Site Specific Data Collection Methods

Iowa DNR

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Approaches to Deriving Site-Specific Water Quality Based Limits

IAC 61.2(5)"d" – Implementation Strategy states that "A wastewater treatment facility may submit to the department technically valid instream data which provides additional information to be used in the calculations of their wasteload allocations and effluent limitations. Facilities may choose to collect site specific information in lieu of the default pH and temperature data for calculating ammonia limits. IAC 61.2(5)"d" and 61.2(4)"g""(4)" also allow facilities to collect site-specific mixing zone study information.

Wastewater treatment facilities are encouraged to plan ahead when considering any data gathering effort. Many of these efforts require seasonal data particularly collected during low stream flow conditions.

Site Specific Data Collection Methods

1. Water Chemistry Data. The permittee may choose to collect site-specific ambient and/or effluent water chemistry data in lieu of the statewide default values and submit the data for Department consideration. For example, a facility may choose to collect site specific effluent pH and temperature, as well as upstream pH and temperature data to derive site specific ammonia limits. Also, a facility may submit site specific effluent and upstream hardness, sulfate and chloride data to obtain site specific chloride and sulfate limits. The following table shows the different water chemistry parameters that could affect a specific chemical criterion.

Chemicals	Water Chemistry Parameters	
	Upstream	Effluent
Ammonia nitrogen	Monthly pH & Temperature	Monthly pH & Temperature
Metals	Hardness	Hardness
Chloride	Hardness & Sulfate	Hardness & Sulfate
Sulfate	Hardness & Chloride	Hardness & Chloride
Temperature	Maximum monthly background temperature	--

Wastewater treatment facilities are encouraged to plan ahead when considering any site-specific data gathering effort. Some of these efforts require seasonal data particularly collected during low stream flow conditions. A detailed sampling plan should be submitted to IDNR for approval prior to beginning any site-specific data collection. Both local and regional data may be collected and submitted to the Department.

a. *Local Values:* If the applicant desires that local values be used, they must supply a minimum of 2 years of water chemistry readings and sample at least once per month.

1. Background Water Chemistry: The applicant must submit a minimum of 2 years of grab samples for ambient background water chemistry and the samples must be collected at least once per month. More frequent monitoring in a shorter time period than 2 years may be allowed if the applicant can demonstrate that the monitoring data are collected in a representative year. The factors IDNR will consider to determine if the data are collected in a representative year include: stream flow (no drought or flooding conditions), weather patterns of the year, etc). Monitoring values should be obtained from upstream of the outfall at a representative location of the true upstream background condition of the discharge (usually beyond 50 feet of the discharge at an upstream location).

   In cases for certain pollutants, seasonal water chemistry data may be required to catch the most critical conditions such as low stream flow and high temperature conditions. The sample plan must be able to catch the required critical conditions.

2. Effluent Water Chemistry: For effluent water chemistry determinations, a 24-hour composite sample of the final effluent is required. For intermittent discharges, a 24-hour composite sampling may not be feasible; a representative grab sample is also acceptable.

3. Sampling should not occur during rainfall/runoff conditions. At least 72 hours is recommended between rainfall/runoff period and the collection of sampling.

4. Data shall be collected in the receiving stream that is governing the ammonia WLA. Contact the DNR staff for the appropriate stream location.

5. The sampling location should be far enough upstream of the wastewater treatment facility outfall to be beyond any backwater impacts of the discharge.

6. Sampling data submitted to the department shall include the date, time and result of each data point.

b. *Regional Background Values:* Regional water chemistry data could be available that represents the upstream background conditions. For example:

1. Another facility, at a reasonable distance upstream of the facility of interest, has collected background readings of water chemistry data (such as hardness,

sulfate and chloride) that is representative of the background chemistry for the facility of interest;

2. Ambient monitoring data are available within the same watershed (such as STORET data) that is representative of the upstream background conditions of the facility of interest.

The factors that could influence if the regional background data are acceptable to use include: the distance to the outfall, another discharge between the regional station and the oufall, another tributary, which could influence the water chemistry at the outfall. If the site specific ambient data are judged to be acceptable, the site specific data will be used instead of the statewide default water chemistry values.

2. Mixing Zone Study. A facility may provide information on the actual mixing zone characteristics during low stream flow conditions to demonstrate that a greater percentage of the low stream flow is mixing with the effluent than projected by the department.

A mixing zone study must be performed prior to NPDES Permit re-issuance. When it is not feasible to complete a Mixing Zone study prior to the permit re-issuance, the mixing zone study may be incorporated into the compliance schedule. The Water Resources Section can provide the facility with preliminary WQ-Based permit limits to aid in evaluating the need for a Mixing Zone study. Facilities may choose the use of models such as CORMIX modeling to estimate the mixing zone size in lieu of field mixing zone studies. It is recommended that contact be made with the Water Resources Section staff to discuss the scope of a mixing zone study.

Tracers may be used to delineate the site specific mixing zone boundaries. Commonly used tracers include different dye products such as rhodamine WT dye. Specific conductance and chloride tracers may also be used for mixing zone study purposes. If dye is injected to an effluent and could potentially reach a waterbody during a mixing zone study, an application for the authorization to use the dye must be submitted to the Department for approval.

Several different field efforts are acceptable for obtaining the mixing zone information: Visible Assessment, Dye Injection - Visible Boundary, and Dye Injection - Fluorometric Measurements.

a. **Visible Assessment:** This procedure is a simple field documentation of the effluent's mixing with the stream under low stream flow conditions. A facility shall provide pictures, video, drawings, a detailed map of the location and physical stream data on how the two waters are combining. Typically the effluent can be seen (foam, turbidity, or color differences) to mix with

the stream. Dye may be added to the effluent to facilitate the visible assessment. This approach is appropriate for smaller, shallower streams. A letter of authorization for the discharge of dye is required from the local department field office before dye is introduced into the stream.

b. **Dye Injection - Visible Boundary Measurements:** This type of study provides quantifiable data particularly on larger waterbodies. The procedures may be modified if needed for specific stream conditions. This study must be performed at or near 7Q10 stream flow conditions. Models such as CORMIX model are available to project the percentages of mixing obtained during field flow conditions to 7Q10 regime. The resources required for this type of study include a 3 person field crew, for approximately two days. It may take several staff days to assemble data and prepare a report.
   1. Lay out downstream station locations along shoreline at interval of 50', 100', 200', 500', 1000', 1500', and 2000' below the outfall.
   2. Assemble boundary marking floats. Test steam depth for float line length and ability to wade.
   3. Run short test of dye introduction into the effluent. The dye introduction is normally poured as a slug of dye into the effluent at the last manhole or at the outfall.
   4. Run actual dye study and set out markers. Time of travel between stations may also be obtained, if desired.
   5. Measure stream flow, (depth, velocity, cross section) at selected downstream sites and upstream of outfall. Obtain effluent flow measurement at time of dye injection.
   6. Prepare report of the findings.

c. **Dye Injection - Fluorometric Boundary Measurements:** This procedure is similar to the Visible Dye effort noted above, however, the actual measurement of dye concentrations (or collection of water samples for later analysis) will be made at various locations in the mixing zone. The resources required for this type of study include a 3-4 person field crew for approximately 2 to 3 days. It may take several staff days to perform the analysis, assemble data and prepare the report.

   1. The dye shall be fed into the effluent at a constant rate/concentration over the duration of time required to collect all dye samples.
   2. The collection of dye samples (or measurement of concentrations) will be made across the stream from the shoreline until a point in the stream where no additional dye is expected.
   3. The same station locations will be used starting at the lower location and proceeding upstream. Stream flow measurements as noted above also will be required.

3. Diffusers. An alternative to collecting site specific information is the installation of a diffuser. Diffusers may be installed by facilities to achieve rapid and complete mixing in lieu of shoreline discharges, which could also result in site specific mixing zone information.

Administratively, the concept of a diffuser is established in Chapter 61, Water Quality Standards (61.2(4)d(3) and 61.2(4)g(3)) as follows, "The use of a diffuser device to promote rapid mixing of an effluent in a receiving stream will be considered on a case-by-case basis with its usage as a means for dischargers to comply with an acute numerical criterion." The underlying objective of the use of a diffuser is to achieve rapid and complete mixing of the effluent with the stream's critical low flows.

Use of an in-stream diffuser is an artificial means to increase the mixing zone. Typically 75 - 80% of the low stream flow is passed across a diffuser. Additional permits beyond the NPDES and wastewater construction permits may be required for this type of structure. For example, the U.S. Army Corps of Engineers may need to approve this type of structure in a river with a navigation channel. No mixing zone study is needed for the use of a diffuser. However a follow-up stream study will likely be required to demonstrate that the diffuser is working properly.

4. Site-Specific Coefficient of Variation Data Collection. Coefficient of variation (CV) is a standard statistical measure of the relative variation of a set of data, and it defined as the standard deviation divided by the mean.

Iowa's statistical method of permit limit derivation requires an estimate of the CV of the distribution of the daily measurements of the parameters (such as *E coli*, ammonia and toxics) after the plant complies with the requirements. This CV may be based on the individual treatment facility's operations. Where the CV data is lacking, a default value of 0.6 is used. EPA recommends a value of 0.6 as a default CV, if the regulatory authority does not have more accurate information on the CV for the pollutant or pollutant parameter. Permit limits are usually not extremely sensitive to small changes in the CV. The value of 0.6 is typical of the range of variability of effluents measured by EPA and represents a reasonable degree of relative variability. However, wherever possible it is recommended that data on effluent variability for the pollutant of concern be collected to define a CV rather than using the default value.

The following describes the specific steps to collect site specific CV values:

1. The effluent data should be collected for the specific parameter when the facility is operating normally meeting both the approved design and meeting current NPDES permit limits;

2. The applicant should submit a minimum of 2 years of samples and the samples must be collected at least once per month to reasonably quantify the CV to reduce uncertainty;

3. Sampling should not occur during rainfall/runoff conditions. At least 72 hours is recommended between rainfall/runoff period and the collection of sampling;

4. The sampling method and testing method should be consistent with the current NPDES permit requirements if they are part of the monitoring requirements;

5. For effluent water chemistry determinations, a 24-hour composite sample of the final effluent is required. For intermittent discharges, a 24-hour composite sampling may not be feasible; a representative grab sample is also acceptable;

6. Sampling data submitted to the department shall include the date, time and result of each data point.