Presented below are water quality standards that are in effect for Clean Water Act purposes.

EPA is posting these standards as a convenience to users and has made a reasonable effort to assure their accuracy. Additionally, EPA has made a reasonable effort to identify parts of the standards that are not approved, disapproved, or are otherwise not in effect for Clean Water Act purposes.

Illinois Permitting Guidance for Mixing Zones
March 15, 1993

Purpose

Mixing zone regulations promulgated by the Illinois Pollution Control Board (IPCB) are found at 35 Ill. Adm. Code 302.102. These regulations were amended on January 25, 1990 as part of the toxics control rulemaking wherein state standards were updated to comply with recent changes in the Federal Clean Water Act. This guidance document outlines the Agency's approach to implementing these rules specifically in regard to establishing limitations in National Pollutant Discharge Elimination System (NPDES) permits.

Introduction

Illinois regulations require that discharges to waters of the state must meet water quality standards in addition to state effluent limits and appropriate federal categorical criteria. In certain cases it is appropriate to allow the mixing of effluent with the receiving water prior to the determination of compliance with these water quality standards. The Agency has the responsibility of establishing these mixing allowances in the form of mixing zones and zones of initial dilution. In the case of NPDES permits, these allowances are used to translate water quality requirements into discharge limits that are incorporated into the permit.

Part A: Application of Mixing Zone Regulations

In order to implement Illinois mixing zone provisions the Agency must answer three basic regulatory questions:

1) When is it appropriate to allow a mixing zone?

2) What restrictions are placed on the size and location of mixing zones?

3) How will mixing zone allowances be incorporated in NPDES permits?

The following step-by-step procedure describes the Agency's procedure for application of mixing to a given situation. As stated in the regulation at Section 302.102(d), (f-i), mixing zones are dealt with exclusively in NPDES permits.

1. Determination of Reasonableness of Treatment

The opening paragraph of the mixing zone regulations (Section 302.102(a)) states that an opportunity for mixing shall be allowed provided that the stipulations concerning "best degree of treatment" found in 304.102 are met. Listed under the category of General Effluent Standards Section, this rule states that dischargers must provide the best degree of treatment to wastewater:

> ... it shall be the obligation of any person discharging contaminants of any kind into the waters of the State to provide the best degree of treatment of wastewater consistent with technological feasibility, economic reasonableness and sound engineering judgment. For making determinations as to what kind of treatment is the "best degree of treatment" within the meaning of this paragraph any person shall consider the following:
>
> 1) what degree of waste reduction can be achieved by process change, improved housekeeping and recovery of individual waste components for reuse; and
>
> 2) whether individual process wastewater streams should be segregated or combined.

Mixing zones are allowed only after best degree of treatment is provided. Each permit must be reviewed to assure that this level of treatment is reflected in permit limits. **In addition to the construction of treatment plant hardware as discussed below, best degree of treatment also encompasses plant operations, housekeeping, raw material selection, etc. that will produce the best possible effluent.** The following are to be used as guidelines in this determination and best degree of treatment will be assumed if appropriate demonstration is made for all regulated parameters:

a. Compliance with State effluent standards.

b. Compliance with Federal BAT categorical limits.

c. A parameter specific determination by the Agency addressing the need for additional treatment, **improved operations and maintenance, raw material selection or housekeeping improvements that are** technically feasible and economically reasonable. The Agency may request additional information from the discharger to address this provision as necessary.

The review of best degree of treatment is an integral part of the permit issuance process for new facilities and those undergoing additional construction or equipment replacement. The best technically feasible and economically reasonable treatment processes must be included during these construction periods. The useful life of treatment facilities is an important factor in any subsequent best degree of treatment review, i.e., at permit renewal. In addition, the economic reasonableness of replacing an existing treatment facility or component that still holds useful life will be assessed using best professional judgement. It is not the intent of the Agency to reassess previous decisions that an existing treatment process is the best degree of treatment while the treatment component still retains useful life. However, existing treatment facilities may be deemed by the Agency not to be the best degree of treatment while still within useful life if water quality standards change or the mixing zone conditions are altered due to an increase in upstream concentrations. Evaluations concerning new water quality standards, parameters not previously evaluated, or other changes in the mixing zone will be made routinely at permit renewal. In such cases, a new evaluation is necessary because the mixing zone may no longer be allowable. But if the mixing zone is still valid, i.e., **meets the mixing zone provisions of the regulations**, the requirement to improve a facility to the best degree of treatment may only be made during periods of construction undertaken to increase treatment capacity or to replace equipment which is past its useful life.

Another component of the demonstration of best degree of treatment is the evaluation of the mixing characteristics of the outfall structure. The mixing zone regulations at Section 302.102(b)(1) requires that the outfall be designed "... to attain optimal mixing efficiency of effluent and receiving waters." Furthermore, Section 302.102(b)(12) states that provision must be made to assure that the mixing zone is as small as practical given reasonable economic and technical constraints. If the area of mixing is in compliance with the other requirements of Section 302.102, the Agency **will make its determination concerning compliance with this provision based on its best professional judgement.**

2. <u>Mixing Zone Size and Location Limitations</u>

A. The Mixing Zone Proper.

Limits on overall size are included in Section 302.102(b) 8 and 12:

1) 25% of cross-sectional area or volume of flow (whichever is more restrictive) for streams providing greater than or equal to 3:1 dilution under conditions of 7Q10 and design average discharge.

2) as small as possible and in no case have a surface area no larger than 26 acres.

The 25% of cross sectional area or volume of flow establishes the extent of the zone of passage given at 35 Ill. Adm. Code 302.102(b)(6) for mixing situations where the upstream flow to effluent dilution ratio is 3:1 or greater. No directive for the size of the zone of passage for discharges to streams with less available dilution is specifically given but paragraph 10 of Section 302.102(b) states that no body of water may be used totally for mixing with a discharge outfall. For purposes of allowing mixing in these situations yet providing a zone of passage, the Agency will generally restrict allowable mixing to 50% of the upstream flow or 50% of the cross sectional area (whichever is more restrictive) at 7Q10. No mixing will be allowed in streams with a 7Q10 flow of zero.

Discharges to lakes which have no discernible and reliably predictable currents in the immediate vicinity of the discharge outfall must be assessed with dye studies conducted under critical effluent and water body conditions as outlined under Part B in order to receive mixing allowances.

Aside from overall size limitations, the rules provide additional length and location limits. Section 302.102(b), paragraphs 2, 3, 4, 5 and 7 prohibit mixing zones from adversely impacting aquatic life habitats, public use areas or **the waterbody as a whole.** Before granting mixing in the permit, the Agency must have knowledge of the locality such that the following may be ensured:

1) Tributary stream entrances shall not be occluded by a mixing zone nor shall access by migrating aquatic life be impeded in either direction.

2) Mixing zones shall not infringe upon bathing beaches, bank fishing areas, boat ramps or dockages or any other public access area.

3) Mussel beds, endangered species habitat, fish spawning areas, areas of outstanding aquatic life habitat (e.g., riffle areas) or any other natural features vital to the well being of aquatic life shall not be threatened or impaired by a mixing zone.

4) Mixing zones shall not infringe upon intake structures of public or food processing water supplies, watering areas routinely accessed by wild or domestic animals, or points of irrigation withdrawal.

In instances where a new or relocated discharge is proposed the above information will be provided by the discharger in the form of a habitat survey report or as part of the formal application for a mixing zone. In cases of an existing outfall, Agency biologists will provide habitat and biological information from their direct knowledge of the receiving stream and facility. Their comments will provide a key portion of the permit writers mixing evaluation, i.e., are mixing zone regulations being met at this existing site or should the discharge be moved to a better site where no conflicts occur. Where Agency produced biological information is absent, the discharger may be required to supply this information (see Part B Additional Mixing Zone Demonstrations).

It will be the responsibility of all dischargers with existing or proposed effluent concentrations in excess of chronic water quality standards or criteria to provide the Agency with required documentation of the mixing characteristics of the discharge. This includes the chronic standards at 35 Ill. Adm. Code Section 302.208(d), the standards at (e), and any chronic derived water quality criterion obtained as a result of the application of Section 302.210. Such information will be submitted as part of NPDES permit application or as a permit requirement after issuance. At a minimum, a conservative "default mixing zone demonstration" as outlined below will be required. If the discharger believes that a more representative demonstration than the Agency's initial determination is necessary to characterize mixing, it will be his responsibility to provide the appropriate modeling and/or field data. These requirements are discussed in Part B and a comprehensive description of dispersion models and field investigation of mixing characteristics are contained in the Technical Support Document (TSD) (1).

The regulations also state that "No mixing is allowed where the water quality standard for the constituent in question is already violated in the receiving water." Normally, such a violation will be detected when upstream water quality data are examined for mass balance determinations (waste load allocations). If the upstream concentration is already at or over the standard, the determination of the allowable mixing zone would end and the permit would contain water quality standards as limits at the point of discharge. This procedure is described in detail in "Procedures for Determination of Water Quality Based Effluent Limits" and uses the following equation:

$$Ce = \frac{Cds(Qus + Qe) - CusQus}{Qe}$$

B. Zones of Initial Dilution

With the advent of acute water quality standards, there is a need for a mixing area that will protect waterbodies from short lived or limited area impacts yet still make provision for instream mixing opportunity where reasonable treatment to meet the standard does not exist. The regulations provide for this situation in subsections (c) and (e) of 302.102. Subsection (c) states that acute standards must be met within the area [and at all times] where mixing is allowed except where provided by subsection (e). Here the concept of the zone of initial dilution (ZID) is introduced.

The regulatory definition of a ZID uses the terms "rapid" and "immediate" to describe mixing in this area. The fact that the ZID may afford only a minimal area of exposure to aquatic life is stressed in these defined terms.

USEPA provides a detailed approach to defining the ZID in the second edition of the TSD that is compatible with Illinois regulations (2). USEPA's concept of the ZID is based on passage of organisms through the effluent plume without resulting lethality. USEPA uses the term criterion maximum concentration (CMC) to denote a protective concentration for a short-term (one hour) exposure. The equivalent terms in Illinois standards are the Acute Aquatic Toxicity Criterion (AATC) and the Acute Standard (AS). The CMC is considered protective for a one hour exposure period, hence any organism which would spend less than one hour passing through a ZID at or less than the CMC would be protected from lethal effects. Although Illinois regulations do not specify the one hour exposure, the AATC is computed virtually identically to the CMC and the TSD exposure concept can be applied to Illinois mixing zones. The spatial dimensions used in the TSD for defining ZIDs are, therefore, used in this document. However, one of the TSD alternatives which abandons set spatial dimensions in favor of an exposure area based on time of passage is rejected. In this option for allowed mixing a one hour travel time would be granted before standards must be met at the edge of a ZID. This concept is clearly in opposition to the language and intent of the regulation and is, therefore, rejected.

Any effluent exceeding the AATC or AS and discharged to an intermittent or very low flow stream or to a wetland or lake with poor dilution potential cannot be a candidate for a ZID because organisms could not be expected to avoid exposure. The AATC or AS must be met at the end-of-pipe in these situations. The TSD offers three alternative ZID delineation methods providing criteria for areas where the AATC or AS may be exceeded in a given portion of the receiving water. The discharger may propose alternate approaches to defining the ZID. These will be reviewed on a case-by-case basis for consistency with the regulations. The two alternatives deemed suitable for use in Illinois will be utilized to define the maximum extent of the ZID. They are given in the TSD as follows:

1. A high velocity discharge may be utilized to ensure that the AATC or AS is met within a very short distance from the outfall and thereby allow only a few minutes of exposure to passing aquatic organisms. The initial velocity of the discharge must be at least three meters per second. Additionally, a spatial limitation in any direction from the discharge port(s) of 50 times the square root of the cross-sectional area of the port(s), i.e., single or multipoint diffuser, is imposed. When high velocity diffusers are used, a dye study will usually be required to verify predicted effluent dispersion at the edge of the allowed ZID. Permit limitations can be based on the above calculations but a provision for a field verification will be included in the permit.

2. The second alternative allows a discharger to utilize a lower velocity outfall. The most restrictive of the following must be met:

    A. The AATC or AS must be met within 10% of the distance from the edge of the outfall structure to the edge of the regulatory mixing zone in any spatial direction;

    B. each individual discharge port must cause the AATC to be met within a distance of 50 times the square root of the cross sectional area of the pipe flowing full at defined flow* conditions; and

    C. the AATC must be met within a distance of five times the local water depth. The local water depth is defined as the average of the depth of the water at the point of outfall (end-of-pipe or entrance of an effluent ditch) and the maximum depth within the area defined in A or B above. Since this is a more conservative approach than option A above, field verification may not be needed, however dye studies may be required where appropriate.

    *For municipal facilities the effluent discharge will be the average of the three consecutive lowest months flow for the past two years of record. Industrial effluents will generally utilize daily maximum flow.

As a part of the permit review process, the Agency will complete a default initial mixing demonstration to characterize the mixing likely in the ZID. In some cases, the Agency may require the discharger to perform the necessary analysis or submit sufficient data to allow the Agency to complete the evaluation. The procedure for the default ZID mixing determination when applying an acute water quality standard from Section 302.208(d) or a derived criterion from Section 302.210 is taken from the TSD (2). A supplementary equation is provided for converting the flux averaged dilution factor (S) to an effluent limit.

$S = 0.3 \frac{x}{d}$ where

S = flux averaged dilution

x = distance from outlet where the acute standard or AATC must be met (ft)

x is determined from the most stringent of the three alternatives (A, B and C) of the second ZID delineation method (low velocity discharges) found on pages 6 and 7 of this document, slightly modified from the TSD.

d = diameter of outfall if it were flowing full through a pipe at design conditions (ft)

Obtain d by the following method:

A. Determine design slope value, s_1, for the outfall sewer.

B. Determine effluent flow, Q_e, in cfs. This is annual average flow for industrial discharges and the average of the three lowest consecutive months of flow over the past two years of record for municipal dischargers.

C. Use Manning's Equation based upon a roughness value of n = 0.13 to determine pipe size, d, which will flow full corresponding to Q_e and s_1 values.

The only field measurement normally required by the above procedure will be to determine average water depth. This is done by measuring depths in the allowable ZID and averaging the lowest and highest values obtained. More sophisticated methods to obtain the average may also be employed, however, all measurements must be taken at low water levels, e.g., river discharges of less than harmonic mean flow.

When the flux-averaged dilution (S) value is obtained, the following equation is utilized to calculate permit limits:

$Ce = S(C$[illegible]$-C_u) + C_u$ where,

Ce = the concentration of a substance in the effluent (effluent permit limit for daily maximum concentration)

Cd = the acute water quality standard or AATC for the substance

Cu = the upstream concentration of the substance

Cu may be obtained from a monitoring station maintained by the Agency or a monitoring requirement may be placed in the permit to obtain needed upstream data.

Dischargers not able to meet limits produced by this screening process (having met the best degree of treatment requirement) may seek to demonstrate mixing efficiency in the ZID by the more complex modeling or tracer studies described later in this section.

Mixing allowance will be granted on a parameter specific basis for both the mixing zone proper and the ZID. The resulting variably sized mixing zones and ZIDs possible at a single discharge outfall will thereby reflect the individual review of best degree of treatment and existing effluent quality (see #4 below). Monitoring activities designed to assess compliance with permit conditions will occur at the NPDES sampling point rather than at some point in the receiving water.

3. Toxicity Assessment

Toxic effluents must be further evaluated because of their potential to violate water quality standards. This entails either whole effluent toxicity (Sections 302.621 and 630) or numeric standards or criteria for substances that are not presently regulated in the NPDES permit and can be shown to be a potential problem to the receiving stream. The presence of substances producing whole effluent toxicity may not have been considered when review of steps 1 and 2 above was conducted.

The Agency generates whole effluent toxicity results for many dischargers. Planning Section will generate bioassay review sheets summarizing Agency bioassay results (collected 1 - 1-1/2 years before permit expiration) as well as results from prior biomonitoring plans, USEPA testing or bioassays required from the permittee at permit renewal. These reviews will be made a part of the permit writer's review notes and will remain in the appropriate facility file.

Where significant toxicity* is encountered in an effluent, the permit writer will require further biomonitoring as a permit condition. A clause to perform a toxicity reduction evaluation (TRE) will accompany this requirement. If the effluent is typified as having a fairly consistent toxicity problem in this further testing, the TRE will attempt to identify the source and options for its elimination. In some cases, the identified toxicant will be already regulated by the permit with a stipulated mixing allowance. However, when unregulated toxic substances are discovered,

*Significant toxicity may generally be defined as effluent toxicity exceeding the stipulations of 35 Ill. Adm. Code 302.621 for all dischargers and, for dischargers to smaller streams displaying adverse downstream impacts as determined by an Agency biosurvey, exceeding the stipulations of Section 302.630.

analysis of best degree of treatment must be repeated. **A detailed explanation of the Agency's biomonitoring policy is given in "Effluent Biomonitoring and Toxicity Assessment - Aquatic Life Concerns".** The absence of acute effluent toxicity in discharge situations of greater than 100:1 dilution will usually eliminate the need for additional modeling or mixing demonstrations beyond that covered in this document up to this point.

4. Existing Effluent Quality

When mixing is allowed, the permit writer must implement permit limits corresponding to existing effluent quality (EEQ). This procedure goes beyond the granting of State effluent standards or other indicators of best degree of treatment as default permit limits. When a discharger has demonstrated through the years that the treatment systems in place can exceed the performance dictated by the technology based permit limits permit limits reflective of the existing abilities are in order. The TSD (1) provides a procedure for determining the maximum expected effluent concentrations expected given past plant performance:

In cases where effluent monitoring data is available for the parameters of interest, effluent limitations will be determined using a statistical approach at the 95% confidence level. The following statistical approach has two parts. The first part is a determination of the percentile ranking for the highest measured effluent concentration. The percentile ranking (P_n) can be determined from the following formula:

$$P_n = (0.01)^{1/n}$$

Where n is the number of samples.

The second part of this statistical approach is a relationship between the above-determined percentile ranking and the appropriate upper bound percentile ranking for a lognormal effluent distribution. For determining permit limitations, the appropriate upper bounds are the 95th percentile for both daily maxima and monthly averages. The relationship for determining daily maxima is:

$$\frac{C_{95}}{C_{Z_p}} = \frac{\exp(2.326\sigma - 0.5\sigma^2)}{\exp(Z_p\sigma - 0.5\sigma^2)}$$

Where σ is determined from the coefficient of variation (CV) by $\sigma^2 = \ln(CV^2+1)$ or $\sigma = \ln(CV^2+1)$ and Z_p is the Z-value of the percentile ranking p_n. CV will be assumed to be 0.6 unless the discharger has justified a different coefficient of variation.

The daily maximum permit limit is then determined by multiplying the highest daily maximum effluent concentration by C_{95}/C_{Z_p}. The monthly average permit limit is determined by multiplying the highest recorded monthly average by C_{95}/C_{Z_p} provided that at least two effluent samples were used to determine the "average". If only one sample per month or less was collected, the monthly average is calculated by multiplying the yearly mean effluent concentration by C_{95}/C_{Z_p}. If the number of samples is 35 or less, C_{95}/C_{Z_p} can be obtained from Appendix A. Samples larger than 35 will use a multiplier of 1.1. The Agency will disallow outlier values from these calculations.

Existing effluent quality will be used as a measure of best degree of treatment and will supercede the criteria set forth in the section entitled Determination of Reasonableness of Treatment except when the following conditions are met:

1. The resulting effluent limits are more stringent, and;

2. Such limits do not preclude reasonable increases in flow or pollutant load to the treatment plant up to the design capacity of the plant during the term of the permit. This determination will be based on the best professional judgement of the Agency based on available information. The Agency may ask the permittee to provide additional information necessary to make this determination.

If an increase of a plant's design capacity becomes necessary, the new treatment facilities shall be evaluated using the guidelines set forth in the section of this document entitled Determination of Reasonableness of Treatment. EEQ limits established for the previous treatment facilities will therefore not necessarily apply to the new permit. EEQ limits will be applied once sufficient effluent data is generated for the new plant. Best professional judgement will be utilized to set permit limits initially.

5. Bioaccumulative Substances

Mixing zones for bioaccumulative substances* will not be allowed if there is a current sport fish advisory for the waterbody reach involved. These advisories are published in the Illinois Water Quality Report (305(b)) on a biennial schedule and in an annual publication entitled "Guide to Eating Illinois Sport Fish". In addition to ensuring that water quality standards for bioaccumulative substances will be met outside of the mixing zone, the permit will require additional studies where the Agency determines that a significant amount of these substances will be discharged. Other NPDES permits are written which regulate bioaccumulative substances but no documentation exists that levels above detection limits are actually discharged. A significant amount is therefore a measurable amount found with enough regularity as to represent what is believed to be a genuine release. Where it appears that a measurable discharge exists, the permittee will be required to perform body burden analyses on fish collected below the outfall to document that no actual impact will occur, i.e., fish body burdens approaching the action level or other applicable guideline. This requirement should be repeated in each succeeding permit. The Agency may also require caged fish or internal waste stream studies to determine the presence of bioaccumulative substances in an effluent where they are suspected but are non-measurable by other means.

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*Bioaccumulative substances for purposes of this document are those which have a more stringent human health or wildlife criterion than aquatic life criterion. This will be indicated in the permit writer's review notes file as part of the implementation of Subpart F narrative standards.

Part B: Additional Mixing Zone Demonstrations

1. Existing Discharges

The default mixing zone and ZID delineation models described in Part A will not suffice when a discharge approaches the maximum limits set by these relatively simple analyses. The equation for the mixing zone proper assumes ideal mixing and, therefore, any discharge that contains concentrations of substances near the effluent limits calculated may in fact violate mixing zone standards if poor mixing is actually present. The equation predicting ZID dilution is more conservative but also may assume better mixing than actually occurs. Better models (requiring more sophisticated input data) may be adequate in some cases (see Holley and Jirka [2]). The discharger may demonstrate to the Agency that advanced models are adequate to document mixing and receive mixing zone allowances in the permit.

Where models cannot adequately describe mixing, rhodamine WT dye, conductivity, chloride or other tracers can be used in field work to identify a series of effluent residual contours. This should be done under both a seasonal low flow and a normal mean or median flow. The results from these two conditions can be utilized to extrapolate for 7Q10 and design average discharge. The various models given in the TSD (2) may be applied to predict effluent contours or extrapolate to different flow conditions using existing tracer study data. The decision to require a field study will lie with the Agency. For non-intermittent streams with a flow up to 50 cfs immediately downstream of the outfall and lakes under 3 feet maximum depth, vertical mixing can be assumed to be uniform. For streams with flow beyond 50 cfs and lakes with depth greater than 3 feet, and in instances where differences in ionic strengths or temperatures are of concern, the residual contours should be identified at the surface and selected depth intervals. Recommendations given in the TSD for tracer studies (pp. 74 and 75) should be followed where possible. The Agency will always reserve the right to review and approve mixing zone delineation study plans.

In some instances, the Agency may require biological monitoring to assess an effluent's compliance to the ecological provisions of the Board regulations. These may consist of studies of in-place communities of organisms such as mussel beds or artificial substrate devices to document the effects of water quality on benthic communities.

2. Proposed New or Relocated Discharges

Modeling will generally be used to predict mixing zone dimensions for proposed new discharges. Methods recommended in the TSD should be used unless site specific characteristics indicate that another model better fits the situation. The decision to require sophisticated modeling or dispersion studies will be based on the overall diluton ratio between effluents and receiving waters. Generally, such studies will be unnecessary when dilution ratios are greater than 1,000:1. If the system cannot be successfully modeled, it may be necessary to perform a dispersion study as discussed above with a temporary discharge of city water, groundwater or upstream river water and a tracer substance. The following points must be addressed if modeling is utilized.

a) The type of modeling to be used for a given discharge shall be addressed in the application document. References, such as text books, technical papers, etc., for the modeling methods to be used shall be listed. Examples of methods and models are available in references listed in Appendix A.

b) Data supplied for the modeling must be based on factors particular to a given system and should include:

   1) Stream and effluent flows.

   2) Stream geometry at 6 to 10 locations downstream from the outfall.

   3) Longitudinal and lateral boundaries of the mixing zone.

   4) Dispersion coefficient value(s) and other hydraulic characteristics of the stream.

c) Predicted effluent residual concentration contours in a sketch of the proposed mixing zone.

d) Biological and Habitat Characterization.

   1) Identify habitat types in the proposed mixing zone, e.g., substrate types, cover characteristics, etc.

   2) Delineate mussel beds within 1,000 feet of the proposed mixing zone.

   3) Research the likelihood for endangered or threatened species (state or federal) to inhabit the mixing zone.

   4) Identify any unique or highly valued (fish spawning or congregating areas, etc.) habitats within the proposed mixing zone.

e) Verification by _in situ_ methods will be required when the discharge commences.

The Agency may require a confirmatory dye study after a new discharge begins to verify the model. The results of these studies may indicate that refinments to the outfall design are necessary.

Part C: Application Information

Information Required

When the screening procedures outlined in Part A prove inadequate for mixing zone or ZID characterization, the following information must be submitted to the Agency as a mixing zone application.

a) Facility Information

   1) Design and operating data.

A) NPDES permit number.

B) Treatment type.

C) Design average and maximum flow.

D) Monthly average flow for each of the last 24 months.

E) Physical and biological characteristics of the effluent.

F) Any proposed expansion or upgrading program.

2) Outfall data.

A) Location.

B) Outfall modification considerations to induce rapid mixing (e.g. high rate diffusers).

C) Physical characteristics of the existing or modified outfall.

D) Any available toxicity data for the effluent.

E) Chemical components of the effluent.

b) Receiving Waterbody Information

1) General Information

A) Name of the receiving water body.

B) The location of the point of discharge by county and United States Geological Survey (USGS) coordinates. (This should be highlighted, along with the discharge points of any other known dischargers, on a copy of the most recent 7.5 or 15 minute USGS topographic map).

C) Distance in river miles from the facility's outfall to both the next downstream outfall and the next downstream tributary to the receiving stream.

2) Receiving stream hydraulic factors:

A) Seven day ten year low flow (7Q10) immediately upstream of the outfall.

B) Stream velocity, depth and top width at 7Q10. (Stream velocity and depth should be measured at mid-channel).

C) Representative channel geometry.

3) Receiving stream water quality data and biological information:

A) Any existing data for the last twelve months on the concentrations of water quality constituents, including pH and temperature in the general vicinity of the outfall (upstream and downstream).

B) Any existing data concerning the biological characteristics of the stream up and downstream of the outfall, including such items as habitat, benthic macroinvertebrates, fisheries, and algal blooms.

C) For new or modified discharge outfalls, determine unique habitat occurrence in any area likely to come under effluent impact that was unaffected prior to the change. Include information on mussel beds, fish nursery areas or any other habitat that differs from the usual habitat configuration of the receiving water.

4) Receiving stream morphological factors:

A) Substrate type.

B) Variation of structure via natural meandering, pool and riffle sequence, proximity to side channels, backwater lakes, harbors, etc.

C) Degree of dredging, channelization or other alteration of natural stream character.

D) Accumulation of logjams and other naturally occurring vegetative debris, and presence of manmade habitats such as dikes, pilings, wing dams and riprap.

5) Receiving stream riparian habitat and land use description:

A) Topography.

B) Land cover including forest, agricultural row crop, marsh, grass buffer strip, residential lawn, etc.

C) Land use, zoning classification and projected growth patterns in the vicinity of the outfall using the following classifications: residential, commercial, industrial, wetlands recreational, agricultural. A specific determination should be made regarding utilization and accessibility of the adjoining property and receiving water body within the proposed mixing zone.

6) Stream use related information:

A) The present and anticipated uses of the receiving water body.

B) The existence of an impact upon any spawning or nursery areas of any indigenous aquatic species.

C) Any obstruction to migratory routes of any indigenous aquatic species.

D) The synergistic effects of overlapping mixing zones or the aggregate effects of adjacent mixing zones.

c) Application Submittal, Review and Approval

1) A written application will consist of the following:

A) Review conducted in parts a and b of this Section.

B) Details of Methodology used in delineating the mixing zone.

C) Details of calculations made in delineating the mixing zone and, if applicable, the ZID.

D) A sketch of the proposed mixing zone showing length, width, and, if applicable, the ZID. If concentration lines are developed for the mixing zone, a concentration profile should also be shown.

2) Submittal shall be addressed to:

Illinois Environmental Protection Agency
Planning Section
Division of Water Pollution Control
2200 Churchill Road
P.O. Box 19276
Springfield, Illinois 62794-9276

Upon receipt and approval of a completed mixing zone application, the location, dimensions and allowable dilution ratio of the mixing zone and, if applicable, Zone of Initial Dilution, will be designated in a written response to the applicant.

BM:jk/sp/3023n

References

1. USEPA. March, 1991. Technical Support Document for Water Quality-Based Toxics Control. Office of Water. EPA/505/2-90-001. Washington, D.C.

2. Holley, E. R. and G. H. Jirka, 1986. Mixing in Rivers. Technical Report E-86-11, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

BM:jk/sp/3023n

Appendix A. Reasonable Potential Multiplying Factors: 95% Confidence Level and 95% Probability Basis

Number of	Coefficient of Variation																			
Samples	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
1	1.4	1.9	2.6	3.6	4.7	6.2	8.0	10.1	12.6	15.5	18.7	22.4	26.4	30.8	35.6	40.7	46.3	52.2	58.4	65.0
2	1.3	1.6	2.0	2.5	3.1	3.8	4.6	5.4	6.4	7.4	8.5	9.7	11.0	12.3	13.6	15.1	16.5	18.0	19.6	21.2
3	1.2	1.5	1.8	2.1	2.6	3.0	3.5	4.0	4.6	5.2	5.8	6.5	7.2	7.9	8.6	9.3	10.1	10.8	11.6	12.4
4	1.2	1.4	1.7	1.9	2.2	2.6	3.0	3.3	3.7	4.2	4.6	5.1	5.5	6.0	6.4	6.9	7.4	7.9	8.3	8.8
5	1.2	1.4	1.6	1.8	2.1	2.3	2.6	2.9	3.2	3.6	3.9	4.2	4.5	4.9	5.2	5.6	5.9	6.2	6.6	6.9
6	1.1	1.3	1.5	1.7	1.9	2.1	2.4	2.6	2.9	3.1	3.4	3.7	3.9	4.2	4.5	4.7	5.0	5.2	5.5	5.7
7	1.1	1.3	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.1	3.3	3.5	3.7	3.9	4.1	4.3	4.5	4.7	4.9
8	1.1	1.3	1.4	1.6	1.7	1.9	2.1	2.3	2.4	2.6	2.8	3.0	3.2	3.3	3.5	3.7	3.9	4.0	4.2	4.3
9	1.1	1.2	1.4	1.5	1.7	1.8	2.0	2.1	2.3	2.4	2.6	2.8	2.9	3.1	3.2	3.4	3.5	3.6	3.8	3.9
10	1.1	1.2	1.3	1.5	1.6	1.7	1.9	2.0	2.2	2.3	2.4	2.6	2.7	2.8	3.0	3.1	3.2	3.3	3.4	3.6
11	1.1	1.2	1.3	1.4	1.6	1.7	1.8	1.9	2.1	2.2	2.3	2.4	2.5	2.6	2.8	2.9	3.0	3.1	3.2	3.3
12	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.0
13	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.4	2.5	2.6	2.7	2.8	2.8
14	1.1	1.2	1.3	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.2	2.3	2.4	2.5	2.5	2.6	2.7
15	1.1	1.2	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.8	1.9	2.0	2.1	2.2	2.2	2.3	2.4	2.4	2.5	2.5
16	1.1	1.1	1.2	1.3	1.4	1.5	1.6	1.6	1.7	1.8	1.9	1.9	2.0	2.1	2.1	2.2	2.2	2.3	2.4	2.4
17	1.1	1.1	1.2	1.3	1.4	1.4	1.5	1.6	1.7	1.7	1.8	1.9	1.9	2.0	2.0	2.1	2.2	2.2	2.3	2.3
18	1.1	1.1	1.2	1.3	1.3	1.4	1.5	1.6	1.6	1.7	1.7	1.8	1.9	1.9	2.0	2.0	2.1	2.1	2.2	2.2
19	1.1	1.1	1.2	1.3	1.3	1.4	1.5	1.5	1.6	1.6	1.7	1.7	1.8	1.9	1.9	1.9	2.0	2.0	2.1	2.1
20	1.1	1.1	1.2	1.2	1.3	1.4	1.4	1.5	1.5	1.6	1.7	1.7	1.8	1.8	1.8	1.9	1.9	2.0	2.0	2.0
21	1.1	1.1	1.2	1.2	1.3	1.3	1.4	1.5	1.5	1.6	1.6	1.7	1.7	1.7	1.8	1.8	1.9	1.9	1.9	2.0
22	1.1	1.1	1.2	1.2	1.3	1.3	1.4	1.4	1.5	1.5	1.6	1.6	1.7	1.7	1.7	1.8	1.8	1.8	1.9	1.9
23	1.0	1.1	1.2	1.2	1.3	1.3	1.4	1.4	1.5	1.5	1.5	1.6	1.6	1.7	1.7	1.7	1.8	1.8	1.8	1.9
24	1.0	1.1	1.1	1.2	1.2	1.3	1.3	1.4	1.4	1.5	1.5	1.5	1.6	1.6	1.6	1.7	1.7	1.7	1.8	1.8
25	1.0	1.1	1.1	1.2	1.2	1.3	1.3	1.4	1.4	1.4	1.5	1.5	1.5	1.6	1.6	1.6	1.7	1.7	1.7	1.7
26	1.0	1.1	1.1	1.2	1.2	1.3	1.3	1.3	1.4	1.4	1.4	1.5	1.5	1.5	1.6	1.6	1.6	1.6	1.7	1.7
27	1.0	1.1	1.1	1.2	1.2	1.2	1.3	1.3	1.4	1.4	1.4	1.5	1.5	1.5	1.5	1.6	1.6	1.6	1.6	1.7
28	1.0	1.1	1.1	1.2	1.2	1.2	1.3	1.3	1.3	1.4	1.4	1.4	1.5	1.5	1.5	1.5	1.5	1.6	1.6	1.6
29	1.0	1.1	1.1	1.1	1.2	1.2	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.5	1.5	1.5	1.5	1.5	1.6	1.6
30	1.0	1.1	1.1	1.1	1.2	1.2	1.2	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.4	1.5	1.5	1.5	1.5	1.5
31	1.0	1.1	1.1	1.1	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.4	1.5	1.5	1.5	1.5
32	1.0	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.4	1.4	1.5	1.5
33	1.0	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.4	1.4
34	1.0	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.4
35	1.0	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4