



Campaign to Safeguard America's Waters (C-SAW)

**Box 956 Haines, Alaska, 99827 Phone/Fax 907-766-3005
gershon@aptalaska.net**

C-SAW National Mixing Zone Survey

BACKGROUND

Mixing zones, i.e. pollution-dilution zones, have the potential to significantly undermine the fundamental purpose of the Clean Water Act (CWA) – to restore and maintain the integrity of our nation's waters. Although permit writers and water quality managers should be fully aware of their use of the "dilution-solution", many admit to knowing very little about the extent and impacts of individual and cumulative mixing zone authorizations on the state or federal level.

To formally investigate the basic parameters of mixing zone authorization, C-SAW submitted a four-page survey on mixing zone use to all 50 states in the Spring/Summer of 2001. Surveys were sent to each state's water quality standards (WQS) coordinator, or National Pollution Discharge Elimination System (NPDES) permit writer. Repeated attempts were made by phone and email to solicit responses from every state. When a returned survey was incomplete or survey responses clearly contradicted one another, C-SAW directly contacted the respondent or resolved the deficiencies and internal inconsistencies from documents posted on official state web sites.

As of October 2002, 46 states had fully or partially completed the survey, or directly assisted C-SAW in the completion of the survey. Survey results remain outstanding for four states (Alabama, Oregon, North Carolina, and South Dakota) that either refused to devote staff time to the survey, refused to submit completed survey information, or determined the information to be unavailable.

The goal of the survey was to determine the extent to which point source discharges meet state water quality standards at the "end of the pipe", and to investigate the prevalence and circumstances surrounding the application of mixing zones in the country as a whole. Readers are encouraged to contact their state agencies, the EPA, or C-SAW for clarification regarding specific responses or questions.

THE SURVEY

Most of the survey questions were interpreted as absolutes. This approach was necessary given the tremendous potential for discretionary application of state mixing zone protocols when unrestricted through specific regulatory language. For example: the question reported in Table 2 Col. 1 asked whether a state allows acute criteria to be exceeded in mixing zones through the application of Zones of Initial Dilution (ZID). Although a state may not allow acute criteria to be exceeded in every mixing zone, if they permit ZID to be authorized, the answer to that question would be “Yes.”

Several exceptions to the “absolute” rule are found in Table 4. The decision to include non-absolute responses to questions marked ** was predicated on the high number of responses indicating a specific procedure was employed in a significant percentage of mixing zone authorizations although not incorporated into the formal regulation.

As a result of using an absolute approach, and depending upon the specific question and percentage of time a given state reaches a particular decision, a state’s policies may appear from the survey to be more or less protective than they are in reality. Notwithstanding this limitation, the survey does provide significant insights into our country’s current regulatory posture on the use of mixing zones.

Due to variations in definitions and terms between states, several survey questions were determined to be ambiguous and are not reported below. Unanswered questions, “I don’t know” responses, and “?” responses were all tallied as “?” in the Tables.

SURVEY QUESTIONS AND EXPLANATORY NOTES:

Table 1

Col. 1. Is your state delegated authority over the federal NPDES permitting program?

Col. 2. Record the number of NPDES permits in your state, identifying the number of Publicly Owned Treatment Works (municipal sewage treatment plants) and industrial dischargers.

Notes: Most states listed only “major” permits, i.e., permits for high quantities of pollutants or highly toxic pollutants. A few states reported having issued thousands of permits, which probably reflected inclusion of minor permits and general permits (e.g., storm water runoff discharge locations, seafood processors, etc.) Some states simply listed a total number of permits.

Col. 3. Number of NPDES permits incorporating mixing zones into water quality based effluent limits (WQBEL)?

Notes: Some states apply mixing zones via specific effluent limit modifications (WQBEL), however states offering generic mixing zones and those basing permit limits on the “complete mixing” concept often authorize dilution without developing a WQBEL. The intent was to determine how many permits utilize dilution allowances – the responses from states that calculate few WQBEL but that otherwise regularly employ dilution allowances (as determined from other questions in the survey or direct interviews) were modified accordingly.

Col. 4. Does your state regulation describe a process for mixing zone authorization?

Notes: State mixing zone rules vary greatly from state to state, and may be found in regulation, official policy documents, or agency guidance. In some cases these rules are several pages in length, containing detailed instructions on size determinations, where they can be applied or denied, how they will be modeled and monitored, etc.; in other cases states have no formal written protocols and simply acknowledge that mixing zones may be authorized at the discretion of the regulatory agency.

Col. 5. Does your state provide generic mixing zones and/or site-specific mixing zones?

Notes: Approximately half of the states offer generic dilution factors (10:1, 100:1...) where they believe there is a sufficient volume of receiving water to facilitate rapid “complete mixing” (<5% variation in concentration of the pollutant from background conditions throughout a specified segment of the receiving water.)

Col. 6. Does your state assume chronic aquatic life criteria will be exceeded in mixing zones?

Table 2.

Col. 1. Does your state regulation authorize Zones of Initial Dilution (ZID) in which acute aquatic life criteria are not met?

Notes: Every state answering “No” to the use of ZID was contacted directly to determine whether they allow acute criteria to be exceeded without formally designating a ZID. Affirmative responses were tallied as a “Yes” to the question, since the intent was to determine the potential for exceeding acute criteria.

Col. 2. Does your state mixing zone regulation require a human health risk evaluation when pollutants in the mixing zone will exceed human health criteria?

Notes: The question referred to the performance of a standard human health risk evaluation (ingestion, inhalation, and direct contact) specifically related to exposure that could result from the presence of the mixing zone. A response of N/A means that the state does not allow mixing zones where human health criteria are exceeded.

Col. 3. Has your state ever denied the authorization of a mixing zone?

Notes: Several states responded N/A because they do not solicit requests; ergo there are no “denials.”

Col. 4. Does your regulation plan for reduced mixing zone use in the future?

Notes: Nearly every state replied “No”, although eight states are required by the Great Lakes Initiative (See CWA §1268) to phase out the use of mixing zones for bioaccumulative pollutants by 2010. Where appropriate, answers were adjusted and noted in the table by the response “GLI.”

Col. 5. Does your state allow mixing zones to be applied in all waters?

Notes: I.e., lakes, streams, rivers, etc...

Col. 6. Does your state allow mixing zones to be applied in waters with Total Maximum Daily Loads (TMDL?)

Col. 7. Does your state allow mixing zones to be applied in waters reported on the CWA 303(d) list for impaired waters?

Table 3.

Col. 1. Does your state allow mixing zones for all types of pollutants?

Notes: Some states reported prohibiting mixing zones for bacteria, or bioaccumulative pollutants, etc... If any type of pollutant is prohibited under routine conditions, e.g., fecal bacteria in drinking water supplies, the response was recorded as a “No.”

Col. 2. Does your state allow mixing zones to be applied in all classes of waters?

Notes: Some states reported prohibiting mixing zones in waters designated as drinking water sources, or in Outstanding National Resource Waters (ONRW), etc...

Col. 3. Does your state allow mixing zones to be applied in waters with threatened and endangered species?

Col. 4. Does your state set absolute size restrictions on mixing zones?

Col. 5. Does your state set mixing zone boundaries on the basis of cross-sectional percentages of the waterbody or volume ratios between the discharge and the receiving water?

Notes: Specific policies varied widely: 25% by cross-section of a stream, 10% by cross-section of a lake, 50% by cross-section of a river, 10% by volume of the receiving water, etc...

Col. 6. Does the state automatically assign the portion of the waterbody required to achieve complete mixing as the mixing zone?

Col. 7. Does the state apply instream flow calculations when determining dilution factors in mixing zones?

Notes: Specific policies varied widely: 7Q10 (7 day low flow in 10 years), 3Q2, 1Q10, etc...

Col. 8. Does the state employ mathematical models to determine mixing zone size or dilution factors?

Notes: Several states have developed their own formula, many reported using CORMIX, PLUME, and UDKHDEN depending upon the characteristics of the waterbody.

Table 4.

Col. 1.** Does the state employ in-stream modeling scenarios prior to mixing zone authorization (dye dispersion, test cards...?)

Col. 2.** Does the state routinely conduct a baseline evaluation of conditions and biota prior to mixing zone authorization?

Col. 3. Does the state perform a cost/benefit analysis vis-à-vis the needs of the discharger and the needs of the public prior to mixing zone authorization?

Col. 4. Does the state routinely perform monitoring studies at mixing zone boundaries?

Col. 5.** Has the state conducted studies on the long-term impacts of individual or multiple mixing zones?

Col. 6. Does the state tally the total annual discharge into mixing zones (gallons/year or pounds/year)?

Col. 7. Does the state post mixing zone locations with informational signs, maintain a list of all waters that have mixing zones, and maintain maps of all mixing zone locations?

RESPONSES

See Tables 1-4 attached.

Note: A thorough evaluation of individual state results and consultation with an appropriate state regulator should be performed before judgment is passed on any state's "performance." Responses reflect the knowledge of one, or in some cases, a few members of each state agency's staff. Variations in terminology and policy between states could further skew the interpretation of a state's relative commitment to water quality protection. For example: issuance of fewer mixing zones does not necessarily reflect a commitment to better water quality protection. A state with weak water quality criteria would have less need to apply dilution factors, and would therefore need to authorize fewer mixing zones. Similarly, states with dry climates may have fewer mixing zones because the receiving waters may be ephemeral, or their facilities might lose sufficient moisture through evaporation to preclude the need for a daily discharge into U.S. waters. Because of these and other potential mitigating factors, the value of the survey clearly rests in providing a big picture view of mixing zone application.

SUMMARY

Mixing zones are here; mixing zones are there; mixing zones are everywhere...

1. Across the U.S. the overwhelming majority of polluted discharges (numbering in the tens of thousands) are diluted in public waterbodies to "meet" applicable WQS. Every state authorizes the use of dilution in one or more permits. Four states reported to have approved mixing zones in less than 10% of their permits. Nearly half the states reported providing dilution allowances in greater than 90% of their permits. Twelve states were unaware of how many discharges under their jurisdiction had been authorized mixing zones.
2. All but four states have a regulation for authorizing the dilution of wastes into public waters. The four states without mixing zone regulations authorize mixing zones through agency policies and procedures.
3. Every state allows discharges of pollutants into mixing zones to exceed chronic aquatic life criteria – scientifically determined numerical limits for pollutants beyond which it is assumed there will be long-term reproductive, neurological, and/or developmental impacts to aquatic life.
4. In all but five states discharges into mixing zones may exceed acute aquatic life criteria – scientifically determined numerical limits for pollutants beyond which it is assumed there will be near-immediate mortality to aquatic life.
5. Twenty-one states routinely apply generic mixing zones to discharges without any site-specific evaluation of the receiving water.
6. Three states reported routinely evaluating the risks to people where human health criteria are exceeded in a mixing zone.

7. No state regulations require a reduction or elimination of mixing zone use over time (aside from the eight Great Lakes states required under federal law to eliminate mixing zones for bioaccumulative chemicals by 2010.)
8. Nearly every state permits mixing zones to be authorized within any state water, for all classes of waters (i.e., drinking, fishing, recreation, etc.) including within legally impaired waters and waters containing threatened or endangered species.
9. Twenty-nine states do not categorically prohibit using mixing zones for any types of pollutants.
10. Forty-four of forty-six states surveyed develop mixing zone dimensions through the application of mathematical models and thirty-eight define the area of mixing to reflect a predetermined cross-sectional width or length of the receiving water. Six states monitor mixing zone boundaries to check on the accuracy of the models.
11. Eight states occasionally undertake a biological examination of the receiving water prior to mixing zone approval.
12. Two states perform cost benefit analyses to determine the economic impacts of authorizing mixing zones on the discharger or the public.
13. Six states occasionally monitor mixing zone boundaries and seven states perform long-term impact analyses of mixing zones on the aquatic ecosystem.
14. No state regularly posts mixing zone areas, and only one state reported maintaining a publicly accessible list and map of mixing zone areas.
15. No state records the individual or cumulative volume or quantity of pollutants discharged into mixing zones, or the miles of streams, rivers, lakes, or coastal waters under their jurisdiction directly impacted by mixing zones.

CLOSING REMARKS

The federal government delegated the authority to adopt and implement mixing zone policies to the states in 1983 (See 40 CFR 131.13.) EPA is required to review these mixing zone policies for consistency with the CWA. However, since states are given substantial deference to interpret and apply their own regulations, they enjoy tremendous discretion in the development and implementation of mixing zone policies, which in turn provides extraordinary influence to the states over the management of our national waters. This is ironic considering that the failure by states to adequately protect public waters led directly to the return of federal control over water pollution management via the CWA.

C-SAW has been working on mixing zone issues since 1998. In our experience, the vast majority of citizens are unaware of the use of mixing zones within public

waters. The fact that public notification policies for mixing zones are almost non-existent most likely contributes to this observation.

Many state mixing zone rules reviewed by C-SAW in the course of performing this survey fail to address the issues of multiple or overlapping mixing zones, the cumulative and synergistic effects of various pollutant combinations, the tendency of some pollutants to attract biota, or the inclusion of meaningful sideboards on the discretionary authority of individual permit writers. Many states place no restrictions on the types of pollutants that may be discharged at concentrations exceeding water quality criteria, thereby authorizing dilution factors for many pollutants that don't "dilute." For example: most states permit mixing zones for heavy metals that are often deposited on the bottom within a short distance of an outfall pipe. They are not diluted nor do they disperse. Nevertheless, few states have adopted specific regulatory language to address the efficacy of authorizing mixing zones for either heavy metals, other non-dissolving pollutants, or pollutants that bioaccumulate. Regulatory deficiencies such as these are all the more critical considering the minimal requirements for monitoring mixing zone impacts on the water column, sediments, and biota.

Given the political and financial pressure exerted by dischargers at the state level it is unsurprising that many state mixing zone rules are very broad, contain minimal levels of monitoring, and provide few opportunities for meaningful public understanding or oversight. Gaps in documentation and testing most likely present major challenges to anyone attempting to determine where mixing zones are located, what pollutants are being diluted, the effects of mixing zones on the organisms, wildlife, and people that depend upon those waters, or the socio-economic costs of this practice on society as a whole.