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GUIDELINES FOR DERIVING AMBIENT AQUATIC LIFE ADVISORY CONCENTRATIONS

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I. Introduction

A. Aquatic life advisories will be issued for selected chemicals for which not enough toxicity, bioaccumulation and/or field data are available to allow derivation of ambient water quality criteria for aquatic life using the procedures described in "Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses" (Stephen et al. 1985), hereinafter referrred to as the "National Guidelines". Aquatic life advisories will contain compilations and interpretations of available data that are directly pertinent to the derivation of aquatic life advisory concentrations.

B. Aquatic life advisory concentrations are intended to be used mostly for evaluating the aquatic toxicity of concentrations of pollutants in effluents and ambient waters, whereas water quality criteria for aquatic life provide a stronger basis for regulating concentrations of pollutants in effluents and ambient waters. Advisory concentrations have the following two intended uses:

1. Advisory concentrations are intended to be used to interpret data on concentrations of chemicals in ambient water. If the concentration of a chemical in ambient water is equal to or below the aquatic life advisory concentration for that chemical, there is probably no cause for concern about effects on aquatic organisms and their uses. If, however, the ambient concentration is above the advisory concentration, the discharger should quickly evaluate the available exposure and effect data to determine whether it is prudent to:

   a. obtain additional data concerning the concentration of the chemical in the effluent and/or ambient water;

   b. obtain additional laboratory and/or field data on the effect of the chemical on aquatic organisms and their uses so that a more accurate, and usually higher, aquatic life advisory or a water quality criterion can be derived;

   c. conduct acute and/or chronic toxicity tests on the effluent; and

   d. reduce the ambient concentration of the chemical.

After a reasonable period of time, the appropriate regulatory agency should evaluate all available pertinent data concerning the ambient concentration and the effects of the pollutant on aquatic life to determine whether it is appropriate to take any action such as establishing a permit limit for the pollutant or requiring toxicity tests on the effluent. Such agency may choose to regulate either before or after collecting additional data.

2. Advisory concentrations are intended to be used to help the U.S. EPA select chemicals for which water quality criteria for aquatic life should be derived. Any chemical that is found to be present in a considerable number of ambient waters at concentrations similar to or exceeding the advisory concentration may become a candidate for derivation of water quality criteria for aquatic life. Thus advisories will provide dischargers with advance notice of chemicals for which criteria might be derived so that they can generate additional data that might be useful for revising the advisory concentration or for deriving water quality criteria for aquatic life.

Additional guidance on appropriate regulatory uses of advisory concentrations and criteria should be obtained from the Criteria and Standards Division, Office of Water Regulations and Standards, U.S. EPA.

C. The procedures described in the National Guidelines will be used as much as possible in the derivation of aquatic life advisory concentrations. Whenever a procedure described in the National Guidelines cannot be used (usually because some required data are not available), a procedure that (a) follows as closely as possible the procedures described in the National Guidelines and (b) is compatible with the intended uses of advisory concentrations will be developed for use in deriving advisory concentrations. Aquatic life advisory concentrations can be based on fewer data than can water quality criteria for aquatic life because advisory concentrations are not intended to have as much regulatory impact as criteria. However, to be compatible with the first intended use, advisory concentrations must be derived so as to ensure that

they are rarely, if ever, higher than what the Criterion Continuous Concentration (CCC) would be if enough data were available to allow derivation of a national aquatic criterion for the chemical. The data requirements and procedures used for deriving aquatic life advisory concentration is rarely, if ever, above what the CCC would be. Thus, whenever a national criterion is derived for a pollutant for which an advisory concentration is already available, the CCC will almost always be higher than the advisory concentration. On the other hand, an advisory concentration that is too much lower than the CCC will cause unnecessary concern about various chemicals, effluents and ambient waters. To be most useful, the advisory concentration should never be above what the CCC would be and should rarely be more than a factor of 10 less than the CCC.

D. In order to obtain acceptable advisory concentrations for the least cost, the data requirements and procedures used for deriving aquatic life advisory concentrations will be different for different classes of chemicals. When possible, classes will be defined so that data requirements and procedures can be appropriately based on the biological, chemical, physical and toxicological properties used to define the class.

II. Low Molecular Weight Non-ionizable Organic Chemicals

A. This class of chemicals is not very well defined yet. It is expected, however, that all low molecular weight non-ionizable organic chemicals will be in this class after an upper limit on molecular weight has been established. It might be possible to expand this class to include a wider range of chemicals within certain limits.

1. This class is intended to be limited to chemicals for which there is no reason to suspect that the range of acute or chronic sensitivities of saltwater species will differ substantially from those of freshwater species. Therefore, unless there is substantial evidence to the contrary, the data available for freshwater and saltwater species should be considered together in order to derive an advisory concentration that will apply to both fresh and salt water. Because of the differing ionic compositions of the waters, it seems reasonable to assume that the toxicities and BCFs of organic

chemicals that ionize and inorganic chemicals are likely to differ in fresh and salt water.

2. This class is also intended to be limited to chemicals whose range of toxicities to aquatic animal species is relatively small, so that the requirements for acute values do not have to include very many species and do not have to be very specific. Thus this class of chemicals should not include any pesticides that are intended to be effective against any aquatic or terrestrial animals or any metals.

3. This class is also intended to be limited to chemicals that are not especially toxic to plants, so that tests with aquatic plants do not have to be required. Thus this class of chemicals should not include any herbicides.

B. An aquatic life advisory concentration should not be calculated for a chemical unless data are available from acceptable acute tests with at least three animal species, such that:

1. at least one species is a fish in the class Osteichthyes in the phylum Chordata.

2. at least two species are invertebrates such that:

   a. at least one species is in the class Crustacea in the phylum Arthropoda.

   b. the other species is either in the phylum Mollusca (test with embryos and larvae leading to a 96 hour EC50 or LC50) or in a different family of the phylum Arthropoda.

3. at least one is a freshwater species.

4. at least one is a saltwater species.

Available data from foreign species should be included in the advisory, but not utilized to derive an advisory recommendation unless other required data is not sufficient.

Because many of the chemicals in this class are highly volatile or degradable, acute tests with animals and tests with plants that are otherwise acceptable (in terms of acclimation, control mortality, etc. as described in the National Guidelines) are acceptable for this class of chemicals only if:

1. For flow-through tests, the concentrations were measured. If concentrations fluctuated unreasonably, the test should not be used.

2. For renewal tests, the organisms were exposed to fresh test solution at least once every 24 hours and either (a) the properties of the chemical indicate that its concentration in water should not decrease by more than 50% in 24 hours or (b) measurements on tests solutions showed that the concentration of test material did not decrease by more than 50% in 24 hours.

3. For static tests, either (a) the properties of the chemical indicate that its concentration in water should not decrease by more than 50% in 96 hours: (b) measurements on test solutions showed that the concentration of test material did not decrease by more than 50% from the beginning to the end of the test or (c) results of a nominal or measured static test should be multiplied by a factor obtained by dividing a flow-through 96-hr LC50 by a comparable static 96-hr LC50. The comparable flow-through and static tests must be conducted on the chemical in the same laboratory using the same water and organisms from the same sources. The results of the flow-through tests must be based on the time-weighted average measured concentrations of test material and the results of the static test must be based on the concentrations measured at the beginning of the test.

D. Although data from tests with aquatic plants are desirable they are not required because for many chemicals it appears that aquatic plants are adequately protected if aquatic animals are adequately protected.

E. For each species for which at least one acceptable acute value is available, determine a Species Mean Acute Value (SMAV) using the procedure described in

the National Guidelines. (If data from tests in both fresh and salt water are available for a species such as striped bass, all the data should be used together when determining the SMAV for that species.) Then calculate a Genus Mean Acute Value (GMAV) for each genus for which at least one SMAV is available.

F. An FAV should be calculated using the procedure described in the National Guidelines if GMAVs are available for at least one animal species in at least eignt different families, such that either:

1. the acute data requirements specified in the National Guidelines for either fresh or salt water are met, or

2. all the following are included:

   a. three families in the phylum Chordata such that:

      (1) at least one species is in the family Salmonidae.
      (2) at least one is a freshwater species.
      (3) at least one is a saltwater species.

   b. a saltwater penaeid shrimp or mysid.

   c. a freshwater cladoceran.

   d. a family in a phylum other than Chordata or Arthropoda.

   e. two other families not in the phylum Chordata.

As described in the National Guidelines, in some situations a calculated FAV should be lowered to protect an important animal species.

G. If the requirements for calculating an FAV are not met, calculate an Advisory Acute Value (AAV) by dividing the lowest available GMAV by the appropriate factor:

Number of GMAVs	Factor
3	11.0
4	10.0

Number of GMAVs	Factor
5	9.0
6	8.0
7	7.0
8	6.0
9	5.0
10	4.0
11	3.8
12	3.6
13	3.4
14	3.2
15	3.0
16	2.8
17	2.6
18	2.4
19	2.2
20 or more	2.0

The AAV is intended to be equal to or slightly below what the FAV would be if one could be calculated. Since the factors for 8 GMAVs and above are only to be used when those GMAVs are not acceptable under the National Guidelines, the lowest factor has been set at 2, to provide a conservative estimate for the advisory concentration. If there are 8 acceptable GMAVs, then an FAV can be calculated directly.

H. If three or more experimentally-determined acute-chronic ratios (ACR) which are acceptable based on the

National Guidelines are available for the chemical, determine the Final Acute-Chronic Ratio (FACR) using the procedure described in the National Guidelines. If fewer than three acceptable experimentally-determined ACRs are available, use enough assumed ACRs of 25 so that the total number of experimentally-determined and assumed ACRs equals three (over 90% of the ACR reported by both Kenaga (1982) and Call et al. (1985) were less than 25 and nearly all the FACRs used to derive water quality criteria for aquatic life have been less than 25). Calculate the Advisory Acute-Chronic Ratio (AACR) as the geometric mean of the three ACRs. Thus is no experimentally-determined acute-chronic ratios are available, the AACR is 25.

I. Calculate the advisory concentration by dividing the FAV (or the AAV if an FAV cannot be determined) by the FACR (or the AACR if an FACR cannot be determined).

J. If necessary, the advisory concentration should be lowered to one-half of the lowest EC50 for an important aquatic plant species for which the EC50 is available from an acceptable test, based on the National Guidelines, in which the concentrations of test material were measured and the effect was biologically important.

K. If a Maximum Permissible Tissue Concentration (either an FDA or other regulatory action level for seafoods or from wildlife feeding studies, as described in the National Guidelines) is available, back-calculate to a concentration in water using a measured BCF (or a predicted BCF if a measured BCF is not available). If necessary, the advisory concentration should be lowered to be equal to the calculated concentration.

L. The advisory should be stated as:

> If the measured or estimated ambient concentration of (a) exceeds (b) in fresh or salt water, one or more of the following options must be completed as quickly as possible:
>
> 1. obtain additional data concerning the concentration of (a) in the effluent and/or ambient water;
>
> 2. obtain additional laboratory and/or field data on the effect of (a) on aquatic organisms and their uses so that a new aquatic life advisory or a water quality criterion can be derived;

3. conduct acute and/or chronic toxicity tests on the effluent;

4. reduce the concentration.

After a reasonable period of time, unless a consideration of all available data concerning the ambient concentration and the effects of (a) on aquatic life demonstrate that the ambient concentration is low enough, it must be reduced.

where (a) = insert name of chemical and

(b) = insert advisory concentration

M. Caveats should be added to the advisory statement in some situations:

1. If data for a commercially or recreationally important species indicate that the species might not be adequately protected by the advisory concentration, but the data do not justify lowering the advisory concentration (for example, because the concentration of test material were not measured), caveat should be added stating that the species might not be adequately protected.

2. If EC50s for a variety of species of algae (or aquatic plants in general) are below the advisory concentration, a caveat should be added stating that algae (or aquatic plants) might not be adequately protected.

References

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Kenaga, E.E. 1982. Predicatability of chronic toxicity from acute toxicity of chemicals in fish and invertebrates. Environ. Toxicol. Chem. 1:347-358.

Stephan, C.E., D.I. Mount, D.J. Hansen, J.H. Gentile, G.A. Chapman and W.A. Brungs. 1985. Guidelines for deriving numerical national water quality criteria for the protection of aquatic organisms and their uses. PB85-227049. National Technical Information Service, Springfield, Va.