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May 19, 2017

Troy Smith, IPDES Rules Coordinator
A.J. Maupin, Wastewater Program Engineering Lead
Idaho Department of Environmental Quality
1410 N Hilton
Boise, ID 83705

Re: IPDES Effluent Limit Development Guidance (ELDG) – Additional Content Request

Dear Mr. Smith/Troy and Mr. Maupin/A.J.

The Association of Idaho Cities (AIC) serves to advance the interests of the cities of Idaho through legislative advocacy, technical assistance, training, and research. Idaho cities play an important role as the primary implementers of the Clean Water Act and have a significant interest in the development of rules and guidance related to IPDES rules and guidance. AIC is actively engaged in water quality issues through the work of our Environment Committee, chaired by Boise City Councilmember Elaine Clegg.

The Idaho Department of Environmental Quality (DEQ) is developing a program to address water pollution by regulating point sources that discharge pollutants to waters of the United States.

AIC appreciates the opportunity to provide the attached additional content for the development of the IPDES program. Please note that this is the first part of the content requested. Content pertaining to watershed-wide or "bubble permits" will follow. The attached content was developed in partnership with the cities of Boise and Meridian, and AIC appreciates their support. Should you have questions concerning our attached comments, please feel free to contact me.

Sincerely,

Seth Grigg

Executive Director

cc: Elaine Clegg, AIC Environment Committee Chair
Johanna Bell, AIC Policy Analyst
Tom Dupuis, AIC Environmental Consultant
Steve Burgos, Boise City Public Works Director
Dale Bolthouse, Meridian City Public Works Director

3.5 Calculate Pollutant-Specific WQBELs
3.5.1 Calculate Pollutant-Specific WQBELs from Aquatic Life Criteria
3.5.2 Calculate Chemical-Specific WQBELs Based on Human Health Criteria for Toxic Pollutants
{INSERT}

3.5.3 Calculate Pollutant-Specific WQBELs using Probabilistic Methods

The permit writer determines when to use a probabilistic approach, such as when key parameters like flow or pH have a wide distribution, minima and maxima occur at unique times, or if requested by the permittee. The standard mass balance steady-state equation can result in a single, worst-case concentration based on critical conditions that are unlikely to coincidentally occur. An alternative to the steady-state method is dynamic simulation using probabilistic techniques as outlined in the 1991 TSD. As described in the 1991 TSD (p. 98), probabilistic models "…use estimates of effluent variability and the variability of receiving water assimilation factors to develop effluent requirements in terms of concentration and variability..." and "…account for the daily variations of and relationships between flow, effluent, and environmental conditions and therefore directly determines the actual probability that a water quality standards exceedance will occur."

Monte Carlo analysis is a method for using the full probability distributions for each of the parameters in the mass balance approach to develop effluent limits. One application of a Monte Carlo simulation is to use the effluent and receiving water flow and concentration data and calculate the probability distribution for the downstream mixed conditions. With this Monte Carlo analysis, the permit writer can test multiple combinations of parameter values based on statistical distributions. The permit writer usually will have site-specific receiving water flow and ambient concentration data sets available to analyze for use in traditional deterministic permit calculations which can also be used to develop the probability distributions. A hypothetical example of the defining values for probability distributions of the receiving water and effluent parameters are shown in Table 27.

Table 27. Example of Probability Distributions for Receiving Water and Effluent.

Parameter	Mean	Standard Deviation	Minimum	Maximum
Receiving water flow (cfs)	1,183	1,663	86	9,560
Receiving water constituent (mg/L)	0.029	0.018	0.010	0.090
Effluent flow (cfs)	8.33	0.94	5.06	12.92
Effluent constituent (mg/L)	0.11	0.17	0.01	2.00

This particular example pertains to the application of Monte Carlo simulation to a nutrient such as phosphorus. The probability distributions are used within a model that performs Monte Carlo simulations to determine the effluent concentration for a range of downstream concentrations. Table 28 shows that if the receiving water target of 0.070 mg/L is interpreted as a 50th percentile value, that the mean effluent discharge concentration can be as high as 3.3 mg/L. If the receiving water target of 0.07 mg/L is required to be satisfied on a 95th percentile basis, then the effluent concentration can average 0.42 mg/L. Table 28 also shows that if the effluent is required to be the same concentration as the in-stream target at the end-of-pipe, then the resulting downstream concentration will be much lower than the criteria the vast majority of the time. The median (50th percentile) downstream concentration will be 0.026 mg/L. An effluent concentration of 0.070 mg/L results in a 95th percentile downstream concentration of 0.061 mg/L.

Table 28. Example Summary Statistics from Monte Carlo Simulation of Downstream Concentrations Resulting from Alternative Effluent Phosphorus Levels.

Effluent Characteristics	**Assumed Allowable Percentile Exceedance of Downstream Concentration in mg/L**	
	50%	**95%**
Mean 3.3 mg/L, Std Dev 0.17 mg/L	0.070 mg/L	0.204 mg/L
Mean 0.42 mg/L, Std Dev 0.17 mg/L	0.033 mg/L	0.070 mg/L
Mean 0.07 mg/L, Std Dev 0.17 mg/L	0.026 mg/L	0.061 mg/L

The resulting statistics of the Monte Carlo simulation can then be used to develop the permit limits. For non-toxic parameters, such as phosphorus used in this example, the permit writer will need to select the seasonality of the loading for effluent limitations. One possibility could be a March through October seasonal average limit of 18.8 lbs/day (0.42 mg/L x 8.33 cfs).

Another Monte Carlo simulation example is to use a mass balance model to calculate downstream concentrations of a toxic substance (i.e., zinc) and a parameter that affects toxicity (i.e., hardness) based on randomly simulated inputs per each repetitive calculation. Each variable (effluent and river flow, and effluent and river hardness and zinc concentrations) was simulated on a daily basis by randomly generating data based on the mean and standard deviation of each using a log-normal distribution using the program @Risk (Palisades Corp.) (Table 29). The mean and standard deviation of each parameter were selected to approximate the same hypothetical data set used for the steady-state analyses. This random simulation for each parameter for each day was done for a 21-year period (7,663 daily values).

Table 29. Example Summary of Statistical Characteristics of the Monte Carlo-Simulated Data where these Values were used as Inputs to Steady-State Methods.

	1Q10	7Q10	Mean	St Dev.	5th	95th	Geometric mean
River flow, cfs	138	258	NA	NA	NA	NA	NA
River zinc, µg/L	NA	NA	NA	NA	NA	5.3	2.2
River hardness mg/L	NA	NA	NA	NA	41	NA	59
Effluent. flow, mgd	NA	NA	20 design 14.5 daily 13.8 weekly	NA	NA	NA	NA
Effl. zinc, µg/L	NA	NA	15.8	6.9	NA	28.8	NA
Effl. hardness mg/L	NA	NA	111	NA	87	NA	111

This process was repeated using successively different long term average (LTA) effluent zinc concentrations until the model shows compliance with the water quality criteria for zinc for the allowed violation frequency. This is done separately for both acute and chronic criteria. The allowable frequency of excursion above the standard was once in 3 years (1 per 1095 days) as recommended in the TSD and included in Idaho water quality standards. The effluent LTA needed to protect for acute and chronic toxicity (LTAa and LTAc) obtained from the model outputs are used to calculate the Maximum Daily Limits and Average Monthly Limits (MDLa, MDLc AMLa, AMLc) using the TSD method. Note that the iterated LTAa and LTAc turned out to be 13.2 and 14.0 µg/L, respectively, for this Monte Carlo simulation, about a 9% reduction in the LTA compared to the originally simulated effluent dataset. Table 30 summarizes the outcome of the Monte Carlo simulation compared to a steady-state method.

Table 30. Comparison of Monte Carlo and Steady-State Methods.

Effluent Limitation	Monte Carlo Method		Steady-State Method	
	Once per month sampling frequency	Four times per month sampling frequency	Once per month sampling frequency	Four times per month sampling frequency
Max. daily limit, µg/L	36	36	17	17
Average monthly limit, µg/L	33	24	13	10

Steady-State Method assumed 95th percentile zinc and 5th percentile hardness concentrations in the upstream receiving water.

Another application of Monte Carlo simulation is for WQBELs is for ammonia in relation to toxicity to aquatic life. Ammonia toxicity is related to pH, temperature and ammonia values in both the receiving water and effluent and sufficient data sets are often available for major municipal facilities to perform a robust Monte Carlo simulation. This may also be the case for Biotic Ligand Model (BLM) criteria, such as copper and zinc, that are related to an even larger number of environmental parameters in the effluent and receiving water (dissolved organic carbon, pH, temperature, anions, cations, etc.).

3.5.4 Permit Options for Impracticable WQBELs

The permit writer determines if the calculated specific WQBELs are impracticable. Examples of when WQBELs are impracticable include: treatment technology capabilities, natural background and legacy issues especially in the water supply, and lack of confidence in monitoring data due to a lack of approved methods, disparate detection limits, contamination issues, and blank correction methods. If the WQBEL cannot be met with treatment, then alterative(s) to effluent limit(s) will be included in the permit by the permit writer. When the WQBELs are determined to be impracticable, the permit writer will determine alternative permit options such as: permit variances, regional or statewide variances, management plans, minimization plans, intake credits, or collection of additional monitoring data.

A few constituents that are likely to have impracticable WQBELs when conventional approaches are used are shown as examples in Table 31. Alternative permitting options should be considered by the permit writer when addressing these constituents. Setting effluent limitations for toxics, particularly at extremely low and unattainable levels, are frequently inappropriate and should be avoided. Instead, the permit writer is to use other conditions and approaches (e.g. variances; pollution minimization plans; integrated plans; toxics reduction strategies…).

Other factors that make addressing these constituents difficult include unique receiving water and/or effluent characteristics. The permit writer shall assess the need for more in-depth studies on receiving water impacts from constituents that are likely to have impracticable WQBELs, such as a Biotic Ligand Model (BLM study), fisheries study, evaluation of hardness, management plans, and/or other studies. The permit writer shall assess the need for additional effluent studies to determine subcomponents of a constituent, individual congeners or a smaller sub-set of the congeners. The permit writer shall seek to develop congener-specific management plan options for those congeners responsible for the majority of the Human Health risk.

When writing permits for poorly characterized receiving water and/or effluent, the permit writer will apply other regulatory approaches to the permit conditions. For example, the permit writer should consider an enhanced monitoring effort where the water body is poorly characterized. The permit writer may also consider a minimization and/or source identification program. Results from this type of program would support improvement to pollution minimizations plans, source controls through purchasing policies, and source specific pretreatment requirements.

Table 31. Examples of Impracticable WQBELs determinations and Permit Options.

Parameter	Analysis and Determination	Permit Option
Arsenic	Effluent concentration similar to source water, source water much higher than applicable criterion, WQBELs not achievable with existing treatment technologies	Intake credit, variance
Bis(2-ethylhexyl) phthalate	Infeasible to achieve reliable samples without contamination	QAPP addresses contamination issues in future monitoring
Mercury	Specific sources	Variance and minimization plans; watershed fish tissue monitoring
Polychlorinated biphenyl (PCBs)	Low detection level method not approved, blank correction issues, multiple congeners to assess	Toxics management plan rather than WQBELs, congener-specific management plan, QAPP addresses blank contamination