waste effluents. In Surface Mining and Fish/Wildlife Needs in the Eastern U.S. Proc. of a Symposium, FWS/OBS-78/81, U. S. Dept. of Interior, pp. 97-104.

10. Birge, W. J., J. A. Black. 1981. In-situ Acute/Chronic Toxicological Monitoring of Industrial Effluents for the Biomonitoring Program Using Fish and Amphibian Embryo Larval Stages as Test Organisms. OWEP-82-001.

11. Peltier, William. 1978. Methods for Measuring the Acute Toxicity of Effluents to Aquatic Organisms. EPA-600/4-78-012, Revised July, 1978.

12. Environmental Protection Agency. 1975. Methods for Acute Toxicity Tests with Fish, Macroinvertebrates, and Amphibians. EPA-660/3-75-009.

13. National Academy of Science, 1973. Water Quality Criteria. 1972. Ecological Research Series, EPA-R3-73-033.

12/1/82

STATUS OF EFFLUENT TOXICITY TEST METHODS*

OFFICE OF MONITORING SYSTEMS AND QUALITY ASSURANCE, ORD

I. Acute Toxicity Tests for Fish and Invertebrates

A. Methods manuals now available

1. 1978 - Methods for Measuring the Acute Toxicity of Effluents to Aquatic Organisms EPA-600/4-78-012

2. 1981 - Effleunt Toxicity Screening Test Using *Daphnia* and Mysid Shrimp

B. Methods manuals in preparation

1. 1983 - Revised version of 1978 manual (now in review)

II. Chronic Toxicity Tests for Fish and Invertebrates

A. Methods that will be available by end of FY-83

1. Fathead minnow (9 day) embryo/larval test

2. *Ceriodaphnia* (7 day) life cycle test

III. Additional Toxicity Tests

A. Mutagenicity test (Ames test) - now available

B. Mammalian (cell) toxicity test - in preparation

---

*For further information, contact, Cornelius I. Weber, Environmental Monitoring and Support Laboratory - Cincinnati, 513-684-7337

ATTENDEES AT THE WORKSHOP ON
BIOMONITORING AND WATER QUALITY LIMITATION
DERIVATION TECHNIQUES FOR TOXIC POLLUTANTS
REGION IV, ATLANTA, GEORGIA
NOVEMBER 30-DECEMBER 1, 1982

	NAME	ORGANIZATION	TELEPHONE NO.
1.	Rick Brandes	OWEP/Permits Div.	426-7010
2.	Lee Tebo	Region IV (Athens)	250-2294
3.	Oscar Cabra, Jr.	Reg. 6/Permits Branch	729-2768
4.	Gerald R. Klug	Reg. 9/Permits Branch	494-7491
5.	Maurice Owens	OWRS/OAE	382-5392
6.	Bob Burm	Reg. VIII/Permits	327-4901
7.	Ed Struzeski	NEIC - Denver	234-4656
8.	Don Wruble	EMSL - Las Vegas, ORD	545-2237
9.	Max Anderson	Reg. V/ESD	886-6228
10.	Ronald Preston	Reg. III/ESD(Wheeling W.VA.)	923-1050
11.	Loys Parrish	Reg. VIII, ESD	234-3263
12.	Tudor T. Davis	ORD - Narragansett RI.	838-4843
13.	Don Mount	ORD - Duluth	783-9528
14.	Joe Cummins	Reg. 10/ESD	442-0370
15.	Marcia Lagerloef	Reg. 10/Permits	399-7151
16.	Bruce Newton	Headquarters/Permits	426-7010
17.	Paul Frey	Reg. IV/Eco. Rev. Br.	546-2294
18.	Bob Schneider	NEIC - Denver	234-4656
19.	William Peltier	Reg. IV (Athens)	250-2294
20.	Mike McGhee	Reg. IV/Permits/WLA's	257-2913
21.	Jim Greenfield	Reg. IV/Permits/WLA's	257-2913
22.	Henry Strickland	Reg. IV/Permits/WLA's	257-2156
23.	Bob Cantilli	OWEP/Permits Div.	426-7035
24.	Ernesto Perez	Reg. IV. Water Div.	257-3973
25.	Roosevelt Childress	Reg. IV/Permits/WLA's	257-2913
26.	Priscilla Oliver	Reg. IV/Compliance	257-3973
27.	Jewell Grubbs	Reg. IV/Compliance	257-7428
28.	Lawrence Benning	Reg. III/Water Permits	597-3689
29.	Hiramay Biswas	HQ/Monitoring, MDSD	382-7012
30.	Fritz Wagener	Reg. IV/Permits	257-2156
31.	Marshall Hyatt	Reg. IV/Permits	257-2156
32.	David Peacock	Reg. IV/Permits	257-2156
33.	Thomas Fikslin	Reg. II/ESD	340-6711
34.	Jim Patrick	Reg. IV/Permits	257-3012
35.	John Alonso	Reg. II/ESD	340-6791
36.	Pete Nolan	Reg. I/Lexington	861-6700
37.	David Parrish	Reg. 6/ESD	729-9777
38.	David Neleigh	Reg. 6/Water	729-2625
39.	Jim Plafkin	Monitoring & Data/OWRS	832-7005
40.	Bob Leger	Reg. I/WQ Branch	223-5031
41.	Allen Ikalainen	Reg. I/WQ Branch	223-5050
42.	Stephen Silva	Reg. I/WQ Branch	223-5020
43.	Billy Fairless	Reg. VII	758-4461
44.	Charles Steiner	Reg. V/ESD	353-9070

45. Walter Redmon	Reg. V/Permits	886-6110
46. Glenn Pratt	Reg. V/Permits	886-6107
47. John Marlar	Reg. IV/Water Div.	257-4793
48. Karen Wardzinski	OSC-Headquarters	382-7700
49. Martha Prothro	OWEP-Headquarters	755-2545
50. Bill Jordan	OWEP-Headquarters	426-7010
51. Paul Traina	Reg. IV/Water Div.	257-4450
52. Tim Stuart	OWRS	382-7074
53. Ned Notzon	OWRS	382-7040
54. Peter Wise	OWRS	382-5389
55. Mark Morris	MDSD	382-7056
56. Rebecca Hanmer	OW/Headquarters	382-5704