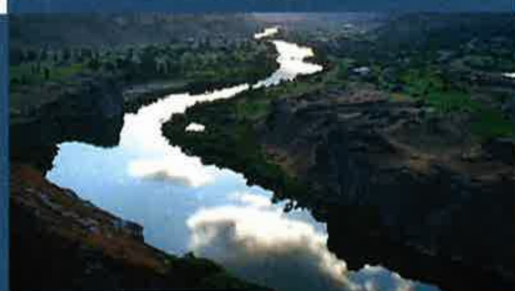
Idaho Department of
Environmental Quality

MIXING ZONE TECHNICAL PROCEDURES MANUAL



DRAFT

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ATTACHMENT 15

- Violate the Idaho water quality standards that require mixing zones to be free from toxic chemicals in toxic amounts, which includes toxicity caused through food-chain transfer

In applying for a mixing zone for bioaccumulative compounds, the discharger may be required to provide information regarding the potential for that compound to bioaccumulate or bioconcentrate in the system in question. In general, the residence time of the compound will increase the propensity to bioaccumulate (e.g., fish occupying a fast-flowing stream are likely less subject to bioaccumulation than those occupying a lake); however, bioaccumulation can occur in all systems, given the right conditions. Information the discharger may be required to provide could include the expected fate and transport of the compound in the system; potential impacts on all species, including species of special concern; and a plan to monitor tissue and sediment or water samples (if determined to be appropriate), both before and after establishment of the mixing zone. It is critical that monitoring of tissue concentrations (and possibly other matrices, such as sediment) be initiated prior to permitting of the mixing zone and be continued through the life of the permit. A final consideration should be for the potential impacts on human health (Section 2.2).

2.4 Required Chemical Analyses

Where possible, all analytical methods used to measure pollutants in the effluent and receiving water body should be approved by EPA. Further, the detection limits and reporting limits should be sufficiently low to ensure that concentrations of concern can actually be reliably measured. Of particular concern are chemicals with very low water quality criteria values such as cadmium. EPA's Office of Science and Technology is a good source for information regarding required methods and their detection limits (http://www.epa.gov/ost/methods/).

2.5 General Size and Location Principles to Consider

Mixing zones should be kept as small as practicable to ensure they do not impact the integrity of the water body as a whole. DEQ's mixing zone policy lists specific principles that should be considered when evaluating the size and location of a mixing zone. However, it is important to note that these principles are not regulatory requirements, and DEQ has discretion to depart from these principles. The following subsections discuss each of the size and location principles in detail.

2.5.1 Flowing Waters

Flow Principle

As described in IDAPA 58.01.02.060.01(e)(iv), a mixing zone should not include more than 25% of the volume of the critical stream flow. Efforts must be made to keep the mixing zone as small as possible. In order to accomplish this, 10% of the critical low flow may be initially considered for dilution; however, additional volume (in 5% increments) can be used if needed (e.g. it is determined the WQBEL can not be practically achieved). When determining whether a WQBEL can be practically achieved, issues such as technological feasibility and cost feasibility may be considered. The rationale for this approach is to ensure that any applicable mixing zone be as small as possible. DEQ may authorize a mixing zone that includes more than 25% of the volume of the critical stream flow provided the discharger demonstrates such dilution is needed and submits sufficient information illustrating that the increased mixing zone size will not unreasonably interfere with the beneficial uses of the receiving water body. Table 5 lists the critical flow values that apply to mixing zones, as described in IDAPA 58.01.02.210.03.

Table 5. Critical Flows to Use in Mixing Zone Evaluations

Criteria	Critical Flow
Aquatic Life – Toxics[1]	
Acute toxic criteria (CMC)[2]	1Q10 or 1B3
Chronic toxic criteria (CCC)[3]	7Q10 or 4B3
Aquatic Life – Non conventionals[4]	
Temperature	7Q10
Ammonia	7Q10
Phosphorus	Seasonal average (May to September)
Human Health – Toxics[1]	
Non-carcinogens	30Q5
Carcinogens	Harmonic mean flow

1Q10: lowest one-day flow with an average recurrence frequency of 10 years
1B3: biologically based low flow which indicates an allowable exceedance of once every 3 years
7Q10: lowest 7-day average flow with an average recurrence frequency of 10 years
4B3: biologically based low flow which indicates an allowable exceedance for 4 consecutive days once every 3 years
30Q5: lowest 30-day average flow with an average recurrence frequency of 5 years
Harmonic mean flow: long-term mean flow value calculated by dividing the number of daily flows by the sum of the reciprocals of those daily flows.

1 These critical flows are specified in IDAPA 58.01.02.210.03.b, and thus are non-negotiable.
2 CMC: Criterion Maximum Concentration.
3 CCC: Criterion Continuous Concentration.
4 These critical flows are not specified in Idaho water quality standards; thus, alternative flows may be used with DEQ approval.

To determine critical flow values where there is an extended record of flow data at or near the discharge point, EPA recommends using the EPA Office of Research and Development's DFLOW program, which can be downloaded free of charge. Alternatively, the USGS SWSTAT can be used. Other statistical methods can be proposed by dischargers, although they should consult with DEQ staff prior to using alternative methods.

Both DFLOW and SWSTAT rely upon the availability of long-term flow data. These models require at least three years, and preferably 10 years, of flow data to provide reliable statistical results. Such data may be independently collected by the discharger or another party within the watershed. Alternatively (as well as to verify discharger data), long-term flow data may be available if there is a nearby USGS stream gage. If there is no suitable USGS flow gage, the approximate size of a river using topozone or other maps can help verify the applicant's flow data/estimates.

In many cases, long-term flow data are not available for a specific receiving water. In that case, one option is to identify comparable watersheds in the area that have long-term data. A simple approach is to then calculate the critical low flows for the comparable watershed and estimate the low flows for the receiving water based on the ratio of upstream drainage areas. Further, long-term flow data can be compiled for multiple, comparable watersheds in the area. These data can be used to develop a correlation between drainage area size and flow, which can then be used to estimate the low flow in the receiving water. Care must be taken in using this approach because of the difficulties in "comparing" watersheds due to potential differences in local precipitation, elevation, topography, soils, aspect, etc.

For more information on critical flows:

DFLOW
http://epa.gov/waterscience/dflow/index.htm

SWSTAT Instructions
http://water.usgs.gov/software/swstat.html

USGS Gage Information
http://waterdata.usgs.gov/nwis/sw

Topozone
http://www.topozone.com

DEQ will consider other stream flow estimates (of which a proportion can be allocated to the mixing zone) where requested by dischargers. Such requests, however, must be accompanied by supporting information to demonstrate that the mixing zones will not affect the designated uses of the water body. For example, mixing zones could be based on tiered stream flows. Appropriate ranges (tiers) of stream flows can be established that range from very low minimum stream flows such as the 7Q10 (the 7-day, 10-year minimum statistical flow value) to very high normal spring runoff levels. The allowable mixing volume would be based on the lowest level of the range. For example, if DEQ establishes a tier between 100 and 150 cubic feet per second (cfs), then the allowable mixing volume would be based on a proportion of 100 cfs. This approach was used by DEQ, EPA, and the Forest Service in establishing a mixing zone for discharges from the Hecla Mining Company Grouse Creek Mine (http://yosemite.epa.gov/r10/water.nsf/NPDES+Permits/Current+ID1319).

Width Principle

The concentration of the constituent(s) being discharged to a mixing zone should meet or be less than the applicable chronic criteria before the width of the effluent plume becomes wider than 25% of the total width of the stream (IDAPA 58.01.02.060.01.e.ii). In addition, the cumulative width of adjacent mixing zones should not exceed 50% of the total width of the receiving water (IDAPA 58.01.02.060.01.e.i). The relevant width of the stream is the wetted width of the water flowing in the channel. Wetted width is a dynamic parameter that varies with flow. Additionally, at any given stream flow, channel widths and wetted widths also naturally change as one goes upstream or downstream. As channel gradients become steeper, flow often becomes more constricted and velocities increase. Likewise, channels tend to spread out and widen with decreasing gradients and lower flow velocities.

It is important, therefore, to define the flow regime (i.e., the level of water) and the channel cross-section downstream where constituent concentrations meet the chronic criteria. Mixing zone models, such as CORMIX, can be used as tools to compare different levels of flow, the width and length of the effluent plume, and the appropriate cross-section where the critical wetted width would be established as a compliance point. Since aquatic life toxics criteria are