Idaho Pollutant Discharge Elimination System

Effluent Limit Development Guidance

State of Idaho
Department of Environmental Quality

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Abbreviations and Acronyms

§	section (usually a section of federal or state rules or statutes)
BAT	best available technology economically achievable
BCT	best conventional pollutant control technology
BMP	best management practice
BOD_5	five-day biochemical oxygen demand
BPJ	best professional judgment
BPT	best practicable control technology currently available
CFR	code of federal regulations (refers to citations in the federal administrative rules)
CWA	Clean Water Act
DEQ	Idaho Department of Environmental Quality
DMR	discharge monitoring report
EDU	equivalent dwelling unit
ELDG	IPDES Effluent Limit Development Guidance
ELG	effluent limit guideline
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
FDF	fundamentally different factors
IDAPA	refers to citations of Idaho administrative rules
I&I	infiltration and inflow
IP	individual permit
IPDES	Idaho Pollutant Discharge Elimination System
kg	kilogram
L	liter
MCL	maximum contaminant level
MDL	method detection limit
mg/L	milligrams per liter
mgd	million gallons per day
ML	minimum level of quantitation
NAICS	North American industry classification system
NPDES	National Pollutant Discharge Elimination System
NSPS	new source performance standard
O&M	operations and maintenance
ORW	outstanding resource waters
POTW	publicly owned treatment works
QAPP	quality assurance project plans
QA/QC	quality assurance/quality control
RPA	reasonable potential analysis
RPTE	reasonable potential to exceed

SEP	supplemental environmental project
SHPO	state historic preservation offices
SIC	standard industrial classification
SPCC	spill prevention, control and countermeasure
SSO	sanitary sewer overflow
SWMP	storm water management program
SWPPP	storm water pollution prevention plan
TBEL	technology-based effluent limit
TMDL	total maximum daily load
TRC	technical review criteria
TSS	total suspended solids
TWTDS	treatment works treating domestic sewage
US	United States
USACE	United States Army Corps of Engineers
WET	whole effluent toxicity
WLA	wasteload allocation
WQBEL	water quality-based effluent limit

1 Introduction

The Idaho Department of Environmental Quality's (DEQ's) Idaho Pollutant Discharge Elimination System (IPDES) Program developed this Effluent Limit Development Guidance (ELDG) to help DEQ personnel, the regulated community, and public users understand the process for developing effluent limits in IPDES permits. IPDES permits implement both technology-based and water quality-based controls, and contain effluent limits for point source dischargers consistent with the statutory and regulatory requirements of the IPDES Program, which governs the discharge of pollutants to waters of the United States in Idaho.

1.1 Purpose and Need

The purpose of this guide is to provide Idaho-specific direction for the development of effluent limits in IPDES permits. This guide serves as a reference for IPDES permit writers to develop, and permittees to understand the development of permits and effluent limits by explaining:

- Framework and process for developing effluent limits
- Statutory/regulatory requirements and existing guidance
- Technical and statistical tools and constraints

While this guide provides direction in many cases, DEQ may have to adjust specific effluent limits in a permit to address site-specific concerns and conditions.

1.2 Relationship to Existing Rules and Guidance

This guide is not intended to be a stand-alone document; rather, it supports implementation of the Clean Water Act (CWA), Idaho Code and administrative rules, federal regulations, and state and national policies, guidance, and standards. These include compliance with Idaho's "Water Quality Standards" (IDAPA 58.01.02), "Wastewater Rules" (IDAPA 58.01.16), and "Rules Regulating the IPDES Program" (IDAPA 58.01.25).

Some sections of this guide are newly developed to address rules, regulations, and conditions specific to Idaho, while other sections represent an adaptation of existing state and US Environmental Protection Agency (EPA) guidance documents, including but not limited to:

- *NPDES Permit Writer's Manual* (EPA 2010): *https://www3.epa.gov/npdes/pubs/pwm_2010.pdf*
- *Technical Support Document for Water Quality-based Toxics Control* (EPA 1991): *https://www3.epa.gov/npdes/pubs/owm0264.pdf*
- *NPDES Decision Analysis Report #2 – Appendix 4. Guidance for Water Quality-Based Effluent Limits* (DEQ 2002): *www.deq.idaho.gov/media/529907-npdes_primacy_report2.pdf*

This guide does not replace, supplant, or change any requirements under state or federal rules and regulations but does identify and reference relevant regulations, policies, and other guidance documents.

1.2.1 Clean Water Act Background

The Federal Water Pollution Control Act, or CWA, is the primary US law addressing pollutants in receiving waters (e.g., streams, rivers, lakes, and reservoirs). The CWA was originally enacted in 1948 and was revised by significant amendments in 1972 (P.L. 92-500), and to a lesser degree in 1977 (P.L. 95-217) and in 1981 (P.L. 97-117). The most recent major amendments to the CWA were made in 1987 (P.L. 100-4). A major part of the CWA is a requirement for controls on discharges to meet the statutory goal of reducing the discharge of pollutants under the National Pollutant Discharge Elimination System (NPDES) permit program.

1.2.2 Idaho Water Quality Standards

A water quality standard defines the water quality goals for a water body. Water quality-based effluent limits (WQBELs) in IPDES permits are a mechanism to achieve and maintain water quality standards in specific receiving waters. The federal water quality standards[1] describe state requirements and procedures for developing water quality standards and EPA procedures for reviewing and, where appropriate, promulgating water quality standards. Idaho's water quality standards were developed in accordance with these federal requirements.

1.3 Regulatory Citations

The following conventions are used to cite legislation and regulations throughout this guide:

- Idaho Code—Title of the code follow by the code citation: "Approval of State NPDES Program" (Idaho Code §39-175C). After initial use, the code is then referred to by the citation (e.g., Idaho Code §39-175C).
- Idaho Administrative Rules—Title of the rule is followed by the rule citation: "Rules Regulating the Idaho Pollutant Discharge Elimination System Program" (IDAPA 58.01.25). After initial use, the rule is then referred to by the rule citation (e.g., IDAPA 58.01.25).
- Code of Federal Regulations—Initial and subsequent references to CFRs use the regulation citation (e.g., 40 CFR 136).
- US Code—Initial and subsequent references to US code use the code citation (e.g., 16 U.S.C. §1531 et seq. or 33 U.S.C. §§1251–1387).
- Clean Water Act (CWA)—Title of the act is followed by the act citation: Clean Water Act section 402 (e.g., CWA §402). After initial use, the act is then referred to by the act citation (e.g., CWA §402).

Guidance and other documents are referenced in full citation when used for the first time. Applicable IDAPA and CFR references are often included as endnotes after the appendices.

2 Data Analysis and Considerations

2.1 Background

The inherent variability of environmental data makes it important to obtain a sufficient quantity and quality of samples to accurately characterize a water body or effluent. Limited data result in greater statistical uncertainty and increases variability. When data quantity and quality increase, the methods used to determine reasonable potential to exceed (RPTE) water quality standards and to set WQBELs are more robust. Therefore, permittees often benefit from having a sufficient quantity and quality of data available for regulatory decision making.

DEQ, EPA, and permittees collect data on effluent and in-stream ambient waters for use in a variety of applications, including:

- Determining if water bodies are achieving water quality standards;
- Estimating effluent concentrations and variability for permit development and compliance; and
- Estimating background concentrations for total maximum daily load (TMDL) wasteload allocations (WLAs).

To ensure that data collected for regulatory decision-making are valid and not affected by contamination from sampling or analytical techniques, quality control must be incorporated in all sampling event planning, collection, preparation, and analysis activities.

Sampling and analytical methods used to determine compliance must conform to 40 CFR 136, which is referenced in IDAPA 58.01.02 and incorporated by reference in 58.01.25, unless otherwise specified in the IPDES permit. Procedures for conducting clean and ultra-clean metal analysis, and procedures for conducting biological tests should be based on EPA-approved procedures as described in IDAPA 58.01.02.090.02 – 03.

Quality control requirements for trace metals sampling and analysis are rigorous because of the high risk for inadvertent sample contamination. Trace level metals data can be compromised by contamination during standard sampling, filtration, storage, and analysis. Procedures referred to as “clean sampling” and “ultra-clean sampling” have been developed by EPA to provide guidance in planning and executing sample collection and analysis. Additional information is provided in the draft *Guidance on the Documentation and Evaluation of Trace Metals Data Collected for Clean Water Act Compliance Monitoring* (EPA 1996a) and *Method 1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels* (EPA 1996b).

Finally, any test result used should be representative of current and projected effluent quality. If any significant process or analytical method changes occurred at a facility that could substantially affect the effluent characterization, then only data collected subsequent to those changes should be used for RPTE and WQBEL calculations.

2.2 Statistical Software

DEQ’s *Statistical Guidance for Determining Background Ground Water Quality and Degradation* (DEQ 2014) identifies that the development of robust statistical analysis requires clear documentation of software used in the analysis, including version numbers and relevant information on the software source and publisher. The use of nonstandard methodologies should be avoided to minimize interpretational problems or inappropriate conclusions. All software should be well documented and widely accepted as to its utility in the kind of statistical analyses performed for developing effluent limits.

EPA’s ProUCL v.5.1 statistical software is an example of acceptable software due to its ease of use, documentation, acceptance, and availability. The software is available for free and can be downloaded at *https://www.epa.gov/land-research/proucl-software*. It is easy to install and includes analysis tools for generating summary statistics for evaluating a RPTE.

2.3 Method Detection Limit (MDL) and Minimum Level (ML) of Quantitation

2.3.1 MDL and ML Definitions

Throughout this section, the terms MDL and ML always refer to the MDL or ML identified in an IPDES permit.

Because many water quality criteria, as well as effluent and receiving water data, are at trace levels, analytical results of samples may yield concentrations not considered detectable (e.g., < MDL) or quantifiable (e.g., < ML) by the analytical method used by the laboratory. Consequently, data sets may include uncensored values (e.g., a measured or quantified value) and censored data (e.g., reported by the lab as below MDL or ML). The differences between MDL and ML, and how censored data are handled for RPTE and WQBEL calculations is an important component of the effluent development process (EPA 2005). The proper use of censored values in permit compliance determinations is also critical, and is addressed in sections 2.3 – 2.4.

This issue continues to evolve on both technical and policy levels, and may be revised as appropriate or adjusted on a permit-specific basis at DEQ's discretion. DEQ is utilizing EPA definitions of MDL and ML in the absence of establishing its own list of approved test methods and definitions, with corresponding detection and quantitation levels. EPA defines MDL as (Appendix B of 40 CFR 136):

> …the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

EPA specifies that the laboratory is required to determine the MDL for each analyte in accordance with the procedures in that part.

EPA defines ML as (40 CFR 136):

> …the level at which the entire analytical system must give a recognizable signal and acceptable calibration point for the analyte. It is equivalent to the concentration of the lowest calibration standard, assuming that all method-specified sample weights, volumes, and cleanup procedures have been employed.

MLs are given for specific methods by EPA; for example, EPA 1600 series method provides MLs. EPA guidance (1996c) suggests that an interim ML (IML) should be calculated when a method specified ML does not exist; the IML[i] is equal to the MDL multiplied by 3.18.

It is difficult to demonstrate compliance when limits are lower than the laboratory levels achievable with approved analytical method. However, just reporting MLs does not properly address the statistical accuracy of approved laboratory techniques.

[i] IML = MDL x 3.18

For example, there are several different methods approved under 40 CFR 136 for the analysis of some pollutants with differing sensitivities and quantitation levels (e.g., mercury). It is important to apply the appropriate technique and ML for the specific pollutant and media being sampled. Different methods are appropriate for measuring mercury concentrations in receiving water than measuring mercury concentration in biosolids. Biosolids do not need Method 1631E, and requiring use of 1631E for biosolids would decrease the accuracy of the measurement due to the need for dilutions required to get the sample into the analytical range.

2.3.2 Calculations Using Values < MDL or < ML

To calculate average pollutant concentrations and average mass loads, use the numeric value of the MDL for each individual lab result that is less than the MDL, and use the numeric value of the ML for each individual lab result that is between the MDL and the ML.

2.3.2.1 Reporting Calculations of Average Values

If the resulting average pollutant concentration value is less than or equal to the MDL, report "less than {numeric value of the MDL}." If the average value is greater than the MDL but less than the ML, report "less than {numeric value of the ML}." If a value is equal to or greater than the ML, report and use the actual value. Compare the resulting average value to the compliance level in assessing compliance.

2.3.2.2 Mass Calculations

To calculate mass loads on each day the parameter is monitored use the following equation:

*Flow (MGD) * Concentration (mg/L) * 8.34((lbs * L)/(mg*MG)) = Mass (lbs/day)*

Use the following when calculating mass load:

- When concentration data are below the MDL, use the MDL to calculate the mass load, and report as less than (<) the calculated mass. For example, if flow is 2 MGD and the reported sample result is <0.001 mg/l (1.0 µg/L):
  - Mass load on the DMR = 0.001 mg/L * 2 MGD * 8.34
  - Mass load on the DMR = 0.01688 lbs/day (round to 0.02 and report "< 0.02 lbs/day")
- When concentration data are below the ML, use the ML to calculate the mass load, and report as less than (<) the calculated mass. For example, if flow is 2 MGD and the reported sample result is <0.005 mg/L (5.0 µg/L):
  - Mass load on the DMR = 0.005 mg/L * 2 MGD * 8.34
  - Mass load on the DMR = 0.0834 lbs/day (round to 0.08 and report "<0.08 lbs/day")
- When concentration data are equal to or greater than the ML, use the laboratory reported value.

2.4 Compliance with WQBELs below MDL or ML

If a RPTE exists, DEQ will establish WQBELs in a permit. At times, DEQ will calculate WQBELs that are below the MDL or ML (Figure 1). In those cases DEQ will establish a compliance evaluation level as appropriate. The permittee will monitor according to their permit, using an approved analytical method for the pollutant. DEQ will determine compliance with concentration and mass limits as follows:

- When the WQBEL is less than the MDL, effluent levels less than the MDL are in compliance with the WQBEL.
- When the WQBEL is less than the MDL, effluent levels greater than the MDL, but less than the ML, may not be in compliance with the WQBEL, unless analytically and statistically confirmed to be below the MDL by a sufficient number of samples, analyses, and use of appropriate statistical techniques.
    - DEQ may require additional monitoring when effluent levels are between the MDL and the ML.
    - DEQ may include as a permit condition that analytical results above the MDL, but below the ML, will trigger an investigation and possible corrective actions.
- When the WQBEL is greater than the MDL, but less than the ML, effluent levels less than the ML are in compliance with the WQBEL.

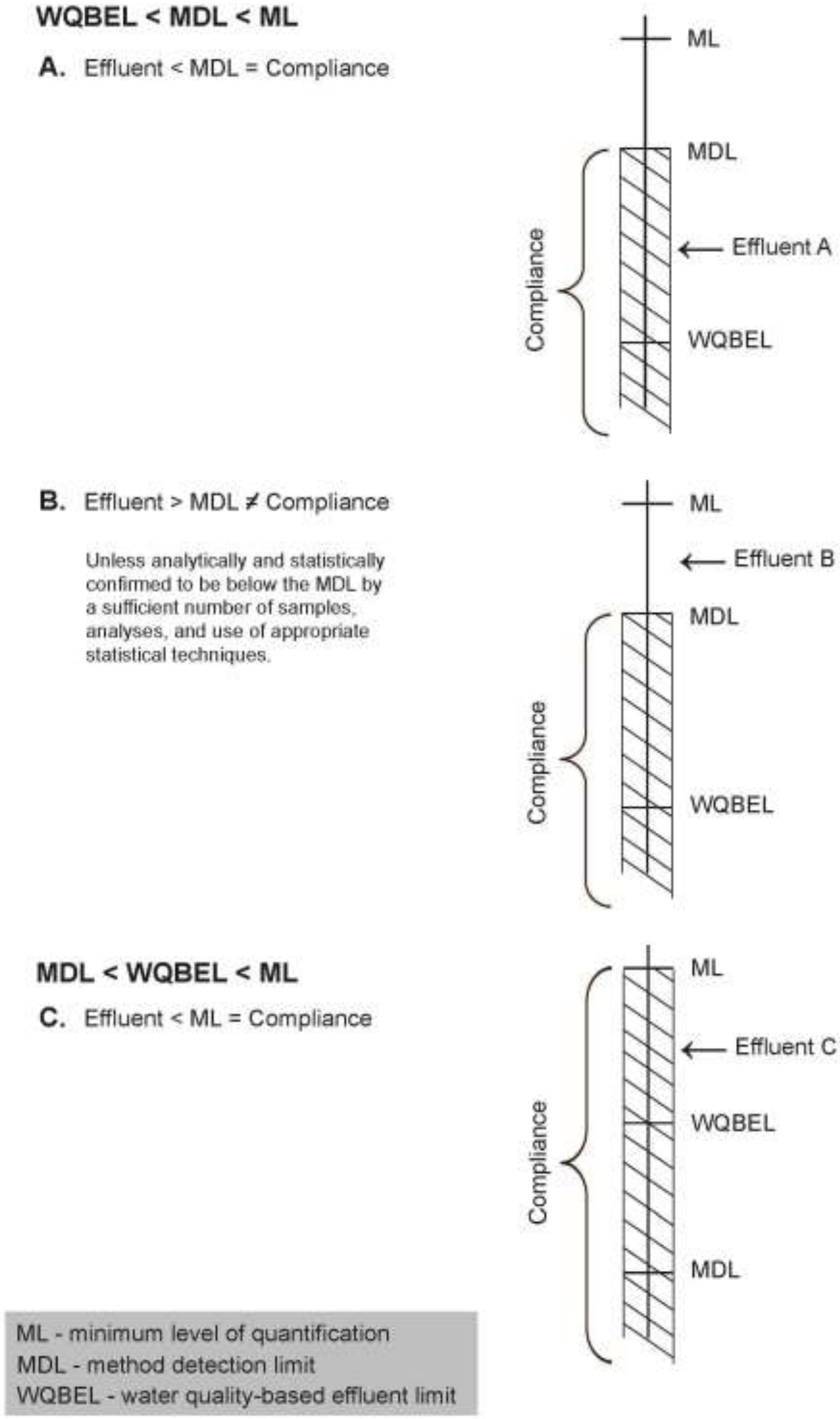

Figure 1. Compliance with water quality-based effluent limits.

2.5 Alternate Test Procedure

When appropriate, any person may submit a written application for review of an alternate test procedure (ATP; alternate method) for nationwide use to the National Alternate Test Procedure (ATP) Program Coordinator[2]. Alternatively, any person may request DEQ, as the permitting authority, to approve the limited use of an alternate test procedure (ATP)[3]. After reviewing the application, DEQ will notify the applicant of approval or rejection of the use of the ATP. DEQ may restrict the approval to a specific discharge or facility (and its laboratory) or, at DEQ's discretion, to all Idaho dischargers or facilities (and their associated laboratories) as specified in the approval. If DEQ does not approve the application, DEQ will specify what additional information might lead to a reconsideration of the application.

2.6 Significant Figures, Rounding, and Precision

Much of the information in section 2.6 was adapted from the Oregon's *The Use of Significant Figures and Rounding Conventions in Water Quality Permit* (ODEQ 2013).

2.6.1 Significant Figures

Regardless of the measuring device, there is always uncertainty in a measurement. Significant figures include all of the digits in a measurement that are known with certainty plus one more digit, which indicates the uncertainty of the measurement. For example, a mass reported as 1.1 g indicates the measurement is accurate to the nearest 0.1 g (i.e., the actual mass is between 1.0 and 1.2 g), but if the measurement is 1.10 g it is accurate to the nearest 0.01 g. This has implications both for permit limit development and for establishing compliance with a permit limit. Table 1 lists the significant figure conventions used by the IPDES Program.

Table 1. IPDES conventions for significant figures.

Conventions	Examples	Number of Significant Figures
1. All non-zero digits (1-9) are to be counted as significant.	23	2
	231	3
2. All zeros between non-zero digits are always significant.	4308	4
	40.05	4
3. For numbers that do not contain decimal points, the trailing zeros may or may not be significant. In this situation, the number of significant figures is ambiguous.	470,000	2 to 6
4. For numbers that do contain decimal points, the trailing zeros are significant.	0.360	3
	4.00	3
5. If a number is less than 1, zeros that follow the decimal point and are before a non-zero digit are not significant.	0.00253	3
	0.0670	3

As indicated in the third convention above, numbers that contain trailing zeros but do not contain decimal points can be problematic. For example, "10" could be either one or two significant figures. There is no way to know what was intended unless there is a note that explicitly states how many significant figures there are.

Replacing “10” with “10.” is not a robust solution to this problem since Excel replaces “10.” with “10” and the information that the user intended to provide is lost.

The problem of how to interpret numbers with trailing zeros is pervasive enough that EPA changed the Maximum Contaminant Level (MCL) for arsenic in drinking water from 10 ppb to 0.010 ppm to clarify the number of significant figures associated with the MCL.

2.6.2 Rounding

In reporting results and calculating permit limits or mass loads, it is necessary to round the results to the correct number of significant figures. There are different rounding conventions in use, and the IPDES Program will utilize a hybrid approach in which the rounding convention used for a number ending in 5 depends on the context. In reporting measured values, 5 is rounded to the nearest even number. For calculated values, 5 is rounded up. Table 2 lists the IPDES rounding conventions used.

Table 2. IPDES conventions for rounding calculated and measured values.

Conventions for Rounding	Examples	
	Rounding Off Calculated Values	Rounding Off Measured Values
1. If the digit being dropped is 1, 2, 3 or 4, leave the preceding number as-is.	1.11 → 1.1 1.12 → 1.1 1.13 → 1.1 1.14 → 1.1	Same
2. For calculations: if the digit being dropped is 5, round the preceding digit up.	1.15 → 1.2 1.25 → 1.3	N/A
3. For measurements: If the digit being dropped is 5, round the preceding digit to the nearest even number (0 is considered an even number when rounding).	N/A	1.15 → 1.2 1.25 → 1.2
4. If the digit being dropped is 6, 7, 8 or 9, increase the preceding digit by one.	1.16 → 1.2 1.17 → 1.2 1.18 → 1.2 1.19 → 1.2	Same

A shorthand version of the information presented is as follows:
• Calculated values– the digit 5 should be rounded up, unless the permittee has chosen to follow the convention for measured values. The permittee must do so on a consistent basis.
• Measured values – the digit 5 should be rounded to the nearest even number.

This hybrid approach is utilized because for calculated results, rounding of 5 is consistent with the convention used by Microsoft Excel software, which is utilized extensively by the IPDES Program to perform RPA-related calculations. If commercial software packages and spreadsheets employ a different rounding routine, the analyst should not change the results generated by the software. For measured values, rounding of 5 to the nearest even number is consistent with *Standard Methods for the Examination of Water and Wastewater* (APHA, AWWA, WEF 1999). If a permittee chooses to use the same convention for calculated values as for measured values, the permittee may do so, provided they consistently do so.

2.6.3 Reporting Significant Figures

Two types of permit limits include:

- Those for which compliance is determined based on the results of a laboratory or field measurement; and
- Those for which compliance is based on the results of a calculation.

If compliance is established based on a laboratory or field measurement, the number of significant figures in the permit limit should be the same as the number of significant figures associated with the laboratory or field measurement methodology.

If compliance is determined based on the results of a calculation, the number of significant figures in the permit limit should be determined in a manner that is consistent with the IPDES conventions for determining the number of figures to report (Table 3).

Table 3. IPDES conventions for determining the number of figures to report.

Convention	Example
1. For addition or subtraction. The number of decimal places in the result is equal to the number of decimal places in the least precise value used in the calculation. *Note*: the number of decimal places is equal to the number of digits to the right of the decimal point.	13.681 – 0.5 = 13.181 becomes 13.2 0.5 is reported to only one decimal place so the final answer has one decimal place. *Note*: the number of digits in the answer is determined by the number of decimal places in the least precise measurement, and not by the number of significant figures.
2. For multiplication or division. The number of significant figures in the result is equal to the smallest number of significant figures of the values used in the calculation.	2.5 x 3.42 = 8.55 becomes 8.6 2.5 has the fewest significant figures (two) so the final result has two significant figures.
3. For calculations involving multiple arithmetic operations. The number of significant figures is determined by rules 1 and 2 above, with arithmetic operations performed in the following order: a. Operations in parentheses b. Multiplication c. Division d. Addition e. Subtraction In a situation with multiple operations it is important not to round answers after each intermediate step. Instead keep track of the right most digit that would be retained based on rules 1 and 2 above (shown in the example on the right by an underline). The order of operations is seldom an issue in permitting. This information is included for completeness.	(2.5 x 3.42) + 13.681 – 0.5 = 22.731 becomes 22.7 1) First do the operation in parenthesis (in this case multiplication – rule 2 above) = 8.55 + 13.681 – 0.5 2) Next perform addition - Rule 1 above = 22.231 – 0.5 3) Then subtraction – rule 1 above = 21.731 all digits carried through = 21.7 final rounding In step 1, (based on rule 2), 8.55 would only be reported to two significant figures (retaining one decimal place). In this case, one place to the right of the decimal is the limiting digit for steps 2 and 3, and therefore the final result is reported to one decimal place.
4. For values that are not considered. Values that are considered “exact” numbers are not included in the determination of the final number of significant figures. Here are some examples of exact values: **a. Design flow of a treatment facility.** By contrast, the measured flow at a facility is not an exact number and does affect the number of significant figures in a calculation. Measured flows at treatment plants typically have two significant figures. **b. Conversion factors.** These should be selected so that the number of digits is at least that associated with measured values used in a calculation.	**Example 1:** For a POTW with a design flow of 1.5 MGD, the mass load of a pollutant measured at 5.25 mg/L is calculated as follows: 5.25 mg/L x 1.5 MGD flow x 8.34 = 65.7 lbs The result contains three significant figures because the concentration of 5.25 contains three significant figures. The other numbers in the calculation, 1.5 MGD (design flow) and 8.34 (conversion factor), have no effect on the number of significant figures in the result. Note that if the MGD of the facility were measured at the plant rather than being supplied by the design engineer, the number of significant figures

c**. Values below the MDL or ML.** Where the permittee uses <{value of MDL} or <{value of ML} when averaging, the MDL and ML are considered "exact" numbers and are not included in the determination of the final number of significant figures. **d. Counted values such as:** i. Bacteria measurements ii. The number of samples iii. Values denoting time (days, months, etc.)	associated with the flow would matter. Flow measurements typically have two significant figures. Example 2: What is the average of the following three concentrations: 4.6 mg/L, 2.3 mg/L and ≤ MDL or ML Where ML = 0.1 Answer: (4.6 + 2.3 + 0.1)/3 = ≤2.3 mg/L The number of significant figures is equal to the number of significant figures for the detected concentrations. The 0.1 MDL value and the 3 in the denominator (a counted value) do not affect the number of significant figures or decimal places in the final rounding.

2.7 Sample Size, Data Normality, and Outliers

Much of the information in section 2.7 was adapted from the DEQ's *Statistical Guidance for Determining Background Ground Water Quality and Degradation* (DEQ 2014).

2.7.1 Sample Size

This section specifically addresses quantifiable measurements above the detection limit not affected by censoring. Procedures for dealing with censored data are discussed in sections 2.3–2.4. The quality and quantity of available monitoring data are two of the most important factors in determining effluent and water quality. Individual samples are only representative of water quality at a particular time in a particular location, which often varies seasonally or changes with time and location. The greater the number of independent samples collected over time, the more representative the characterization of the effluent or water quality. Larger sample populations also increase the statistical confidence in the evaluation of effluent and water quality. Valid statistical testing depends upon collection of adequate data. Statistical tests rely on using estimates of the true mean and true variance of a population. For example, the estimate of the true mean is the average of the data points collected. The estimate of the true standard deviation is the standard deviation of the data points collected.

The number of samples needed to conduct a statistical analysis depends on the site-specific conditions, which in turn controls the data variability. EPA's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Unified Guidance* (EPA 2009) recommends a minimum of 8 to 10 independent samples be available to estimate the standard deviation of a parametrically distributed statistical population (e.g., normal, gamma or lognormal distributions). DEQ recommends collecting 12 independent samples for most IPDES statistical analysis methods. In stark contrast, a tolerance interval estimate for a nonparametric distribution may require a minimum of 59 independent data points to achieve 95% coverage[ii] at 95% confidence (Conover 1999, EPA 2009, Gibbons 1994).

In other situations, such as the presence of a seasonal trend, the Seasonal Kendall Test requires a minimum of 3 years of monthly data, or 36 data points (Gilbert 1987). When quarterly data are sparse, the Kruskal-Wallis test can be used as long as there are at least 3 years of quarterly data collected in the same months (a minimum of 12 independent data points). To quantify serial correlation effects (temporal dependence), Harris et al. (1987) state that at least 10 years of quarterly data, or 40 data points, may be necessary.

As illustrated in the previous paragraphs, **adequate sample size varies on a case-by-case basis and is a site-specific decision that must consider factors unique to each project and site.** The goal of determining sample size for statistical analyses is to find the number of samples that provides adequate yet practically feasible evidence with which meaningful conclusions can be made. DEQ, in consultation with permittees, as appropriate, will make the final determination of what constitutes adequate sample size.

2.7.2 Data Normality

EPA has determined that daily measurements of many pollutants follow a lognormal distribution (EPA 2010). Procedures in this guide allow permit writers to project a critical effluent or background concentration (e.g., the 99th or 95th percentile of a lognormal distribution of effluent concentrations) from a limited data set using statistical procedures based on the characteristics of the lognormal distribution. These procedures use the number of available effluent data points for the measured concentration of the pollutant and the coefficient of variation (CV) of the data set, which is a measure of the variability of data around the average, to predict the critical pollutant concentration. Figure 2 provides an example of a lognormal distribution of effluent pollutant concentrations and projection of a critical effluent pollutant concentration (C_d).

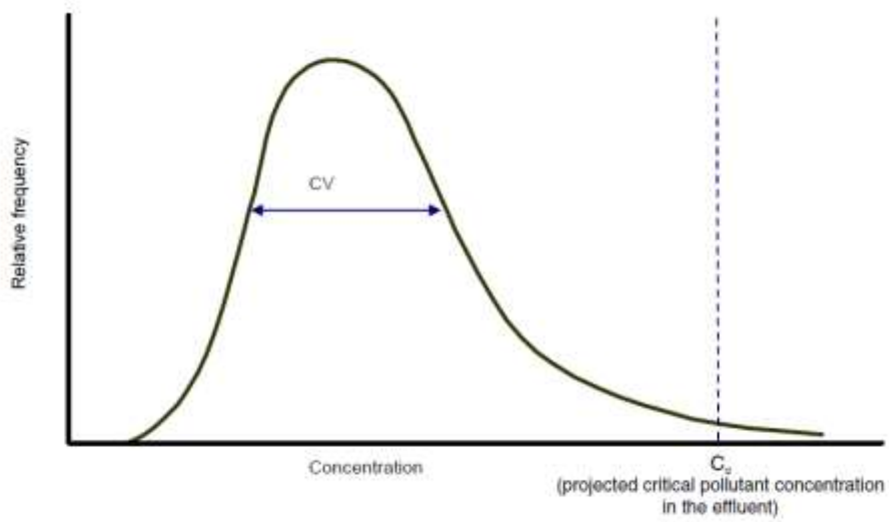

Figure 2. Example of lognormal distribution of effluent pollutant concentrations and projection of critical concentration (Cd) (EPA 2010).

[ii] where 95% of future samples will fall within the interval

For pollutants that do not follow a lognormal distribution, DEQ will rely on alternative procedures to determine the critical pollutant concentration (e.g., evaluate the distribution as gamma or non-parametric) (DEQ 2014; EPA 2009, 2013a, 2013b).

2.7.3 Outlier Analysis

In any effluent or water body data set, it is possible that outliers (anomalous results) will exist. Outliers can have one of three causes: (1) a measurement or recording error, (2) an observation from a different population, or (3) a rare event with a very low probability of occurrence. Outliers can be discarded from the data set with adequate justification. For example, a valid justification for removing an outlier would be the simultaneous occurrence of extreme values in four independent data sets on the same day. This type of event would strongly suggest either a field contamination issue or a lab error. The EPA's Unified Guidance (EPA 2009) and ProUCL manuals (EPA 2013a, 2013b) provide additional guidance on how outliers should be handled.

For example, EPA's ProUCL statistical software evaluates data with the Dixon's or Rosner's tests at a specified significance level (recommend 5%). Rosner's test is used for datasets with $n \geq 25$ and Dixon's test is used for datasets with $n < 25$. Chapter 12 of EPA's Unified Guidance (EPA 2009) identifies the assumptions and requirements for Dixon's and Rosner's tests.

In addition, DEQ will adhere to the following guidelines for outlier inclusion/exclusion and correction measures:

- If an error in transcription, dilution, or analytical procedure can be identified and the correct value recovered, the observation should be replaced by its corrected value and further statistical analysis performed with the corrected value.
- If the observation is in error but the correct value cannot be determined, the observation should be removed from the data set and further statistical analysis performed on the reduced data set. The observation removal and the reason for its removal should be documented when reporting results of the analysis.
- If no error in the value can be documented, it should be assumed that the observation is a true but extreme value. In this case, the value should not be altered or removed. However, it may be helpful to obtain another observation in order to verify or confirm the initial measurement.

3 Determining Technology-Based Effluent Limits (TBELs)

4 Determining Water Quality-Based Effluent Limits (WQBELs)

5 Final Effluent Limits and Antibacksliding

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Key Terms

Citations for key terms used in this guide are provided below. To see the official definition for a term, users should go directly to the rule that is referenced.

Term	IDAPA, CFR, or CWA Citation
Antibacksliding	Clean Water Act section 402(o).
Application	IDAPA 58.01.25.010.03.
Background	IDAPA 58.01.25.010.08.
Balanced, Indigenous, Community (or Population)	40 CFR 125.71(c).
Best Management Practices (BMPs)	IDAPA 58.01.25.010.09.
Biochemical Oxygen Demand (BOD)	IDAPA 58.01.25.010.10.
Compliance Schedule or Schedule of Compliance	IDAPA 58.01.25.010.17.
Direct discharge	IDAPA 58.01.25.010.24.
Discharge	IDAPA 58.01.25.010.27.
Discharge Monitoring Report (DMR)	IDAPA 58.01.25.010.26.
Discharge of a Pollutant	IDAPA 58.01.25.010.28
Draft Permit	IDAPA 58.01.25.010.29
Effluent	IDAPA 58.01.25.010.30
Effluent Data	40 CFR 2.302(a)(2)(i)–(ii)
Effluent Limitation	IDAPA 58.01.25.010.31
Effluent Limitation Guidelines (ELG)	IDAPA 58.01.25.010.32
Facility or Activity	IDAPA 58.01.25.010.38
Fundamentally Different Factors	IDAPA 58.01.02.010.39
General Permit	IDAPA 58.01.02.010.40

Hydrologically-Based Design Flow	IDAPA 58.01.02.010.50 • 1Q10 (IDAPA 58.01.02.210.03.b.i) • 1B3 (IDAPA 58.01.02.210.03.b.ii) • 7Q10 (IDAPA 58.01.02.210.03.b.iii) • 4B3 (IDAPA 58.01.02.210.03.b.iv) • Harmonic Mean Flow (IDAPA 58.01.02.210.03.b.v)
Idaho Pollutant Discharge Elimination System (IPDES)	IDAPA 58.01.25.010.42
Indirect Discharger	IDAPA 58.01.25.010.45
Intake Pollutant	IDAPA 58.01.25.303.07.a.i
Load Allocation (LA)	IDAPA 58.01.25.010.50
Major Facility	IDAPA 58.01.25.010.51
Method Detection Limit (MDL)	40 CFR 136, Appendix B
Minimum Level (ML)	40 CFR 136, Table 2
Mixing Zone	IDAPA 58.01.25.010.54
Municipality	IDAPA 58.01.25.010.55
National Pollutant Discharge Elimination System (NPDES)	IDAPA 58.01.25.010.56
New Discharger	IDAPA 58.01.25.010.57
New Source	IDAPA 58.01.25.010.58.a
Owner or Operator	IDAPA 58.01.25.010.62
Permit	IDAPA 58.01.25.010.63
Person	IDAPA 58.01.25.010.64
Point source	IDAPA 58.01.25.010.65
Pollutant	IDAPA 58.01.25.010.66
Pretreatment	IDAPA 58.01.25.010.68
Process Wastewater	IDAPA 58.01.25.010.71
Publicly Owned Treatment Works (POTW)	IDAPA 58.01.25.010.73
Reasonable Potential Analysis (RPA)	58.01.25.302.06.a.ii–vi
Reasonable Potential to Exceed (RPTE)	58.01.25.302.06.a.ii–vi
Recommencing Discharger	IDAPA 58.01.25.010.75

Secondary Treatment	IDAPA 58.01.25.010.78
Sewage Sludge	IDAPA 58.01.25.010.84
Source	IDAPA 58.01.25.010.90
Storm Water	IDAPA 58.01.25.010.94
Technology-Based Effluent Limitation (TBEL)	IDAPA 58.01.25.010.95
Total Maximum Daily Load (TMDL)	IDAPA 58.01.02.010.100
Treatment Works Treating Domestic Sewage (TWTDS)	IDAPA 58.01.25.010.100
Variance	IDAPA 58.01.25.103
Wasteload Allocation (WLA)	IDAPA 58.01.25.010.104
Water Body (Unit)	IDAPA 58.01.02.010.110
Water Quality-Based Effluent Limitation (WQBEL)	IDAPA 58.01.25.010.107
Waters of the United States	IDAPA 58.01.25.003.aa
Whole Effluent Toxicity	IDAPA 58.01.25.010.110

Appendix A.

Endnotes: IDAPA and CFR References

[1] 40 CFR 131
[2] 40 CFR 316.4
[3] 40 CFR 136.5