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Stakeholder Workgroup Pollutant Guidance Recommendations

Idaho Pollutant Discharge Elimination System

Effluent Limit Development Guidance

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Submitted to:

Idaho Department of Environmental Quality

Submitted by:

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1 Introduction

IPDES permit writers should consider contemporary issues from many perspectives including water quality, data collection, laboratory analysis, treatment, and issues relevant to citizens of the State of Idaho. The following guidance provides additional direction for special topics. IPDES implementation will be an evolving experiment on the topics in this Appendix<?>, as it has been and will continue to be in other states for toxics, temperature and nutrients. Thus, the IPDES program will have to address interesting and difficult issues. The program is anticipated to adaptively manage new implementation approaches to address these emerging as they occur in permits. This current guidance version is anticipated to be a framework that allows innovation and flexible approaches moving forward.

2 Toxics

Toxics are a broad group of chemicals that can have a toxic effect on living organisms. The CWA Section 307(a) "priority" pollutants are a subset of this group of pollutants. The Technical Support Document for Water Quality-based Toxics Control (EPA 1991; TSD) provides a foundation for evaluating toxics; however, the document is dated and Idaho permit writers should be aware of current issues regarding toxics such as those described below. The following matrix provides an overview of toxics and topics to consider.

Category	**Ammonia**	**BLM**	**Metals** **Cd Pb Zn** **Arsenic**	**Hg**	**HHC** **PCBs** **Phthalates** **Plus Others**
Characterize Effluent (stats test) (clean data validity)	Toxic and dissolved oxygen impacts MPEC 95th	Copper	Cause of background Intake variance	MPDEC Geometric mean	Blank correction
Characterize Receiving Water (stats test) (clean data validity)	Little or no ambient Mixing Zone	Mixing zone Geometric mean	Mixing zone Geometric mean	Geometric mean	Mixing zone Geometric mean Blank correction
Applicable Water Quality Standards	Appropriate frequency and duration	Updates to criteria	WER (BLM*) Recalculation 304(a) criteria	Fish tissue	Probabilistic approach Variances
Alternative Reg. Approaches	2013 Federal Appendix N	Revisions	Mixed hardness CTs	Minimization	Manage by Congeners
Need for WQBELs (RPA)	Monte Carlo Mixed pH	Monte Carlo	TSD	DEQ guidance	Plausible cause and reductions

Find WQBELs (interim and final)	Monte Carlo	Monte Carlo	Plausible cause and reductions	Dental BMPs	Toxic management plans Congener cap

2.1 Characterize the Receiving Water

The permit writer has a responsibility to understand the data used to characterize the receiving water (and the effluent). The permit writer should examine the data and identify issues that necessitate investing the background of the data values. Examples of these issues include the following.

Are the data relevant? Have conditions changed such that older data are no longer applicable to the current situation. Many waters in Idaho are regulated, for agriculture, flood control, flows for aquatic species, hydropower, navigation, recreation, and/or other purposes. These modifications result in the alteration of the hydrologic characteristics and biological potential for some waters. Occasionally the operational rules for regulating the flows change and can affect water quality. If the water quality data are not representative of the flow conditions for the permit, then these data should not be used.

Are the data representative? If the data have issues, including but not limited to: sampling or monitoring protocol irregularities, outliers, or Quality Assurance/Quality Control (QA/QC), then the permit writer should censor the data.

How were the data collected? The water quality standards for many toxics are set at extremely low concentrations, (e.g., microgram, nanograms, and picograms). Appropriate protocols and methods (e.g. duplicates, blanks…) must be followed during the data collection or samples could easily be contaminated. If collection methods contaminate the sample, the data should be blank corrected or censored and the data should be collected using appropriate methods and results should be appropriately handled (e.g. blank adjusted where needed).

What laboratory method was used to analyze the sample? There are various methods for the laboratory analysis of toxics, including approved and unapproved methods. Additionally these methods may have different detection levels. The permit writer should use caution when assessing a dataset when the results are based on different methods and different detection levels.

What is the data distribution? The permit writer should generally use the geometric mean. However, additional statistical analysis of the data to evaluate the data distribution (e.g. using ProUCL software) may be necessary. The use of the geometric mean for background should be used by the permit writer for toxic pollutants. The Great Lakes Water Quality Initiative of 1995 (multi-state & EPA regions) is the most recent and comprehensive toxics rule-making in the US and uses a geometric mean for the background[1] While the TSD is silent on this issue, DEQ's previous WQBELs guidance used the geometric mean.

- Unless determined otherwise by statistical analysis, use geometric mean for receiving water concentrations.

2.2 Identify Applicable Water Quality Standards

Water quality standards to protect aquatic organisms and human health can be complex and dependent on including fish tissue concentrations, hardness, pH, temperature, water effect ratios (WERs), and/or other variables.

- Review toxic criteria that exist to protect both aquatic life and human health. Because aquatic life and human health differ in sensitivity to various toxins, the parameters for which criteria are set, as well as their levels, usually differ as well.
- In establishing the applicable criteria that are depended on other parameters, such as ammonia criteria based on pH and temperature, and metals criteria based on hardness, it is appropriate to used values for these parameters that recognize effluent mixing in the receiving water at the allowable dilution (use mixed hardness, mixed pH).

2.3 Characterize the Effluent

The permit writer has a responsibility to understand the data used to characterize the effluent (see section Characterize the Receiving Water). Many factors can influence the influent and effluent water quality. The permit writer should understand these factors, many of which are included in the IPDES application. The influent can be impacted by inflow/infiltration, pretreatment, significant industrial users, categorical users, and other factors. The effluent is impacted by the treatment processes and operations at the facility.

- Confirm critical conditions are accurate and representative. Accurate and representative data must meet appropriate data collection protocols, QA/QC requirements (e.g. blank correction); post analytical statistical methods (e.g. data censoring as appropriate), and other factors (e.g. usual influent sources; non-representative sampling event…).

2.4 Regulatory Approach

Setting effluent limitations for toxics, particularly at extremely low and unattainable levels maybe appropriate provided other conditions and approaches also included (e.g. variances; pollution minimization plans; integrated plans; toxics reduction strategies, fish tissue monitoring, etc.). The permit writer should consider inserting other regulatory approaches into the permit when an analysis would be based on poorly characterized receiving water and/or effluent. The permit writer should consider an enhanced monitoring effort where the water is poorly characterized. The permit writer may consider a minimization and/or source identification program. The results can support improvement to pollution minimizations plans, purchasing policies, and source specific pretreatment requirements. The permit writer can consider more in-depth studies of the

[1] USEPA, 1995, Great Lakes Water Quality Initiative, https://www.epa.gov/gliclearinghouse/about-great-lakes-initiative

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pollutant and its potential impact on the receiving water such as a Biotic Ligand Model (BLM study), fisheries study, evaluation of hardness, management plans, and/or other studies. Another approach for the permit writer to consider is an assessment of the subcomponents of a pollutant, for example individual congeners or a smaller sub-set of the congeners occurring or responsible for the majority of the Human Health risk.

- Check for additional guidance documents on specific toxics. For example: Implementation Guidance for the Idaho Mercury Water Quality Criteria[2].
- Aquatic life criteria for metals are expressed in the dissolved form, but permit limits by EPA regulation must be expressed in the total or total recoverable form. There are default conversion factors identified in the water quality standards, but site specific alternative values can be used, referred to as the Chemical Translator (CT) (EPA, The Metals Translator: Guidance for Calculating a Total Recoverable Limit from a Dissolved Criterion, June 1996).

2.5 Evaluate the Need for WQBELs

The permit writer should check if there is DEQ guidance for the pollutant. DEQ has developed guidance for specific pollutants. The permit writer is likely to immediately start a reasonable potential analysis spreadsheet. However, the permit writer should first consider the appropriate tool to use for the pollutant and the site conditions. A simple mass balance equation may not be appropriate and other tools should be considered, such as a Streeter-Phelps equation, a mixing zone model like CORMIX, or a water quality model. After selecting the appropriate tool, the appropriate critical conditions should be selected. Compounding conservative assumptions with each selection can result in a critical condition with a probability that it is unlikely or impossible to ever occur and for the general water quality criteria, they apply at all flows. Critical conditions should be carefully defined to examine a scenario that has reasonable potential to occur.

- Consider probabilistic approaches to evaluating RPA and calculating limits if needed, the EPA TSD notes that this is a viable and in some situations preferable approach to the steady state approach, Monte Carlo modeling is one example.
- Use appropriate tools for evaluation. For example BLM for copper.
- Consider the differences in metals (dissolved and total) versus organics.

2.6 Determine Interim and Final WQBELs

If the evaluation of the need for WQBELs results in a conclusion that effluent limitations are necessary, the conditioning of those limits should be considered carefully. If it is impracticable to set narrowly defined effluent limitations that will not be protective of water quality, be ineffective and lead to the need for variances and/or compliance issues, then the permit writer should consider alternative formulations. Similarly, the permit writer should consider an appropriate duration and level for interim effluent limitations.

[2] IDEQ, 2005, **Implementation Guidance for the Idaho Mercury Water Quality Criteria, https://www.deq.idaho.gov/media/639808-idaho_mercury_wq_guidance.pdf**

2.7 Special Topics

Examine if site specific criteria or variances are appropriate. For example, given the geology and historical mining activities in Idaho, background concentrations for some metals may be greater than the water quality standards.

2.8 Anti-Backsliding

New information and better data may result from improved techniques and lower detection limits. Also the use of dynamic, "probabilistic" modeling of loadings eliminating so of the unknowns and excess conservatism reflected in earlier approaches can provide new information. Older permits may be based on poorly collected (e.g. dirty v clean metals sampling methods), analyzed (e.g. incorrect/inappropriate lab method…), and/or interpreted data. Collection and use of current data that are correctly collected, analyzed and characterized should be used to explain the basis for any limits that were eliminated or made less stringent to avoid continuing poorly formulated effluent limitation due to anti-backsliding.

3 Temperature

A number of industrial facilities in Idaho discharge cooling water and/or industrial process wastewater that have temperatures higher at times than the ambient receiving waters. In addition, facilities such as municipal WWTFs also have a heat load (thermal load) when the effluent temperature is higher than that of the ambient receiving water. Municipal wastewater is warmed during treatment processes by a variety of mechanisms, including solar radiation on open tanks and warm air injected into the wastewater for aeration to support biological treatment.

Temperature is not a toxic pollutant under the Clean Water Act and thus the need for limits (reasonable potential analysis) and effluent limits calculations (if needed) should be evaluated differently than for toxics. This has been recognized by DEQ in other guidance (Idaho Mixing Zone Implementation Guidance, December 2016, see page 4):

> "The TSD was written to specifically address toxic pollutants for which acute and chronic criteria were developed. Its procedures should be modified when addressing nontoxic pollutants such as phosphorus, sediment, bacteria, or temperature."

3.1 Characterize the Receiving Water

Many of the considerations for the receiving water identified in Section 2.1 also pertain to temperature, and in particular how the hydrology in much of Idaho has been substantially altered by water management facilities and activities. Hydrologic alteration in many cases changes the natural temperature regime in substantial ways. One key and common situation in Idaho is storage of water in large reservoirs that thermally stratify, with release from low level outlets during the summer irrigation season. This water management shifts water temperatures downstream on a seasonal basis because the reservoirs act as "thermal capacitors," storing cold snow melt runoff in spring and early summer, releasing colder hypolimnetic (bottom) water during the summer, and then releasing warmer water than would be present naturally during the fall and early winter seasons when air temperatures fall faster than released water temperatures. Another common hydromodification in Idaho is diversion of water from rivers and streams for various uses, including domestic and industrial water supplies and irrigation water. Reduction in stream and river flow may allow more solar warming than would otherwise occur naturally. Thus, hydromodifications can either decrease or increase water temperatures compared to natural conditions, or even both on a seasonal basis.

Another critical consideration for temperature is that many streams and rivers in Idaho naturally warm longitudinally as water flows downstream due to solar radiation inputs and higher air temperatures in the low elevations in our semi-arid hot climate. Thermal discharges equilibrate to ambient temperatures downstream of the discharge from deep stratified dams. This is because temperature is a “non-conservative” pollutant. Below is a relevant discussion taken from Washington Department of Ecology Temperature and NPDES permits guidance[3]

> “Non-conservative pollutants are defined as those that are mitigated by natural biodegradation or other environmental decay or removal processes in the receiving stream after in-stream mixing and dilution have occurred. The concentration of non-conservative pollutants is reduced after they are discharged into the receiving stream as a result of these removal processes.
>
> The temperature in effluent is considered a non-conservative pollutant and is reduced (i.e., cooled) after it is discharged into a cooler receiving stream. Cooling happens as a result of the transfer of thermal energy from the warmer effluent to the cooler stream and the thermal energy loss associated with evaporation of the effluent/ receiving water mixture. The rate of effluent temperature reduction is dependent upon many factors: dew point, radiant energy from the sun, receiving water surface temperature, flow, and currents and tides.
>
> It is important to remember that thermal energy is not “in” the water in the same sense that copper atoms and ammonium ions are in water. Thermal energy is absorbed by the water molecules, which is manifested as temperature and a property of the water.”

In addition to characterizing seasonal flows and temperatures, it may also be important or necessary to compile available aquatic biological data for the receiving water, especially data regarding the fish and benthic macroinvertebrate communities upstream and downstream of effluent discharges. The biological data will be critical if any of the alternative regulatory approaches described in Section 3.4 below are to be considered.

3.2 Identify Applicable Water Quality Standards

Applicable water quality standards for temperature are described in the main Effluent Limits Guidance report, and that information is thus not replicated here. Of importance is the fact that all receiving waters in Idaho vary considerably on a seasonal basis, and designated uses such as Cold Water Aquatic Life and Salmonid Spawning, and associated numeric criteria, also have

[3] WDOE, 2010, Water Quality Program Guidance Manual, *Procedures to Implement the State’s Temperature Standards through NPDES Permits, Revised October 2010*): https://fortress.wa.gov/ecy/publications/publications/0610100.pdf

specific seasonal components. These may be identified in the water quality standards on site-specific basis (such as the Boise River).

3.3 Characterize the Effluent

Effluent temperatures, especially for municipal WWTFs, can vary widely over the course of the year in relation to seasonal water temperatures in wastewater coming into the facility, process operations, and solar radiation. As noted above, receiving waters also vary considerably on a seasonal basis, and as noted below, the applicable water quality standards also have a seasonal component. As a result, it will be typical to characterize the effluent temperatures on a seasonal basis that aligns with the receiving water characteristics and water quality standards.

Another aspect of effluent characterization pertains to evaluation of the thermal plume and associated mixing zone. Section 2.7.2 of DEQ's mixing zone guidance (DEQ, 2016) identifies specific considerations when evaluating thermal plumes:

> "DEQ will consider whether the heat in the discharge will cause unreasonable interference with, or danger to, beneficial uses as well as, the limitations expressed in *EPA Region 10 Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards* (EPA 2003). Thermal plumes should not cause: impairment to the integrity of the aquatic community, including interfering with successful spawning, egg incubation, rearing, or passage of aquatic life; and, thermal shock, lethality, or loss of cold water refugia (IDAPA 58.01.02.060.01.d). To minimize or avoid these types of unreasonable interference, the following will be considered when conducting a mixing zone analysis (EPA 2003):
>
> - Within 2 seconds of plume travel from the point of discharge, maximum temperatures should not exceed 32 ºC.
> - The cross-sectional area of the receiving water body exceeding 25 ºC should be limited to less than 5%.
> - The cross-sectional area of the receiving water body exceeding 21 ºC should be limited to less than 25%, or if upstream temperatures exceed 21 ºC, then at least 75% of the receiving water body should not have temperature increases of more than 0.3 ºC.
> - In spawning and egg incubation areas, the maximum weekly maximum stream temperatures should not exceed 13 ºC, or the temperatures should not be increased by more than 0.3 ºC above ambient stream temperatures during times when spawning and incubation occur."

3.4 Regulatory Approaches

Alternative regulatory approaches for temperature include Use Attainability Analyses (UAA) and general water quality standards variances. UAAs may be appropriate because many water bodies in Idaho have not been assigned formal use designations, and undesignated water are presumed by default to support Cold Water Aquatic Life. Standards variances and site-specific criteria may also be appropriate for some receiving waters. Another alternative regulatory approach pertaining specifically to temperature is the 316(a) variance process, described in Sections 3.4.1 to 3.4.3 below.

3.4.1 Introduction to the 316(a) Temperature Variance

The regulatory process followed in a 316(a) demonstration is summarized in **Error! Reference source not found.**. The numbers in each box pertain to the major section numbers from a typical report outline for a 316(a) demonstration. This figure was developed consistent with federal and state regulations and guidance as summarized in Sections 3.4.2 and 3.4.3 below.

The left side of Figure 3-1 pertains to the short-term applicability of the 316(a) process for existing and near-term effluent discharges (that is, for the next permit cycle or so). This short-term application is based on EPA regulations for existing discharges that cause “no appreciable harm” per 40 Code of Federal Regulations (CFR) 125.73(c)(1).

The right side of this figure pertains to the longer-term applicability of the 316(a) process for future growth and development that is expected to occur in a city over time to the point where design flows are being treated at each WWTF. Thus, the modeling for the thermal mixing zones and far-field thermal modeling at design flow conditions are integrated with the biothermal assessment to demonstrate that the balanced indigenous community (BIC), as characterized by representative important species (RIS), will be protected at these future conditions for the thermal component of those discharges.

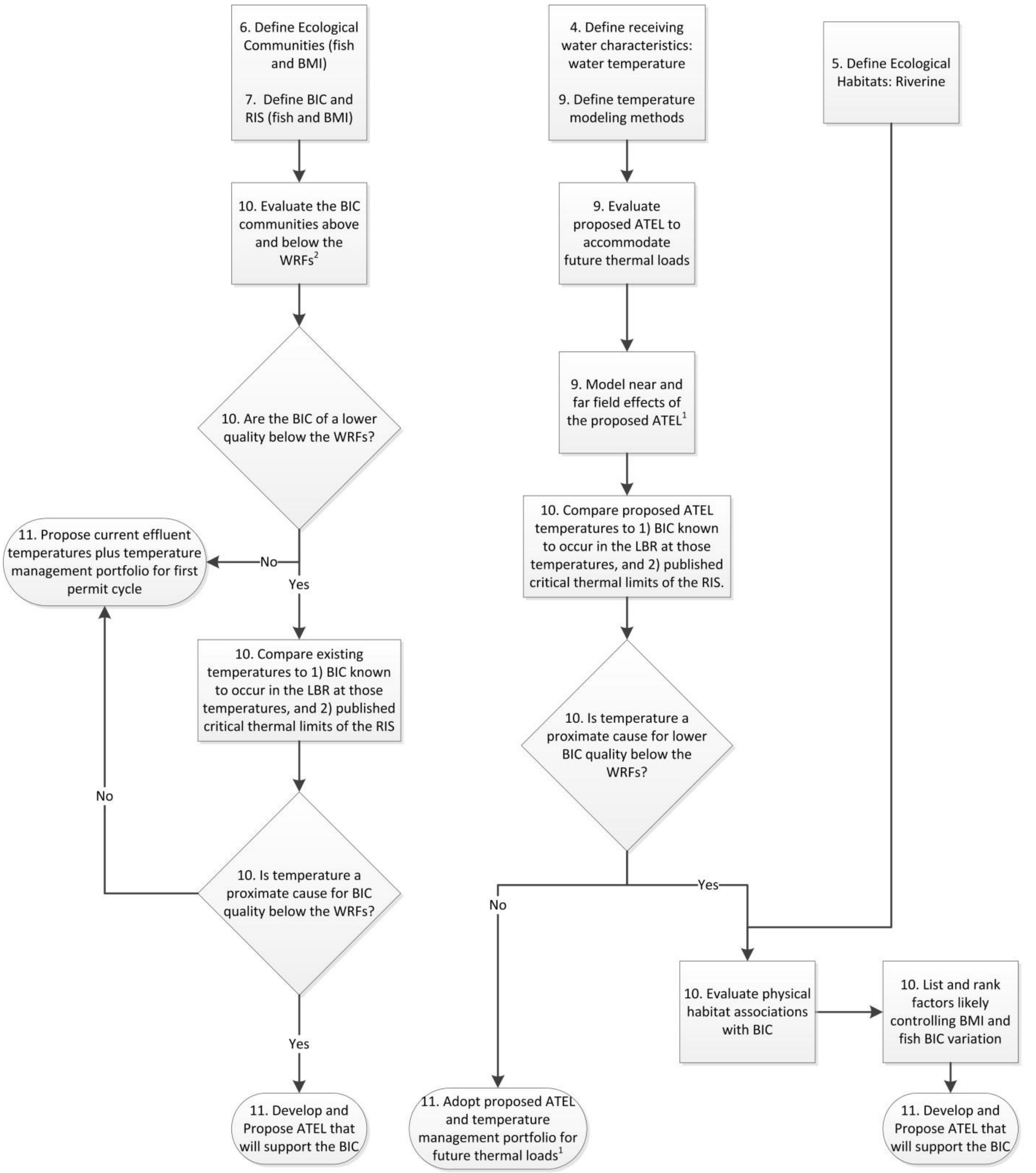
Error! Reference source not found. is a simplified version of **Error! Reference source not found.**, and shows the inter-relationship between the short-term process and longer-term process, and the concept that the longer-term implementation of the process involves periodic monitoring and potential reassessment (e.g., for each 5 year permit cycle).

3.4.2 Federal Regulations and Guidance for 316(a) Demonstrations

EPA’s regulations pertaining to thermal discharges pursuant to Section 316(a) of the Clean Water Act are found at 40 CFR 125.70 through 125.73. The implementation of Section 316(a) thermal variances in NPDES permits is further summarized in an EPA memorandum from James A. Hanlon, Director of the Office of Wastewater Management, to EPA Water Division Directors in Regions 1–10 dated October 28, 2008. These regulations and memo identify several key regulatory elements applicable to a 316(a) demonstration:

- 40 CFR 125.73(c) provides direction for existing discharges in relation to the demonstration of “no appreciable harm.”
- 40 CFR 125.71(a) defines alternative effluent limitations as “… all effluent limitations or standards of performance for the control of the thermal component of any discharge which are established under section 316(a) …”
- 40 CFR 125.71(c) and the EPA memo define BIC as:
  “… a biotic community typically characterized by diversity, the capacity to sustain itself through cyclic seasonal changes, presence of necessary food chain species and by lack of domination by pollution tolerant species. Such a community may include historically non-native species introduced in connection with a program of wildlife management and species whose presence or abundance results from substantial, irreversible environmental modifications. Normally however, such a community will not include species whose presence or abundance is attributable to the introduction of pollutants

that will be eliminated by compliance by all sources with section 301(b)(2) of the [Clean Water] Act; and may not include species whose presence or abundance is attributable to alternative effluent limitations imposed pursuant to section 316(a)."



Notes: ATEL = Alternative Temperature Effluent Limit;
BIC = Balanced Indigenous Community;
RIS = Representative Important Species;
BMI = Benthic Macroinvertebrate;
Object numbers refer to the 316(a) report chapters.

1The proposed ATEL includes effluent re-use, aquatic and riparian improvements, and other potential temperature reduction strategies. On-going water temperature and biological monitoring will verify whether or not the ATEL is protective of aquatic life uses.

2The fish and BMI communities will be evaluated using and upstream and downstream comparison to evaluate the "No Appreciable Harm" regulation (30CFR125.73(c)).

Figure 3-1. 316(a) bioassessment methodology

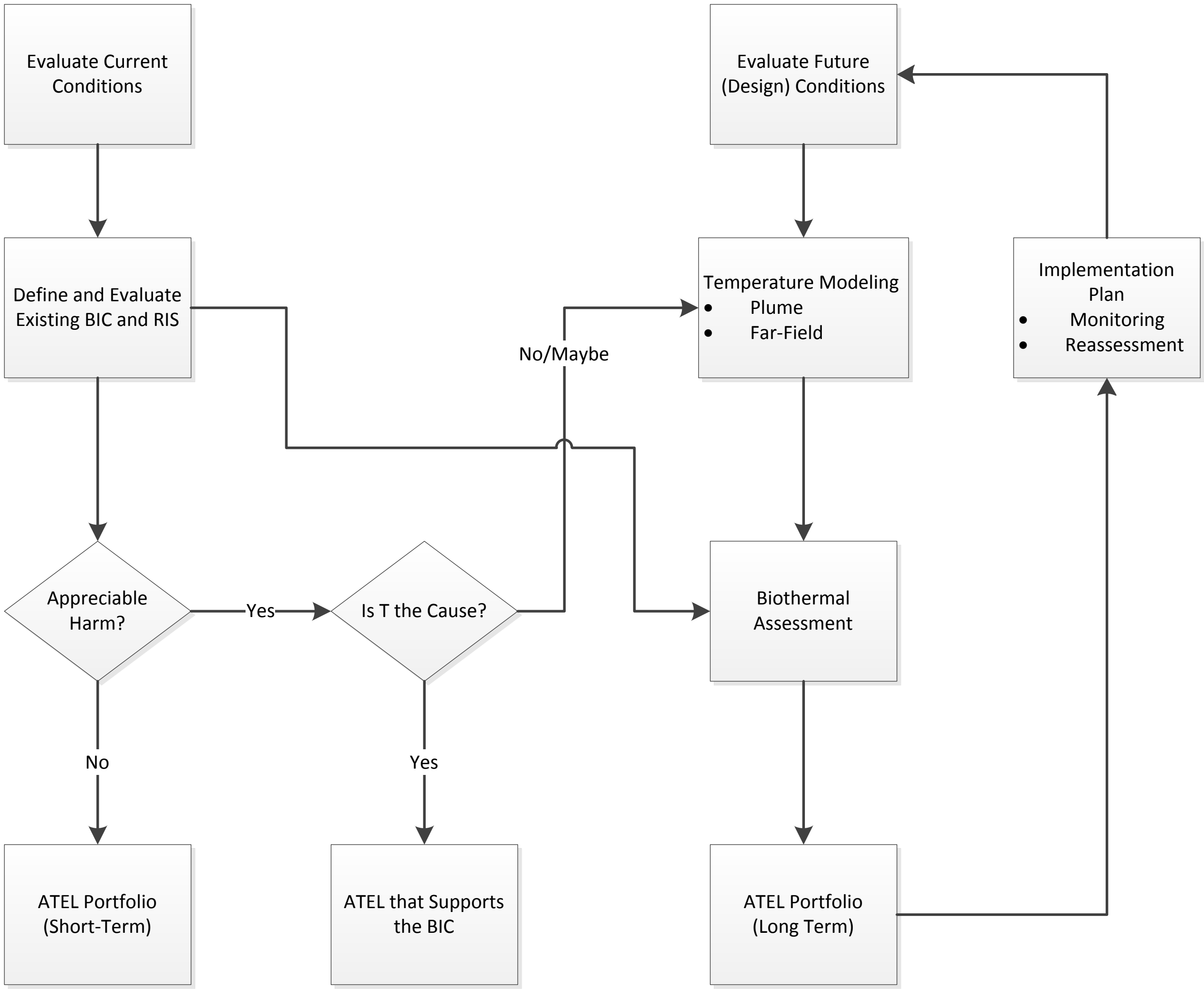


Figure 3-2. Simplified 316(a) bioassessment methodology

3.4.2 Idaho Regulations and Guidance for 316(a) Demonstrations

DEQ has promulgated IPDES regulations at Idaho Administration Procedures Act (IDAPA) 58, Title 01, Chapter 25 (IDAPA 58.01.25). These state regulations have been adopted by the DEQ board and approved by the Idaho legislature. These regulations mirror, are consistent with, and cite the applicable federal regulations noted in Section 3.4.1. These rules become effective with EPA's approval of the IPDES program. In addition, DEQ has developed IPDES guidance, including elements specific to 316(a) demonstrations and variances. These 316(a) elements are consistent with the EPA and state regulations cited above (DEQ, User's Guide to Permitting and Compliance, Volume 1—General Information, June 2016). Section 8 of that guidance addresses variances, including Section 316(a). Table 5 in Section 8 establishes that 316(a) variances are applicable to industrial facilities and publicly owned treatment works (POTWs) such as municipal WWTFs.

3.5 Evaluate the Need for WQBELs

The reasonable potential analysis (RPA) for temperature in Idaho generally will be dictated primarily by temperature impairment listings (Category 5 of the Integrated Report) and related Total Maximum Daily Load (TMDL) processes. If a TMDL has been completed and approved then the temperature limits in a permit must be consistent with the wasteload allocation in the TMDL. If there is no impairment identified for a water body receiving a thermal discharge, and if a TMDL has not been scheduled or completed and approved by EPA, then it may be premature to consider final effluent limits for temperature in a permit being developed. Additional temperature and other receiving water and effluent monitoring may be appropriate in these cases depending on existing data availability for listing decisions.

In some cases, the need for WQBELs for temperature may be determined even in the absence of impairment listings or TMDLs. This will not be the norm for most permits. In these cases, the various complexities and considerations associated with temperature in the sub-sections above will have to be considered and addressed, especially the alternative regulatory approaches in Section 3.4.

3.6 Determine Interim and Final WQBELs

3.6.1 Interim Temperature Limits

Interim limits are often used during compliance schedule periods so that effluent quality is maintained and related receiving effects are minimized or avoided until the final limits are achieved by the permitee. Sometimes these are set based on recent historical performance by the facility, referred to as performance-based limits. These limits are sometimes set as 95th or 99th percentile values, and in the case of temperature should be set as the maximum values for the applicable permit averaging period (e.g., maximum daily, weekly average, or monthly average) within the last several years.

Interim limits for temperature that are performance-based should consider potential climate change impacts to wastewater temperatures over the period of time in which the limits are expected to be in effect. Several key reports have been published documenting the effects of climate change (USDA 2016, EPA 2014). To quantify localized impacts of climate change on stream water temperature, the permit writer can utilize the modeling resource provided by the NorWest project, a multi-agency collaborative led by researchers the U.S. Forest Service Rocky Mountain Station. For example, NorWest provides projected increases in average August stream temperatures calculated as the difference between a 1993-2011 baseline estimate and a 2040 projection, and the Boise River at Veterans Parkway Bridge is expected to increase 1.2 °C by 2040. As a reasonable approximation, the increase in effluent temperature can be scaled to projected stream or river temperature increases.

3.6.2 Final Temperature Limits

For the vast majority of permits, final temperature limits should be based on TMDL wasteload allocations or an alternative regulatory process described in Section 3.4 such as the 316(a) variance demonstration.

3.7 Special Topics

As described in Section 3.4, the Clean Water Act Section 316(a) process is a topic specifically pertinent to temperature. Other important special topics for the permit writer to consider include climate change (in relation to interim limits as discussed above and other issues associated with impairment listings and TMDLs), thermal trading and offset programs, and watershed permitting (including thermal “bubble” permits).

4 Nutrients

FORTHCOMING ADDITION {PRIMARILY FROM DAVID CLARK}

4.1 Characterize the Receiving Water

4.2 Identify Applicable Water Quality Standards

4.3 Characterize the Effluent

4.4 Regulatory Approach

4.5 Evaluate the Need for WQBELs

4.6 Determine Interim and Final WQBELs

4.7 Special Topics