DEPARTMENT OF ECOLOGY
State of Washington

Water Quality Program Permit Writer's Manual

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Water Quality Program
Permit Writer's Manual

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Washington State Department of Ecology
Olympia, Washington

DEPARTMENT OF ECOLOGY
Water Quality Program

July 30, 2018

TO: Ecology Wastewater Permit Writers

FROM: Heather R. Bartlett, Water Quality Program Manager

SUBJECT: June 2018 Permit Writer's Manual Update

The latest revision to the Permit Writer's Manual is attached for your use. It describes Ecology's procedures when issuing permits for wastewater discharges. Permit writers are required to use the procedures in this manual for developing permits. If a permit writer believes a permitting situation requires a different process than in the manual, the permit writer should discuss the alternative process with their supervisor. If a staff member believes a problem or issue needs to be addressed by the manual, they should recommend that their supervisor or Permit Writer's Workgroup (PWG) member bring the issue to Vince McGowan or Eleanor Key.

Heather R. Bartlett

Heather R. Bartlett
Water Quality Program Manager

Attachment

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Acknowledgements

This manual represents an effort by the Water Quality Program to improve its point source pollution control program. Numerous people have contributed to the manual, none more profoundly than Gary C. Bailey. Gary was project lead for the development of the manual and coordinated updates for over 25 years until his retirement in 2011.

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- Roger Von Gohren, Association of Washington Business
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Everyone's efforts are appreciated.

M. Eleanor Key, P.E.
Project Leader

Note to Readers

This manual is a working document for people at the Washington State Department of Ecology (Ecology) who write wastewater discharge permits. It is available to the public on the Ecology web site at: https://fortress.wa.gov/ecy/publications/summarypages/92109.html.

The Department of Ecology is interested in your comments on this manual. Please address comments to:

Permit Writers Manual
Dept. of Ecology
PO Box 47696
Olympia, WA 98504-7696.

Comments may also be posted at https://ecology.wa.gov/About-us/Get-to-know-us/Our-Programs/Water-Quality.

Ecology permit writers will find additional resources on SharePoint at https://partnerweb.ecy.wa.gov/sites/WQ/pwg/default.aspx or from the Program Development Services Section.

The June 2018 update of this manual included additions to the following Chapters:

- Chapter 2, Section 16: New Permit Reauthorization Guidance
- Chapter 6, Section 3: Revised Compliance Schedule Section
- Chapter 6, Section 4: Revised PCB Guidance Section
- Chapter 6, Section 5: Revised WET Chapter Revision
- Chapter 6, Section 6: New Stormwater Section (Intro only)
- Chapter 7, Section 7: Intake Credits for Human Health Criteria
- Chapter 12, Section 1: Revised General Conditions Language
- Chapter 12, Section 3: New sections on Arsenic, Methylmercury, and DEHP Reduction

The 2015 version of the manual transitioned to a new format for figures, tables and appendices. This 2018 version continues the revised numbering approach while adding additional tables and figures. 2011 and earlier versions use a roman numeral numbering scheme. 2015 and later versions use continuous numbering of figures and tables. No changes were made to the appendices.

Glossary

Defining the Terms of Wastewater Permits

401(a) Certification: A requirement of Section 401(a) of the Clean Water Act that all federally issued permits be certified by the state in which the permit is issued. The state certifies that the proposed permit will comply with state water quality standards.

ACEC (Acute Critical Effluent Concentration): The maximum concentration of effluent during critical conditions at the boundary of the zone of acute criteria exceedance assigned in the permit. If no zone of acute criteria exceedance is specified the acute critical effluent concentration shall be one hundred percent effluent.

Acute Toxicity: The lethal effect of a compound on an organism that occurs in a short period of time, usually 48 to 96 hours.

Acute Toxicity Test: A toxicity test with the death of test organisms as the measured response.

AET (Apparent Effects Threshold): For a given quality-assured data set approved by the department, the highest sediment concentration of an individual chemical contaminant which is not associated with statistically significant biological effects (proposed WAC 173-204-020).

AKART: Acronym for "all known available and reasonable methods"..."to prevent and control"..."pollution" (RCW 90.48.010, RCW 90.48.520). (See Chapter 4)

Anti-Backsliding: A provision in the Federal Regulations (40 CFR 122.44) which says a reissued permit must be as stringent as the previous permit with some exceptions.

Average Monthly Discharge Limitation: The highest allowable average of "daily discharges" over a calendar month. Calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month (40 CFR 122.2).

Average Weekly Discharge Limitation: The highest allowable average of "daily discharges" over a calendar week. Calculated as the sum of all daily discharges measured during a calendar week divided by the number of daily discharges measured during that week (40 CFR 122.2). Applicable only to municipal discharges.

Background: The biological, chemical, and physical condition of the water body, outside the area of influence of the discharge under consideration, typically upstream or up-gradient of the discharge. Background conditions may include other human-caused pollution besides the discharge under consideration. For conditions absent any human-caused pollution, see “Natural Conditions.”

BAT (Best Available Technology Economically Achievable): The wastewater treatment technology required to control toxic pollutants. Required to be in place by July 1, 1984, however, EPA has not completed the guidelines for all industries.

BCT (Best Conventional Pollutant Control Technology): This was the second step in defining treatment technology for conventional pollutants. A candidate technology must pass 2 cost tests which compare industrial costs to municipal costs of treatment. BCT was to be in place by July 1, 1984, but EPA did not complete guidelines for all industries.

Biosolids: Biosolids is municipal sewage sludge that meets standards for application to the land.

Boiler Plate Language: See General Conditions.

BMP (Best Management Practice): Permit condition used in place of or in conjunction with effluent limits to prevent the discharge of pollutants. BMPs may include schedules of activities, prohibitions of practices, maintenance procedures, treatment requirements, operating procedures and practices.

BOD (Biochemical Oxygen Demand): The quantity of substances present in a water or wastewater that utilizes oxygen to decompose. The test for BOD is to put a sample of water or wastewater in a sealed bottle with sewage bacteria and measure how much oxygen is used in 5 days.

BPJ (Best Professional Judgment): The highest quality technical opinion developed by permit writer after consideration of all reasonably available and pertinent data or information which forms the basis for the terms and conditions of an NPDES permit. BPJ may also be called BEJ (Best Engineering Judgment). Authorized by Section 402(a)(1)(B) of the Clean Water Act.

BPT (Best Practicable Control Technology Currently Available): The first step of treatment technology identified by EPA for 52 categorical industries. The technology was identified by surveying the treatment technology in use and defining the best average performance. See section 301(b)(1)(A) of CWA.

Bypass: The intentional diversion of waste streams from any portion of a treatment facility.

CCEC (Chronic Critical Effluent Concentration): The maximum concentration of effluent during critical conditions at the boundary of the mixing zone assigned in the permit. Where no mixing zone is specified, the chronic critical effluent is one hundred percent effluent.

Certification, 401(a): See 401(a) Certification.

CFR (Code of Federal Regulations): A codification of the general and permanent rules published in the Federal Register by the Executive departments and agencies of the Federal Government. Environmental regulations are found in Title 40.

Chronic Toxicity Test: A toxicity test which measures a sublethal effect such as failed fertilization, development, growth, or reproduction. Organism survival is also a measured endpoint in some chronic toxicity tests.

COD (Chemical Oxygen Demand): A measure of the decomposable substances in water or wastewater which uses a chemical oxidant instead of bacteria as in the BOD test.

Combined Sewer Overflow (CSO): The event during which excess combined sewage flow caused by inflow is discharged from a combined sewer, rather than conveyed to the sewage treatment plant because either the capacity of the treatment plant or the combined sewer is exceeded.

Compliance Schedule: A schedule of remedial measures included in a permit or an enforcement order, including an enforceable sequence of actions or operations leading to compliance with an effluent limitation, other limitation, prohibition, or standard (CWA 502, 40 CFR 122.47).

Conventional Pollutants: Pollutants typical of municipal sewage and defined by Federal Regulation (40 CFR 401.16) as BOD, total suspended solids, fecal coliform, pH, and oil/grease.

Criteria: The numeric values and the narrative standards that represent contaminant concentrations which are not to be exceeded in the receiving environmental media (surface water, ground water, sediment) to protect beneficial uses.

Critical Condition: The time during which the combination of receiving water and waste discharge conditions have the highest potential for causing toxicity in the receiving water environment. This situation usually occurs when the flow within a water body is low, thus, its ability to dilute effluent is reduced.

Daily Discharge: The discharge of a pollutant measured during any 24-hour period that reasonably represents a calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the daily discharge is calculated as the total mass of the pollutant discharged during the day. For pollutants with limitations expressed in other units of measurement, the daily discharge is calculated as the average measurement of the pollutant throughout the day (40 CFR 122.2).

Development Document: A document prepared during the development of effluent guidelines by EPA which explains the methodology and data which was used to develop the guidelines.

Detection Limit (DL): See Method Detection Limit.

Dilution Factor: A measure of the amount of mixing of effluent and receiving water that occurs at the boundary of the mixing zone. Expressed as the inverse of the effluent fraction e.g., a dilution factor of 16 means the effluent comprises 6.25% by volume and the receiving water 93.75% at the compliance boundary or volume restriction (DF = 1/.0625). The applicable dilution factor is the minimum of volume/volume fraction or effluent concentration at the distance boundary.

Dilution Zone: See Mixing Zone.

Discrete Sample: A single sample of wastewater taken at neither set time nor flow. Also known as a grab sample or single sample.

DMR (Discharge Monitoring Report): A report submitted by a permittee, (usually monthly or quarterly) which gives the results of the effluent monitoring tests performed.

Do. or do.: Within the effluent limits sections of 40 CFR means ditto or the same as above.

Draft Permit: A document which indicates a decision to issue, deny, modify, revoke and reissue, terminate or reissue a permit. Usually is in the form of a permit and indicates a decision to issue, reissue, or modify a permit.

Early Warning Values: Act as a trigger in the groundwater standards to detect increasing contaminant concentrations prior to the degradation of a beneficial use.

Effluent Limitation: Any restriction established by a permitting authority on quantities, rates, and concentrations of chemical, physical, biological pollutants discharged to waters of the state.

Enforcement Limits: The values assigned by the groundwater standards to a contaminant for the purposes of regulation. This limit assures that a criterion will not be exceeded.

EPA Effluent Guidelines: (see Chapter 4 of this Manual).

Excursions: Violations of effluent limits or water quality standards.

Fact Sheet: A document prepared and issued with every permit which summarizes the activities and decisions on the permit and tells how the public may comment (40 CFR 124.8, 124.56).

FR (Federal Register): The periodical of the U.S. government in which draft and final regulations are published.

General Permit: A permit to regulate stormwater point sources or other category of point sources. A general permit is developed for a category of dischargers and is not specifically tailored for an individual discharger (40 CFR 122.28).

Indirect Discharger Or Industrial User: A discharger of wastewater to the sanitary sewer which is not sanitary wastewater or is not equivalent to sanitary wastewater in character.

Industrial Wastewater: Water or liquid-carried waste from industrial or commercial processes, as distinct from domestic wastewater. These wastes may result from any process or activity of industry, manufacture, trade or business, from the development of any natural resource, or from animal operations such as feed lots, poultry houses, or dairies. The term includes contaminated stormwater and, also, leachate from solid waste facilities.

Inspection, Compliance - Without Sampling: A site visit for the purpose of determining the compliance of a facility with the terms and conditions of its permit or with applicable statutes or regulations. The minimum requirements are specified in the Compliance Inspection Checklist

(August 15, 1996).

Inspection, Compliance - With Sampling: Similar to *Inspection, Compliance - Without Sampling* but includes as a minimum sampling and analysis for all parameters with permit limits for the purpose of ascertaining compliance with those limits. For municipal facilities this includes sampling of the influent to determine compliance with the 85% removal requirement. Additional sampling for other parameters may also be conducted.

Inspection, Compliance Follow-Up: An inspection for the main purpose of verifying that a compliance issue required by a previous action (inspection, NOC, order) has been completed or initiated.

Inspection, Coverage: An inspection of an unpermitted facility for the purpose of determining if a permit is required or an inspection of a permitted facility to determine whether permit termination is appropriate.

Inspection, Multimedia Compliance: An Inspection, Compliance - Without Sampling or An Inspection, Compliance - With Sampling which is conducted on a metals mining facility that includes an assessment of dam safety and air permit compliance in accordance with the multimedia inspection checklist.

Inspection, Operator Outreach: An inspection for the purpose of providing assistance to municipal treatment plant operators conducted by a Technical Assistance Officer designated under RCW 43.21A.085.

Inspection, Operation and Maintenance: A scheduled on-site visit to a sewage treatment plant to review operations, record keeping, personnel information and to make visual observations on the condition of a plant and its discharge. Any documented operations deficiencies will be noted and used to provide a basis for making recommendations for future operation and maintenance programs and activities at the plant.

Inspection, Pretreatment Audit: An audit of a municipal treatment facility and system for municipalities that have been delegated pretreatment program responsibilities. Conducted at least once every five years. The primary purposes are to determine compliance with the requirements of the municipalities' approved program and to assess the need for program improvements. Audits are conducted using EPA's "Control Authority Pretreatment Audit Checklist and Instruction."

Inspection, Pretreatment Compliance: An annual inspection of a municipal treatment facility and system for municipalities that have been delegated pretreatment program responsibilities. The primary purpose is to determine compliance with the requirements of the municipalities' approved pretreatment program. Inspections are conducted using the PCT Checklist and EPA's "Guidance for Conducting a Pretreatment Compliance Inspection."

Inspection, Technical Assistance Visit: An inspection on a permitted facility for the sole purpose of providing compliance assistance to the permittee and where the permittee and the inspector have agreed to this purpose prior to or at the initiation of the inspection.

Interference: A discharge which, alone or in conjunction with a discharge or discharges from other sources, both:

Inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal; ***and***,

Therefore is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued there under (or more stringent State or local regulations): Section 405 of the Clean Water Act, the Solid Waste Disposal Act (SWDA) (including title II, more commonly referred to as the Resource Conservation and Recovery Act (RCRA), and including State regulations contained in any State sludge management plan prepared pursuant to subtitle D of the SWDA), sludge regulations appearing in 40 CFR Part 507, the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection, Research and Sanctuaries Act.

Integrated Facility: A primary industry with operations covered by more than one subcategory of operation.

Load Allocation (LA): Within a Total Maximum Daily Load (TMDL), the allocation for the nonpoint sources of a pollutant. This includes all sources not covered by an NPDES permit, including future and natural sources. This does not include reserves for future NPDES discharges or a margin of safety.

Loading Capacity: The amount of pollutant that a water body can receive and still meet water quality standards. A final TMDL must equal the Loading Capacity.

Local Limits: Conditional discharge limits imposed by municipalities upon dischargers to their sewage treatment system.

Major Facility (Permit): A facility discharging to surface water with an EPA rating score of > 80 points based on such factors as flow volume, toxic pollutant potential, and public health impact. EPA reviews these major NPDES permits during issuance and tracks compliance with the permits.

Maximum Daily Discharge Limitation: The highest allowable daily discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. The daily discharge is calculated as the average measurement of the pollutant over the day (40 CFR 122.2).

MCL (Maximum Contaminant Level): Federally promulgated by the Environmental Protection Agency. These are enforceable health-based standards, which means the maximum permissible level for a contaminant in ground water. These values reflect the effect of certain risk management factors such as laboratory confidence limits and economics.

MCLG (Maximum Contaminant Level Goal): Health goals for drinking water which are set at a level at which no known or anticipated adverse effects on the health of persons should occur and which allows for an adequate margin of safety. These limits do not take into account treatment technology and economics as the MCLs do.

MDL (Method Detection Limit): 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. (40 CFR Part 136, Appendix B)

ALSO GIVEN AS:

Detection Limit (DL): Smallest measured amount or concentration of analyte in a sample that gives rise to a Type I error tolerance of alpha under the null hypothesis that the true amount or concentration of analyte in the sample is equal to that of a blank. (The alternative hypothesis is that the true amount or concentration of analyte is greater than that of a blank).

Detection Limit (DL): The minimum observed result such that the lower 100 (1- α) % confidence limit on the result is greater than the mean of the method blanks. (Report of the Federal Advisory Committee on Detection and Quantitation Approaches and Uses in Clean Water Act Programs Submitted to the US Environmental Protection Agency December 2007)

MGD (Million Gallons per Day): A unit of flow commonly used for wastewater discharges. One MGD is equivalent to 1.547 cubic feet/second.

Minimum Level of Quantitation (ML): See Quantitation Level

Minor Permit: Any NPDES individual permit which is not a Major Permit.

Mixing Zone: An area or a volume fraction of the receiving water, specified in a permit, which surrounds an effluent discharge point. This area is not required to meet numeric water quality criteria but must allow passage of aquatic organisms and not upset the ecological balance of the receiving water. The mixing zone specifications and conditions for authorization are given in WAC 173-201A.

Natural Conditions or Natural Background Levels: The surface water quality that was present before any human-caused pollution.

New Discharger: See 40 CFR 122.2.

New Source: Any building, structure, facility, or installation from which there is or may be a discharge of pollutants, the construction of which commenced:

(a) After promulgation of standards of performance under section 306 of CWA which are applicable to such source, ***or***

(b) After proposal of standards of performance in accordance with section 306 of CWA which are applicable to such source, but only if the standards are promulgated in accordance with section 306 within 120 days of their proposal (40 CFR 122.2).

NOEC (No Observed Effect Concentration): The highest measured continuous concentration of an effluent or a toxicant that causes no observed effect on a test organism.

Nonconventional Pollutants: Any pollutants which are not defined as Conventional Pollutants or Toxic Pollutants. Includes pollutants such as COD, nitrogen, phosphorus, and fluoride.

NPDES: National Pollutant Discharge Elimination System (Section 402 of the Clean Water Act). Permits issued under Section 402 of the Clean Water Act. The federal wastewater permitting system for discharges to navigable waters. The authority for issuing these permits has been delegated to the State. NPDES permits issued by Washington permit writers are NPDES/state permits issued under both federal and state law.

NSPS (New Source Performance Standards): Effluent limitations that apply to those dischargers that qualify as new sources under 40 CFR 122.2 and 122.29.

Parties Of Record: People who have indicated an interest in a particular permit during the public notice of application (PNOA) or public notice of draft (PNOD) and are kept informed of progress of the permit and future permit actions.

Pass Through: A discharge which exits the POTW into waters of the State in quantities or concentrations which, alone or in conjunction with a discharge or discharges from other sources, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation), or which is a cause of a violation of State water quality standards.

PCHB (Pollution Control Hearings Board): A 3-member board appointed by the governor to hear and decide appeals of Ecology's permits and orders. See Chapter 16 of this manual and Chapter 371-08 WAC.

Permit: An authorization, license, or equivalent control document issued by EPA or an approved state to implement the requirements of 40 CFR 122.2 and Parts 123 and 124. Permit includes any NPDES GENERAL permit. Permit does not include any proposed or draft permit which has not yet been the subject of public comment or EPA review, if necessary.

Permit, Wastewater Discharge: A document prepared by a permitting authority (Federal Government, State Government, Local Government) which limits the pollutants to be discharged by the holder of the permit (Permittee).

pH: A measure of the acidity of water or wastewater. A pH of 7 is neutral, a pH less than 7 is acidic, and a pH greater than 7 is basic.

Point Source: Any discernible, confined, and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fixture, container, rolling stock, concentrated animal feeding operation, vessel, or other floating craft from which pollutants are or may be discharged. This term does not include agricultural stormwater discharges and return flows from irrigated agriculture. (See 40 CFR 122.3 for exclusions)

Pollutant: Dredged soil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal and agricultural waste discharged into water.

Pollutant, Non-Conservative: Pollutants 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.

Pollution: Contamination, or other alteration of the physical, chemical or biological properties, of any waters of the state, including change in temperature, taste, color, turbidity, or odor of the waters, or such discharge of any liquid, gaseous, solid, radioactive, or other substance into any waters of the state as will or is likely to create a nuisance or render such waters harmful, detrimental or injurious to the public health, safety or welfare, or to domestic, commercial, industrial, recreational, or other legitimate beneficial uses, or to livestock, wild animals, birds, fish or other aquatic life.

Pollution Prevention: Source reduction; or protection of natural resources by conservation; or increased efficiency in the use of raw materials, energy, water or other resources.

Potential Significant Industrial User: A potential significant industrial user is defined as an Industrial User which does not meet the criteria for a Significant Industrial User, but which discharges wastewater meeting one or more of the following criteria:

a. Exceeds 0.5 % of treatment plant design capacity criteria and discharges <25,000 gallons per day ***or***;
b. Is a member of a group of similar industrial users which, taken together, have the potential to cause pass through or interference at the POTW (e.g., facilities which develop photographic film or paper, and car washes).

Ecology may determine that a discharger initially classified as a potential significant industrial user should be managed as a significant industrial user.

POTW (Publicly Owned Treatment Works): A sewage treatment plant and the collection system (40 CFR 122.2).

PQL (Practical Quantification Limit): The lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions.

Precursor: A substance present in effluent that is not toxic in its present form (not listed). However, a precursor could change into or react to form a toxic compound.

Pretreatment: The treatment of wastewater to remove or reduce the concentration of pollutants prior to discharge to a municipal sewage system. Pretreatment may denote a formal program (Pretreatment Program) which allows a municipality to issue permits for discharges to its system under Federal and State authority.

Primary Industry Categories: A group of 34 industry groups for which EPA has or will develop effluent guidelines (40 CFR Part 122 Appendix A).

Priority Pollutant (Toxic Pollutant): A group of chemicals specifically listed in Federal Regulations and with priority for regulatory control (40 CFR 401.15).

Process Control Monitoring: An internal program whereby the permittee performs intermediate checks on the plant's operations to assess the efficiency of the process.

Process Wastewater: Any water which, during manufacturing or processing, comes into direct contact with, or results from, the production or use of any raw material, intermediate product, finished product, byproduct, or waste product.

Proposed Permit: A State NPDES permit prepared after the close of the public comment period (and, when applicable, any public hearing and administrative appeals) which is sent to EPA for review before final issuance by the State.
A PROPOSED permit is not a DRAFT permit (40 CFR 122.2).

PSES (Pretreatment Standards Existing Source): Effluent limitations that apply to existing pretreatment dischargers.

PSNS (Pretreatment Standards New Source): Effluent limitations that apply to pretreatment dischargers qualifying as new sources under 40 CFR 122.2 and 122.29.

Quantitation Level (QL) also known as Minimum Level of Quantitation (ML): The lowest 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. The QL is calculated by multiplying the MDL by 3.18 and rounding the result to the number nearest to (1, 2, or 5) x 10^n, where n is an integer. (64 FR 30417).
ALSO GIVEN AS:
The smallest detectable concentration of analyte greater than the Detection Limit (DL) where the accuracy (precision & bias) achieves the objectives of the intended purpose. (Report of the Federal Advisory Committee on Detection and Quantitation Approaches and Uses in Clean Water Act Programs Submitted to the US Environmental Protection Agency December 2007)

Schedule of Compliance: See Compliance Schedule.

Secondary Standards: Numeric criteria within the groundwater standards designed to protect the public welfare. Limits established for those constituents will not adversely affect human health, but may affect the taste or odor of the water or cause discoloration of laundry or plumbing fixtures. Secondary standards are established for: chloride, color, copper, corrosivity, fluoride, foaming agents, iron, manganese, odor, pH, sulfate, total dissolved solids (TDS) and zinc.

Sediment Quality Standards: These standards identify sediment chemical concentration criteria, and biological toxicity criteria which correspond to no observable acute or chronic adverse effects on biological resources, and which do not pose a significant health threat to humans. The standards are used as a basis for identification of surface sediments that exceed these standards, and for limiting toxic discharges to waters of the state (WAC 173-204-010).

Self-Monitoring Program: A program whereby a permittee is required through the NPDES permit system to maintain records and to report periodically on the amount and nature of the waste components in the effluent. The required information obtained by the Permittee's self-monitoring program is reported to the permitting agency using a Discharge Monitoring Report (DMR) on a regular schedule delineated in the permit.

SEPA (State Environmental Policy Act): A state law which requires an examination of the environmental effects of development projects. (RCW 43.21, Chapter 197-10 WAC)

Significant Industrial User (SIU):

1) All industrial users subject to Categorical Pretreatment Standards under 40 CFR 403.6 and 40 CFR Chapter I, Subchapter N; and;

2) Any other industrial user that: discharges an average of 25,000 gallons per day or more of process wastewater to the POTW (excluding sanitary, noncontact cooling, and boiler blow-down wastewater); contributes a process wastestream that makes up five percent or more of the average dry weather hydraulic or organic capacity of the POTW treatment plant; or is designated as such by the Control Authority on the basis that the industrial user has a reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement (in accordance with 40 CFR 403.8(f)(6)).

Upon finding that the industrial user meeting the criteria in paragraph 2, above, has no reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement, the Control Authority may at any time, on its own initiative or in response to a petition received from an industrial user or POTW, and in accordance with 40 CFR 403.8(f)(6), determine that such industrial user is not a significant industrial user.

Single Sample: See Discrete Sample.

Sludge: Solids produced during wastewater treatment.

Source Reduction: Any practice which eliminates or reduces the amount or use of hazardous substances, pollutants or contaminants that enter a waste stream or are released into the environment, including fugitive emissions, prior to recycling, treatment or disposal, and thereby reduces adverse public health and environmental effects associated with the release of such substances, pollutants or contaminants.

Sanitary Sewer Overflow (SSO): Discharge of untreated sewage from a separate sanitary sewer collection system prior to the headworks of a sewage treatment plant.

State Waste Discharge Permit: A wastewater discharge permit issued under State authority (Chapter 90.48 RCW) to control the discharge of pollutants to waters of the State. Generally issued for discharges to ground water and for industrial discharges to a municipal sewage system when that municipal system does not have a delegated pretreatment program.

State Waters: See Waters of the State.

Stormwater: That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes, and other features of a stormwater drainage system into a defined surface water body, or a constructed infiltration facility.

TDS: See Total Dissolved Solids.

Technology-Based Effluent Limit: A permit limit for a pollutant which is based on the capability of a treatment method to reduce the pollutant to a certain concentration.

TI/RE (Toxicity Identification/Reduction Evaluation): A set of procedures to identify the specific chemicals responsible for whole effluent toxicity.

Tiered Testing: Any of a series of tests that are conducted as a result of a previous test's findings.

Total Dissolved Solids (TDS): The material in water or wastewater that passes through a glass fiber filter. TDS is measured by Method 2540 C in Standard Methods.

Total Maximum Daily Load (TMDL): The sum of the Load Allocations and Wasteload Allocations, plus reserves for future growth and a margin of safety, which are equal to the Loading Capacity of the water body. This is a requirement of Section 303(d) of the federal Clean Water Act and is defined in 40 CFR 130.2(i). The term "TMDL" is often applied to the process to determine a TMDL ("Ecology is doing a TMDL") and to the final documentation of the TMDL ("Ecology has submitted a TMDL").

Toxic: Causing death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunctions in reproduction), or physical deformations in any organism or its offspring upon exposure, ingestion, inhalation, or assimilation.

Toxic Pollutant: Those pollutants, or combinations of pollutants, including disease-causing agents, which after discharge and upon exposure, ingestion, inhalation or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will, on the basis of information available to the Administrator, cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunctions in reproduction) or physical deformations, in such organisms or their offspring. (listed at 40 CFR 401.15).

Toxic Substance (Toxicant or Toxics): Poison or substance, which if present in sufficient quantity or concentration, is capable of producing a toxic response in a native or test organism.

Toxicity: The quality or state of being toxic.

Toxicity Test: A procedure to determine the toxicity of a chemical or an effluent using living organisms. A toxicity test measures the degree of effect a specific chemical or effluent has on exposed test organisms.

TRE (Toxicity Reduction Evaluation): A site-specific study conducted in a stepwise process designed to identify the causative agents of effluent toxicity, isolate the sources of toxicity, evaluate the effectiveness of toxicity control options, and then confirm the reduction in effluent toxicity.

TSD: Abbreviation for Technical Support Document for water quality-based toxics control (EPA/505/2-90-001), ***or***
An abbreviation for a facility which recycles, reuses, reclaims, transfers, stores, treats, or disposes of dangerous wastes as defined in WAC 173-303.

TSS (Total Suspended Solids): Particulates in water or wastewater retained by a glass fiber filter. TSS is measured by tests as given in 40 CFR Part 136 and referenced as Residue - nonfilterable (TSS) or as given in Standard Methods (17th ed.) method 2540 D.

TTO (Total Toxic Organics): Organic chemicals listed within a specific category of discharge (such as electroplating Part 413). TTO is the summation of all quantifiable values of the organic chemicals greater than 0.01 milligrams per liter.

Upset: An exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, lack of preventative maintenance, or careless or improper operation.

Wasteload Allocation (WLA): Within a TMDL, the allocation for point sources of a pollutant that are covered under an NPDES permit. For an individual water quality-based effluent limit, the WLA is the numeric water quality criteria times the dilution factor.

Water Quality-Based Effluent Limit: A permit limit for a pollutant which limits the concentration such that it will not cause a violation of water quality standards. The limit may include a dilution factor if AKART has been determined and other restrictions are met.

Water Quality Standards: Numerical and narrative criteria to protect the beneficial uses of the States' waters. Includes conventional and toxic pollutants. (Chapter 173-201A WAC)

Waters of the State: Lakes, rivers, ponds, streams, inland waters, underground waters, salt waters, and all other surface waters and watercourses within the jurisdiction of the state of Washington.

WET (Whole Effluent Toxicity): The total toxic effect of an effluent measured directly with a toxicity test so that the interaction of all toxicants present in the effluent are assessed.

Chapter 1. Introduction

This manual is a technical guidance and policy manual for permit writers who develop wastewater discharge permits in Washington State. Developing this manual was specified as task element P5 in the 1987 Puget Sound Water Quality Management Plan and subsequent amendments. Maintenance and improvement of the manual is recommended in the final report of the Commission for Efficiency and Accountability in Government (1990).

The first version of this manual was issued in June, 1989. A 23-member advisory committee assisted the Department of Ecology (Ecology) for one year on policy issues identified in the manual. The advisory committee represented those interested in wastewater permits. An internal work group also assisted in the development of this manual.

The primary purposes of this manual are to enhance the quality and consistency of the wastewater discharge permits issued by Ecology and to improve the efficiency of the permitting process.

1. Objectives and Functions

The specific objectives and functions of this Permit Writer's Manual are to:

- Briefly review the legal history of wastewater permitting to provide permit writers with a perspective on their role.
- Define the requirements for permits in Washington. This manual integrates state and federal law, state and federal regulation and Ecology implementation policies. Permits reviewed for 401(a) certification must be consistent with procedures in this manual.
- Ensure statewide consistency in permitting, especially for permits which require best professional judgment (BPJ) determinations.
- Identify state and federal laws, regulations and policies relating to permitting.
- Identify legal opinions of the Attorney General's Offices, rulings of the Pollution Control Hearing Board and rulings of other courts on permitting and permit related issues.
- Gather collective knowledge of Ecology on permit writing.
- Provide a central document to place new information, guidance, and requirements related to permitting.
- Serve as a reference for experienced permit writers.
- Train new permit writers. This manual is identified in the Permit Writers Training Strategy as a component of training for new permit writers. The manual will reduce the training time for new permit writers and the demand on experienced permit writers to train new permit writers.
- Demonstrate to the regulated community and other interested public what the agency does in permitting a wastewater discharge.

This manual is a technical/philosophical compendium of experienced Ecology permit writers.

The manual is expected to be revised annually. Revisions or additions to the manual may occasionally be made between annual revisions. These revisions and additions will be sent with a transmittal cover memo from the Program Manager explaining the need for revision and where the text is to be placed in the manual.

2. Format Follows Process

The manual's format follows the process of developing a wastewater discharge permit. Because of the complexity of the permitting process it is impossible to completely separate functions chronologically. For example, the public involvement chapter is one of the later chapters in the manual because historically public involvement occurred after the permit conditions were drafted. Public involvement now begins upon permit application.

In preparing the manual, we borrowed materials freely from EPA and from other states when appropriate. These materials are cited in the reference section. They are available from the Ecology library and on the Internet.

2.1 Other References

The new permit writer should read and have on hand some reference documents related to permitting. Specifically, the permit writer should have access to water pollution laws and regulations, the Code of Federal Regulations dealing with environmental regulation (40 CFR Parts 100-149 and 400-471), and a current copy of the Clean Water Act. The permit writer should read Chapters 173-220, 173-216 WAC and study Chapter 90.48 RCW. The Technical Support Document for Water Quality-based Toxics Control (EPA 505/2-90-001) is required background reading for Chapters 6 and 7.

3. Scope

The scope of this manual includes:

- Joint State/NPDES permits as issued under Chapter 90.48 RCW and the Federal Water Pollution Control Act
- Municipal wastewater treatment plants
- Industrial/Commercial Facilities
- General Permits
- State waste discharge permits as issued under 90.48 RCW.
- Discharges to groundwater
- Discharges to municipal sanitary sewer systems as part of the state-wide (undelegated) pretreatment program.

4. Inspections and Enforcement

The issuance of a wastewater discharge permit leads to subsequent regulatory activities including inspections and enforcement. Guidance for those functions is provided in the Inspection Manual (Ecology 92-76) and the Compliance Assurance Manual (posted on the Intranet, under the Resources tab, Compliance and Enforcement).

5. Not Regulation

This manual is not regulation and should not be cited as regulatory authority for any permit condition. This manual describes law and regulation pertaining to permitting. These laws and regulations must be followed to issue a legal permit. Where those laws and regulations are not explicit on implementation the manual describes a process for implementation. This process is a program decision (policy) for implementing the laws and regulations and typically has been subject to debate by permit writers and management. If the process does not fit a permitting circumstance, the permit writer can explore alternative processes as long as the law and regulation are met. Alternative processes require section supervisor approval prior to implementation.

6. A Short History Lesson

The point source water pollution control program in this state is based on both Federal and State law which evolved concurrently. The State of Washington began a formal pollution control program in 1945 with the creation of the Pollution Control Commission and enactment of RCW 90.48. The law did not allow strong enforcement. Pollution control was a negotiation process and required the state to demonstrate a water pollution problem and assign the cause of that problem to a specific discharger.

In 1948 the federal government passed the Water Pollution Control Act (PL 80-845). This law provided some funds for the design of municipal wastewater treatment plants and for study of water pollution problems. This law also required the U.S. Surgeon General, in cooperation with the states, to develop water pollution control programs for interstate waters. The Federal Water Pollution Control Act of 1956 (PL 84-660) and its 1961 amendments (PL 87-88) established federal grants for construction of municipal treatment plants.

The Water Quality Act of 1965 (PL 89-234) required states to adopt water quality standards for interstate waters and created a small agency, the Federal Water Pollution Control Administration (FWPCA). These federal laws generally required the states or federal government to demonstrate that a water quality problem had implications for human health or violated water quality standards. Enforcement was minimal because the burden of proof lay with the agencies: they had to demonstrate a direct link between a discharge and a water quality problem before enforcing on a discharger.

Meanwhile, Washington had adopted a waste water discharge permit system in 1955 (Chapter 90.48 RCW). This permit system was apparently not very effective in controlling pollution problems because in 1961 Washington requested assistance of the FWPCA in solving the problems with pulp mill discharges.

Increasing water pollution became apparent in the mid-1960's. Existing laws were not solving the problems. Two examples that reinforced this impression were Lake Erie, which suffered from severe eutrophication and toxic discharges, and the Cuyahoga River, which caught fire on several occasions. The Federal Government responded in 1970 by instituting a discharge permit system based on the authority of the Rivers and Harbors Act of 1899. This system was ineffective because it rapidly got tied up in litigation but it indicated increased Federal interest in controlling wastewater discharges by means of a permit system.

In 1971, the State of Washington enacted legislation which required dischargers to use "all known, available, and reasonable methods of treatment prior to" discharge regardless of the quality of the water to which the wastes are discharged. This law, the Pollution Disclosure Act of 1971 (Chapter 90.52 RCW), signaled a change of philosophy in water pollution law. Instead of trying to assign responsibility for water pollution problems to particular dischargers, the state would require that all dischargers provide a high level of wastewater treatment regardless of the quality of water to which they discharged (technology-based control).

7. The Clean Water Act

The Federal Government, in 1972, also adopted this philosophy of technology-based pollution control when it enacted the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500). Despite the name of the law, it was essentially a new law. Since 1977, the law and its revisions have been popularly called the Clean Water Act (CWA or the Act). This law, in conjunction with our state laws, forms the basis and framework for our water quality regulatory program today. The objective of the law was, "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."

The Clean Water Act lists several goals and policies in Section 101, which show the Congressional intent for the Act. The best known is the goal that, "discharge of pollutants into navigable waters be eliminated by 1985." This goal was not reached, of course, but it still should be used as a principle for permitting. The Act had an interim goal for July 1, 1983: "Water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water." This is known as the "fishable, swimmable" goal.

Congress also recognized the issue of toxics and declared it "national policy that discharge of toxic pollutants in toxic amounts be prohibited."

Other policies in the Act addressed Federal financial assistance, area wide waste management plans, research and demonstration projects.

The Act also contains four important principles:

- Discharge of pollutants to navigable waters is not a right. A permit is required to use public resources for wastewater disposal.

- The discharge permit limits the amount of pollutants to be discharged.
- Wastewater must be treated with the best treatment technology which is economically achievable--regardless of the condition of the receiving water.
- Effluent limits are based on treatment technology but more stringent limits may be imposed if the technology-based limits do not prevent violations of water quality standards in the receiving water.

More specifically, the Act created a system for permitting wastewater discharges (Section 402). This system is known as the National Pollutant Discharge Elimination System (NPDES). The objective of this system is to implement the goals and policies of the Act.

Section 306 provided for the creation of federal standards of performance for wastewater treatment. This eventually resulted in effluent guidelines for major categories of industries.

Enforcement is provided in Section 309 of the Act. Both procedures and penalty amounts were explicitly stated. This strong enforcement language was also a major departure from previous legislation.

In 1973, Washington State's water pollution control law (Chapter 90.48 RCW) was amended to enable the state to apply to EPA for authority to administer the NPDES program. In November of 1973, Washington became one of the first states to be delegated the NPDES program.

Congress amended the Clean Water Act in 1977, 1981, and 1987. In 1977 the construction grants program was reauthorized, and Congress clarified its intent and focus for toxic pollutants. The categories of conventional and toxic pollutants were defined. The 1987 amendments created a schedule to end the federal commitment to the construction grant program, addressed stormwater permits, water quality problems due to toxics, and sludge management. The major philosophical change in these latest amendments is a greater emphasis on water quality based permitting for toxic pollutants. This assumed that all permits now comply with technology based requirements.

8. Technology-Based Control

The permit writer should recognize that the environmental gains in point source pollution in this country in the 1970s and 1980s were largely due to the imposition of technology based control and it remains the basis for both Federal and State law. There has been some discussion recently about utilizing the assimilative capacity of receiving waters to reduce the cost of wastewater treatment. This contradicts the legislative principles in the Clean Water Act and Chapter 90.48 RCW. Legislative and Congressional Policy recognizes that a manageable and equitable clean water program requires a technology based program even though the treatment might be greater than required to meet water quality standards. Our stated public policy is to maintain the highest possible purity of public waters by minimizing pollutant discharges to the extent practicable--as opposed to allowing the maximum tolerable level of pollutant discharge.

Federal legislators also adopted a goal of total elimination of the discharge of process pollutants.

The time stated for achieving the goal has passed but the language remained through several major amendments to the Act. This "zero discharge" goal obviously requires treatment in excess of that necessary to meet water quality standards.

There is no regulatory mechanism in this state for limiting the number of dischargers on a water body until the cumulative effect of the pollutants cause an interference with a designated use of that water, in other words, a violation of water quality standards. Requiring technology based treatment, even though the treatment exceeds the requirements necessary to meet the water quality standards, may continually reduce the pollutant load from any source and postpone the necessity of allocating the waste load from each discharge to assure meeting water quality standards.

The technology based approach also functions as a buffer for our incomplete understanding of the fate and effects of pollutants.

For further discussion of the legal and regulatory background of the permit program see Bellingham v. Ecology PCHB No. 84-211, and the *Clean Water Act of 1987* published by the Water Pollution Control Federation in 1987.

9. Water Quality-Based Control

The 1987 CWA and subsequent regulation clarified an earlier principle of the CWA. The principle is that when there is determined, by scientifically valid methods, to be a potential for the violation of the water quality standards from a discharge, then that discharge must receive effluent limits. The effluent limits are to assure the effluent does not cause a violation of the water quality standards. The law does not require 100% certainty but requires a judgment of reasonable potential based on a rational process in order to impose limitations.

10. Permit Writers Implement These Laws and Regulations

The permit writers in the Department of Ecology are primarily located in the four regional offices, the Industrial Section and the Program Development Section. Permit writers are engineers or environmental specialists and scientists. The regional staff is responsible for both industrial and municipal permits. The Industrial Section writes permits for the largest industrial dischargers such as pulp mills, petroleum refineries and aluminum smelters. The Program Development Section primarily develops general permits.

Permit writers are actually point source pollution control managers with multiple responsibilities, therefore the terms permit writer and permit manager are used interchangeably in this manual.

Permit writers represent the people of the state and the country in limiting the amount of pollutants discharged from point source discharges. They must exercise a considerable amount of discretional authority.

Permit writers should expect to receive criticism from all groups interested in the permit program. Environmental groups often charge Ecology permit writers with not writing strong enough permits, for not keeping permits current and for not enforcing on permits. The regulated community often charges that permit requirements are unnecessary, overly stringent, and expensive.

Permit writers have a large amount of authority and responsibility, and this demands the exercise of good judgment. A good permit writer needs some things that are not in this manual, such as a strong commitment to Ecology's mission, an internal sense of self-worth and self-satisfaction, confidence, and a good sense of humor to make it through the white water of the Water Quality permit program.

11. Permit Tools

The Water Quality Program and the Environmental Assessment Program have developed several tools to assist permit writers. These tools include model permit language, model fact sheet language, templates, and spreadsheets for doing the calculations for water quality-based permitting. These tools are maintained by the Program Development Services Section and available to permit writers on SharePoint at: https://partnerweb.ecy.wa.gov/sites/WQ/pwg/default.aspx.

The spreadsheets are also available to the public within an Excel file called PermitCalc at: https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Water-quality-permits-guidance.

Chapter 2. An Overview of the Permitting Process

This chapter presents an overview of the several kinds of wastewater permits required in Washington State, the permitting process, permit modification, and permit reauthorization. The regulatory view of a permit and the components of a permit are described. The process of writing a permit is described briefly in text and illustrated by the use of flow charts. The tasks identified within the flow charts are described in detail in subsequent chapters.

1. What Type of Wastewater Discharge Permit?

In Washington State anyone discharging wastewater (including contaminated stormwater) must have a wastewater discharge permit. There are three types of wastewater discharge permits:
1) State Waste Discharge Permit; 2) NPDES/State Waste Discharge Permit; and
3) General Permit.

1.1 State Waste Discharge Permit

A *State Waste Discharge Permit* is required for a discharge of wastewater to waters of the state which includes groundwater. A state waste discharge permit is also required for any industrial or commercial operators discharging solid or liquid waste material into sewerage systems operated by municipalities or public entities which in turn discharge to waters of the state. This permit is issued under authority of Chapter 90.48 RCW. A State Waste Discharge Permit is valid for a maximum of 5 years. An applicant for a State Waste Discharge Permit may receive a *Temporary State Waste Discharge Permit* if Ecology fails to act upon a complete application for a period of sixty days. A temporary state waste discharge permit is valid for 5 years or until Ecology issues a state waste discharge permit. A temporary state waste discharge permit authorizes discharge as requested in the permit application. A facility covered under a temporary state waste discharge permit must reapply at least 60 days prior to expiration of the temporary permit.

1.2 NPDES Wastewater Discharge Permit

An *NPDES Permit* is required for a discharge of wastewater to waters of the U.S (surface waters). This permit is issued by Ecology by delegated authority of the Clean Water Act. Since waters of the U.S. are also waters of the state, NPDES permits are actually combined NPDES/State Waste Discharge permits issued under dual authorities. NPDES permits are issued for a maximum of 5 years. Temporary permits are not allowed under the Clean Water Act.

1.3 General Wastewater Discharge Permit

General permits are wastewater discharge permits that are developed for a category of discharger instead of an individual facility. General permits may be issued under federal (actually combined NPDES/State) or State-only authority. The Waste Discharge General Permit Program rule, Chapter 173-226 WAC, clarifies the intent in its purpose statement, "Permits issued under this chapter are designed to satisfy the requirements for discharge permits under 307 and 402(b) of the federal Water Pollution Control Act (33 U.S.C. § 1251) and the state law governing water pollution control (chapter 90.48 RCW)". General permits are typically issued for 5 years. Facilities which are eligible for coverage under the permit apply for coverage and then are covered for the remaining length of the permit. Permittees must reapply for permit coverage at least 180 days before expiration.

1.4 Hydraulic Continuity

Permit writers, in some cases, must decide if the discharge of a pollutant onto the ground near a surface water is subject to an NPDES permit or State Waste discharge permit. Ecology believes the best guidance on this issue comes from the United States District Court Eastern District of Washington (Washington Wilderness Coalition v. Hecla Mining, 870 F. Supp 983, 990). The court held that "since the goal of the CWA is to protect the quality of surface waters, any pollutant which enters such waters, whether directly or through groundwater, is subject to regulation by NPDES permit." The court went on to hold, "[I]t is not sufficient to allege groundwater pollution, and then to assert a general hydrological connection between all waters. Rather, pollutants must be traced from their source to surface waters, in order to come within the purview of the CWA."

The decision on hydraulic continuity is dependent upon the pollutant (type and mobility in soils), the pollutant loading, the soils at the site, and the hydrology of the site. At sites where it is difficult to make a determination, a permit writer should require, by order, a discharger to do appropriate monitoring and analysis to determine whether pollutants discharged to the ground (water) can be traced to surface water. Ground water monitoring or other monitoring that will substantiate the analysis should be required.

2. What Is a Wastewater Discharge Permit?

In its simplest conceptual meaning a wastewater discharge permit is a legal document issued by a regulatory body that allows some entity to discharge wastewater. In reality, a wastewater discharge permit represents a complex regulatory program that incorporates hundreds of legal, engineering, and scientific decisions. A simple permit may be just a few pages long but a complex permit may be dozens of pages. A permit package which would give a reviewer a complete picture of the discharge consists of the application, the permit, and the fact sheet. The permit application documentation gives the permit writer most of the information necessary to produce the permit. The application requirements and detailed process are given in Chapter 3.

The body of the permit has three distinct components:

- The cover page gives the name and location of the facility.
- The effluent limitations, monitoring requirements and other special conditions are in the main body of the permit and are derived for each individual permit or general permit.
- The general conditions are the last several pages of the permit.

Derivation of effluent limits, monitoring requirements and special conditions in permits is covered in detail in Chapters 4 through 13.

The general conditions, sometimes called standard conditions, are exactly the same within each category of individual permit. General conditions come directly from federal or state law or regulation or court interpretations of those laws and regulations. They are not subject to change by the permit writer. Some general conditions may not be applicable to some Permittees because of the circumstance of their discharge but they are not removed from the permit. State waste discharge permits for discharge to ground water have different general conditions from wastewater discharge permits for discharge to surface water.

The fact sheet describes the discharge, the regulatory basis of the permit, and the decisions made on the permit. The requirements of the individual permit fact sheet and a fact sheet check list are given in Chapter 14.

Permits are generally issued for the regulatory maximum period of 5 years. The permit writer may have occasion to issue a permit for less than 5 years and nothing prohibits this although dischargers generally prefer a 5-year permit. Permits may be administratively extended past their expiration date for a period of five years if an application for renewal has been properly submitted. The conditions of an extended permit remain in effect and are enforceable. An extended permit may not be modified.

3. The Permitting Process

The major components of wastewater discharge permitting are illustrated in Figure 1. After receiving the application and making a decision to proceed on a permit, the permit writer reviews the application for completeness and accuracy. When the application is complete the permit writer derives the technology-based effluent limits. This is the core of the permit writer's task. Permit writers must always calculate technology-based effluent limits because they may be more stringent than water quality-based limits.

The technology-based effluent limits are compared with effluent limits which are protective of surface or ground water or sediment quality standards (water quality-based limits). The more stringent of the two is placed in the permit. The effluent monitoring requirements and other conditions are placed in the permit. This proposed permit and fact sheet are reviewed internally, by the permittee and the public, and the permit is subsequently issued as a final permit.

The permitting process is illustrated in more detail in Figure 2. This flow chart illustrates that the major steps of Figure 1 are actually multistep processes. For example, the task of deriving technology-based effluent limits is separated into BCT, BAT, BPJ and AKART. Figure 2 also functions as an index to later chapters because the sidebars list later chapters where the processes are discussed.

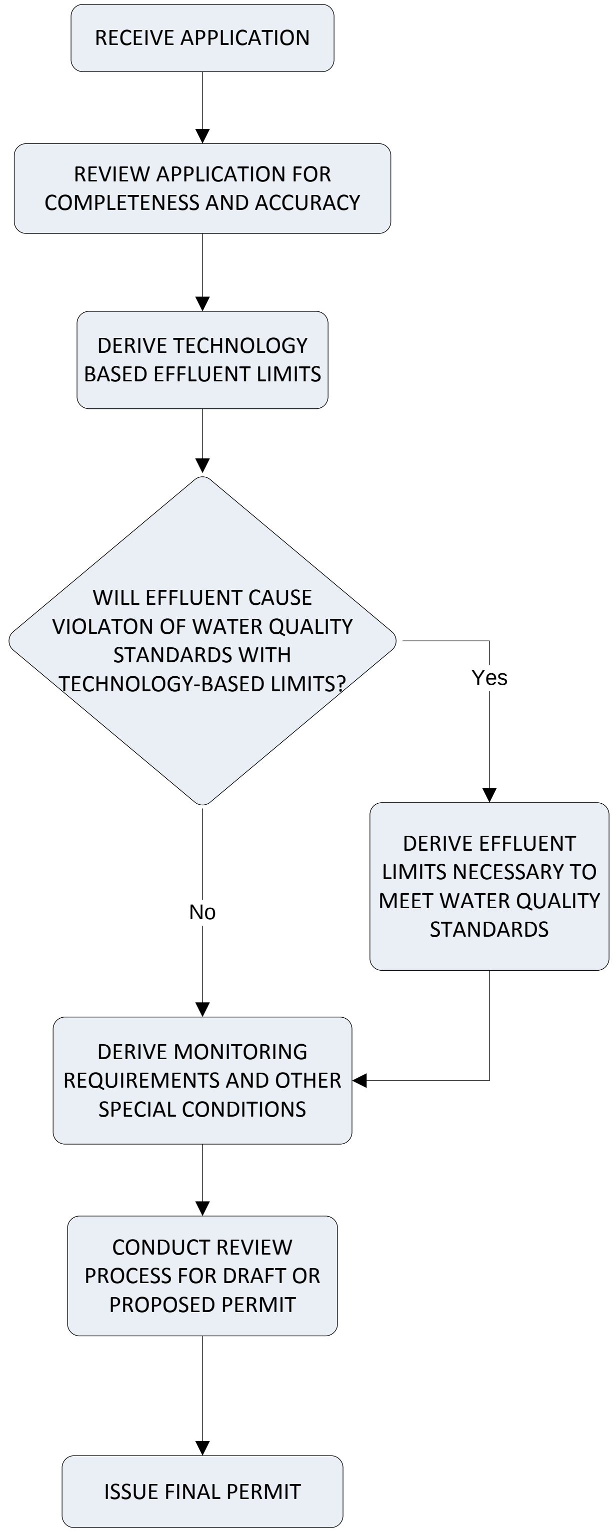
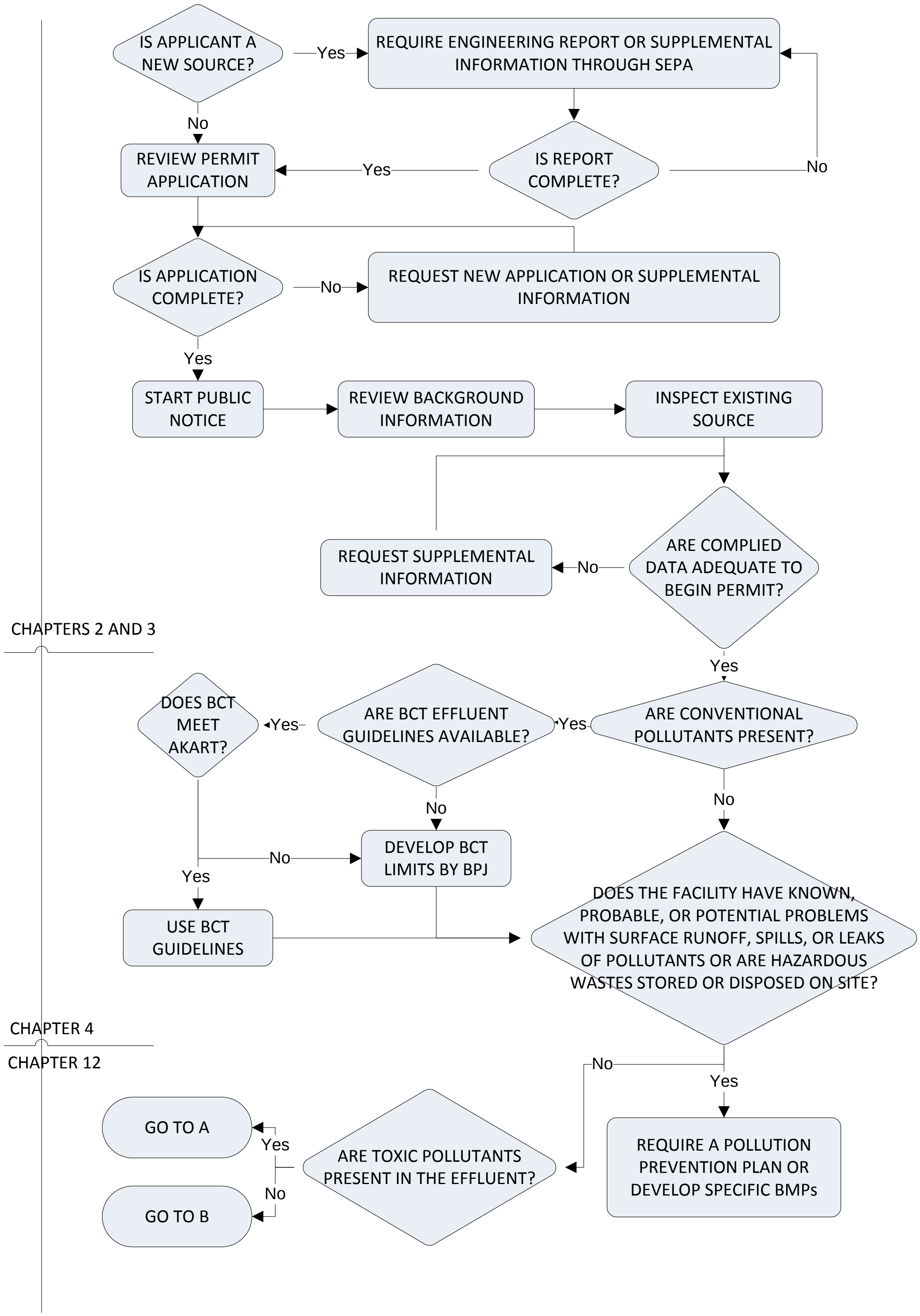


Figure 1. Overview of the Major Components of the Permitting Process for All Dischargers


IS APPLICANT A NEW SOURCE?
Yes
REQUIRE ENGINEERING REPORT OR SUPPLEMENTAL INFORMATION THROUGH SEPA
No
REVIEW PERMIT APPLICATION
Yes
IS REPORT COMPLETE?
No
IS APPLICATION COMPLETE?
No
REQUEST NEW APPLICATION OR SUPPLEMENTAL INFORMATION
Yes
START PUBLIC NOTICE
REVIEW BACKGROUND INFORMATION
INSPECT EXISTING SOURCE
REQUEST SUPPLEMENTAL INFORMATION
No
ARE COMPLIED DATA ADEQUATE TO BEGIN PERMIT?
CHAPTERS 2 AND 3
Yes
DOES BCT MEET AKART?
Yes
ARE BCT EFFLUENT GUIDELINES AVAILABLE?
Yes
ARE CONVENTIONAL POLLUTANTS PRESENT?
No
No
No
DEVELOP BCT LIMITS BY BPJ
Yes
USE BCT GUIDELINES
DOES THE FACILITY HAVE KNOWN, PROBABLE, OR POTENTIAL PROBLEMS WITH SURFACE RUNOFF, SPILLS, OR LEAKS OF POLLUTANTS OR ARE HAZARDOUS WASTES STORED OR DISPOSED ON SITE?
CHAPTER 4
CHAPTER 12
No
Yes
GO TO A
Yes
ARE TOXIC POLLUTANTS PRESENT IN THE EFFLUENT?
REQUIRE A POLLUTION PREVENTION PLAN OR DEVELOP SPECIFIC BMPs
No
GO TO B

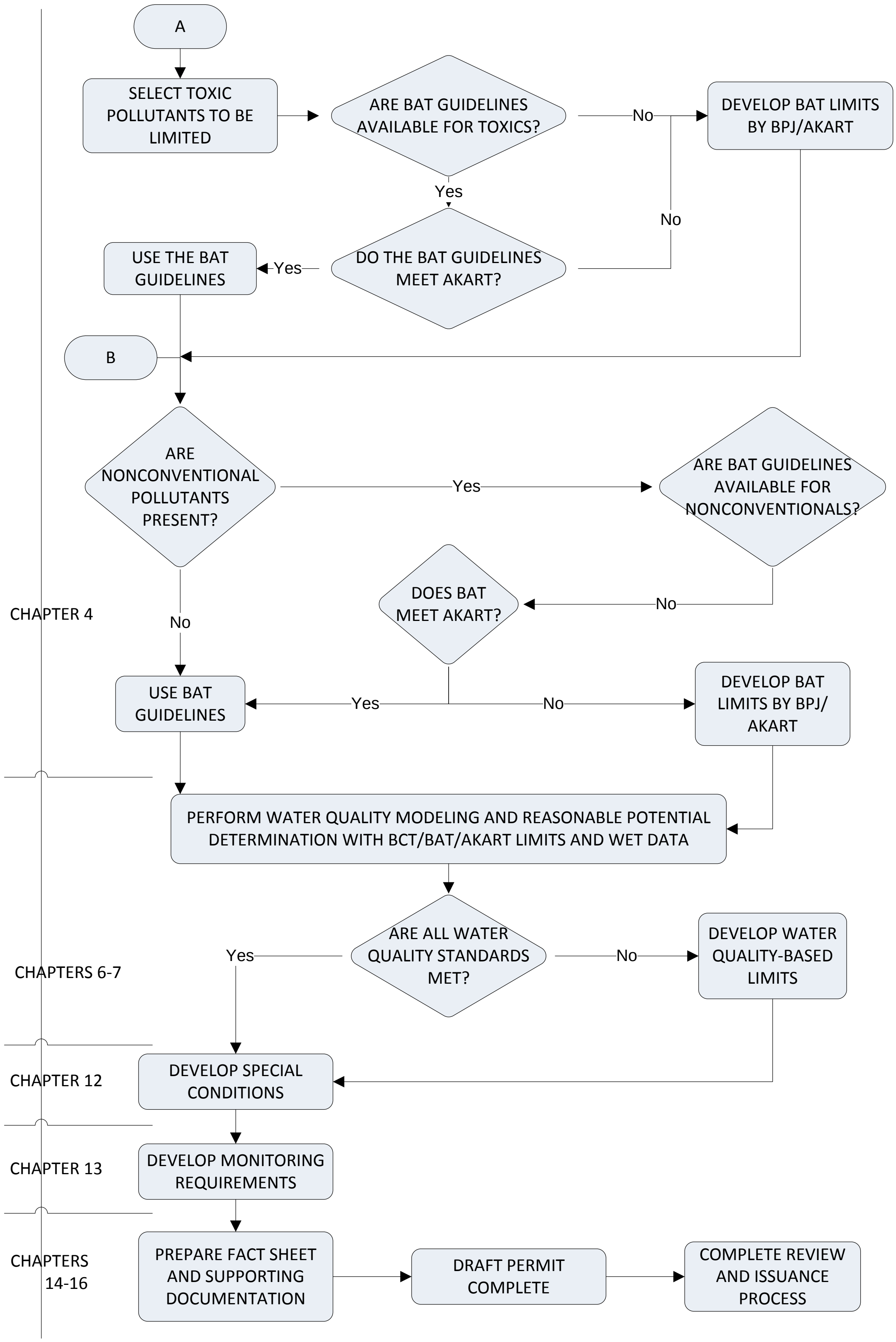


Figure 2. The Permitting Process for Industrial Dischargers

4. Modification of Permits

A permit modification may involve many of the same processes as developing a new permit. A term that has become synonymous with permit modification is “reopening the permit”. Permit modifications may be initiated by Ecology, by the permittee, by the Pollution Control Hearings Board (PCHB), or by the public. Ecology may modify the permit for any of the causes listed in 40 CFR 122.62. Typically, Ecology modifies permits because of *alterations* of the facility (122.62 (a)(1)) or because of new *information* (122.62 (a)(2)) such as the effluent causing a violation of water quality standards. Other causes for modification are listed in 122.62.

If the permittee or the public wants the permit modified, they submit a letter to Ecology requesting the modification and the reason for the request. Ecology may proceed with the modification as requested, or not act on the request. When a permit is modified by Ecology, those portions of the permit that are modified are subject to appeal to the PCHB.

When the PCHB requests a permit modification, it is the result of a permit appeal and the PCHB remands the permit back to Ecology for change.

A permit modification may be minor or major. The definition of minor modification is found in 40 CFR 122.63. A permit modification is *minor* if it:

- Corrects typographical errors;
- Requires more frequent monitoring or reporting;
- Changes an interim compliance date in a compliance schedule, provided the new date is no more than 120 days later and it doesn't affect the final compliance date;
- Allows for a change of ownership or control of a facility;
- Changes the construction schedule for a new source discharger;
- Deletes a point source outfall when the discharge from that outfall stops, provided it doesn't cause a change at the other outfall(s); or,
- Incorporates conditions of a POTW pretreatment program if the pretreatment program has been subject to public hearing.

Minor modifications do not require public notice but the modifications should be sent to the parties of record. Any permit modification which goes beyond the above circumstances is a *major* modification and has the same requirements as a permit renewal including the public notice requirements. Modification does not change the expiration date of the permit.

A permit writer should consider *revocation and reissuance* of a permit when a major modification is required in order to extend the time until renewal. Anytime a permit is modified it may be revoked and reissued if the permittee agrees. Regulations (40 CFR 122.64) allow a permit to be revoked and reissued without permittee agreement for any of the following causes:

- Noncompliance with the permit
- Misrepresentation or failure to disclose facts during application of the permit,
- Discovery that the discharge is endangering human health or the environment,

- A change in any condition that requires either a temporary or permanent reduction or elimination of any discharge or sludge use or disposal practice controlled by the permit (for example, plant closure or termination of discharge by connection to a POTW).

When a permit is revoked and reissued the whole of the permit may be appealed.

5. General Permits

General permits are combined NPDES/state or state-only wastewater discharge permits that are developed for a category of discharger instead of an individual facility. The state regulation covering general permits is Chapter 173-226 WAC. Many of the federal regulations in 40 CFR 122 and 125 are also applicable to NPDES general permits. General permits may be cost effective because a large number of facilities may be covered rapidly with a general permit. When the Water Quality Program decides whether to issue or reissue a general permit, it considers the following:

- Are there a large number of facilities to be covered?
- Do they have similar production processes?
- Do they have similar process pollutants?
- Do only a small percentage have a potential for water quality standards violations?

The terms and conditions of a general permit are similar to those in an individual permit, are developed in a similar manner, and must meet both federal and state requirements. Most of the procedures in this manual are applicable to both types.

The following section is not intended to describe the entire permitting process, only procedures unique to general permits. The permit writer should refer to other pertinent sections of this manual as needed throughout the general permit development process.

6. General Permit Process

The process for developing a general permit is described here under three major categories: permit development, coordination, and public process. The permit writer must manage tasks under each of these categories, often simultaneously, to successfully develop and issue a general permit. An alternative view of this process, with an approximate timeline, is presented in Figure 3. More resources (including Figure 3 in PDF format with hyperlinks) are available on the SharePoint site: https://partnerweb.ecy.wa.gov/sites/WQ/pwg/gp/default.aspx .

6.1 Permit Development

New permits require a few unique actions by permit writers, they must:

- Identify a category of dischargers for the development of a general permit. The Water Quality Program Management Team must concur on the development of the permit.
- Post a public notice of Ecology's intent to develop a general permit. The scope of this public

notice is largely left up to the permit writer, but must be done so as to inform interested and potentially affected persons (Chapter 173-226-130 WAC).

- Place all persons who express an interest in the permit on a mailing list to receive notices of the draft and final permit. This item also applies to reissued permits.
- Publish a public notice when Ecology decides not to develop a new general permit after posting the preliminary determination to do so. Use the same method as chosen to publish the preliminary determination.

New and reissued permits require similar actions for permit development, permit writers must:

- Characterize the wastewater. This may require Environmental Assessment Program (EAP) participation or issuance of administrative orders if components of the wastewater are unknown. The process includes at a minimum, characterization of the pollutants in the wastewater and the development of technology-based effluent limits. See *Chapter 4. Deriving Technology-based Effluent Limits* for more information. Technology-based limits in general permits may be the requirement for best management practices (BMPs).
- Assemble an internal workgroup or refocus an existing permit implementation team.
- Form an external stakeholder advisory group, if necessary.
- Develop a written communication plan with your Public Information Officer (PIO). Consider the need for a media release(s), how you plan to engage with external stakeholders, use of the web and external media, public meetings, etc.
- Create a web page for the permit, or update an existing page. This page should be started shortly before the formation of the external advisory group. The page should tell people that the process for issuance/reissuance has started and indicate how people can subscribe to an informational mailing list and/or ListServ, including our contact information. The people on this mailing list must be notified when a draft permit is available for public comment.
- Prepare an application (Notice of Intent) – Considerations in developing or revising the permit application, also known as the Notice of Intent (NOI):
    - Draft the NOI, or modify existing, as you develop the permit. It must be posted with the draft permit for comment. Consider what questions or data elements are necessary on the NOI such that Ecology staff can properly issue coverage under the general permit and include the necessary site specific requirements identified in the permit. As an example, the Sand & Gravel General Permit includes monitoring and limits that are based on the activities (as identified by NAICS code) conducted at each monitoring point. Therefore the NOI requires the applicant to identify the NAICS codes on each monitoring point which enables the IT staff to globally add the applicable permit limits to each permit based on the identified NAICS codes. In addition the NOI must include all federally required data elements; the PARIS business lead and IT staff will help you meet this requirement. Applications must also include the information necessary for the fee unit to calculate permit fees and these information fields must be added to PARIS. Permit writers must coordinate with the fee unit and IT staff to ensure this critical area of the application is complete.

- Ecology is transitioning to electronic NOIs (eNOIs) for general permits as they are developed and reissued. See *Coordination* below for more detail on working with the Water Quality Program IT staff to develop the eNOI.
- Existing permittees must submit a renewal application using the current NOI form 180 days prior to expiration of the existing permit. Ecology should send notice of this requirement to existing permittees approximately 9 months prior to expiration of the existing permit. This task can be done using WebDocs in the Portal if the letter contains permit specific information. The permit writer would develop the letter and IT staff would build it in WebDocs. The advantage of WebDocs is that it will generate the letters using the information in PARIS and a copy of the letter is uploaded into PARIS automatically. WebDocs letter generation will take 7-21 days. Only permittees who submit a timely application will have continuing coverage under an expired permit and be deemed an "existing discharger" for regulatory purposes.
- If additional information is needed from existing permittees (existing application is inadequate) request the new information as an order to existing permittees at the time of issuance of coverage.

- Fact sheet – Considerations in developing the permit fact sheet:
    - Some writers prefer to draft the fact sheet before the permit. It may also be drafted with the permit, or after. Either way, a fact sheet must accompany the draft permit when it is released for public comment.
    - Fact sheets are prepared for the draft permit only. They are typically not modified for the final permit. Factual errors that may be misleading to a future permit writer are an example of a correction that may be warranted. If the permit writer modifies the body of the fact sheet after the draft comment period, clearly identify this in any modified section(s).
    - The Antidegradation Plan must be addressed in the fact sheet of a general permit (Chapter 173-201A-320(6) WAC). This analysis is not required for individual coverages under a general permit. (Ecology Publication 11-10-073).
    - Fact sheets are not written for individual facilities requesting coverage under a general permit. The fact sheet must contain all requirements of Chapter 173-226-110 WAC.
    - The response to comments (RTC) on the draft permit should be added as an appendix to the fact sheet and posted with the final permit. For more on the RTC, see below under *Public Process*.
    - Update the date on the fact sheet to match the permit effective date.
    - Include a bibliography, citation list, or similar list of sources of information relied on in drafting the permit (RCW 34.05.272). See SharePoint for specific procedures.

6.2 Coordination

- Management review – Discuss the anticipated level of management interaction expected during permit development with your supervisor. New or modified permit conditions with significant impacts to permittees and/or the environment should be discussed.

- Legal review – Coordinate with your supervisor and any legal staff assigned to your permit as necessary. Legal review may be requested for a whole permit, or only specific sections of a draft and/or final permit.
- SEPA – Consider SEPA requirements and begin the process early, if necessary. More information on SEPA is available to Ecology staff on the intranet here: http://teams/sites/SEA/SEPA/SEPA%20at%20Ecology/Home.aspx .
- Economic Impact Analysis –
  - Analyses are scheduled based on when your permit expires or a new permit is needed. The Lead Economist will contact early in the permit development process to confirm your timeline.
    - Please contact the lead economist in the Rules & Accountability section to confirm that your permit is on the workload schedule.
    - It is important to let the Kasia know if you would like or need any changes to your timeline. This workload needs to be scheduled with other agency economic work.
  - An EIA is required for all permits (new or reissued) that are intended to directly cover small business (Chapter 173-226-120 WAC).
  - The Rules Unit requires a final draft permit (prior to issuance) at least six weeks prior to when you plan to issue the draft permit. Schedule this well in advance.
  - The permit writer is required to submit the permit language with a description where permit requirements differ from existing federal laws/rules and/or existing state laws/rules. This includes what options were considered in these cases, and any cost reduction considerations used in drafting the permit.
  - The EIA is written by an agency Economist with input from the permit writer, other agency staff, the program manager, and if appropriate the AAG.
  - The Economist assigned to your permit is available for consultation as you work on your permit, however the six weeks prior to issuing your draft permit is blocked out to work on the EIA.
    - See more details about the economic process: Economics and Your General Permit.
- Permitting and Reporting Information System (PARIS) – Contact Water Quality Program IT staff and the PARIS business lead early in the permit development process. IT staff may require up to 14 months to develop electronic support systems for a new permit including:
  - A separate application (on-line eNOI) for each new general permit.
  - For renewals, the existing NOI should be reviewed for electronic suitability and revised as necessary.
  - A reviewable form of the eNOI must accompany the draft permit during the public

comment period.

  - Collection and maintenance of monitoring data (in coordination with the PARIS database and Portal elements, such as DMRs, reports, etc.).
  - Work with PARIS business lead/data steward and IT staff to ensure that the permit parameters, sampling, and test methods, units of measure, and limits will work within PARIS or if changes need to be made (in PARIS or in the permit).
  - The data steward, with the permit writer's assistance, will need to prepare "global" limit sets and schedules within PARIS to be applied to each reissued or new permit. The IT staff can upload these global schedules and limit sets to all the permit renewals at one time. These limit sets are then available to permit coordinators to add to new permit coverages issued during the permit term.

- Permit fees – Coordinate with the Permit Fee Unit as needed. Near the new permit effective date, provide them with the cover of the permit and copies of all the coverage letters. If WebDocs is used to generate these letters the fee unit can access the renewal letters using PARIS. If staff are uploading new coverage letters during the permit term and uploading these letters to PARIS the fee unit can access these letters in PARIS.

- Office of Regulatory Innovation and Assistance (ORIA) – ORIA maintains an Environmental Permit Handbook (https://www.oria.wa.gov/?pageid=403) that should be reviewed and updated as necessary. New permits may require a new entry for the handbook. After issuance, the permit writer should periodically review the entry for their permit to ensure it remains current.

- EPA review – Typically, EPA will complete their review during the draft comment period. However, they may request up to a 90-day review period. Consider sending the permit to EPA early if a longer review period is anticipated.
  - EPA does not review general permits issued solely under State authority.

- Ecology QA review – All draft general permits must be sent to Quality Assurance (QA) staff for review (see *7. QA/QC Process* below) prior to public notice.

- Environmental Report Tracking System (ERTS) – If your permit directs permittees to ERTS (Report a Spill), contact the ERTS coordinators. Describe how you would prefer reports to be routed (e.g. to regional inspectors). Provide a list of questions the ERTS coordinator can ask to assure all permit required information is collected.

6.3 Public Process

- Communication plan – See above under *Permit Development* for more information.

- Web – Start a webpage or update an existing page. The page should include information on the permit, contact information, a description of the issuance process, and instructions for how interested parties can be placed on a mailing list and/or listserv (if one exists). This will involve coordination with web support staff and your PIO.

- Stakeholder advisory group – Consider the need for stakeholder involvement (e.g. technical, implementation issues). Discuss these with your supervisor and PIO.
- Draft permit issuance – Complete public notice requirements (Chapter 173-226-130 WAC) for the draft permit, including:
    - State Register – Publish a short summary of the permit and the economic impact analysis in the State Register. The publication may also mention SEPA. Coordinate posting with the Ecology Rules Unit. More information is available to Ecology staff on their SharePoint site: http://partnerweb/sites/GR1/rulemaking/Pages/default.aspx.
        - Reminder: Once something is filed with the State Register, it may be posted to the State Register website as early as the Friday before the scheduled publication date.
    - New permits with state-wide coverage: In addition to the state register, post the permit on the web and consider publication in at least five local newspapers. If the new general permit covers a category of dischargers that is highly localized, publication of notice in the major newspapers of one region may be sufficient. The permit writer must save newspaper receipts as part of the permit record.
    - Renewed permits – Notice of renewed permits should be place in the State Register and posted to the web.
    - Post notice of the public comment period and public hearing(s) on Ecology's Public Involvement Calendar (https://ecology.wa.gov/Events/Search/Listing) Schedule notice to post on the same day as publication in the State Register.
    - Work with administrative staff to send individual notices of the draft to the mailing list and required governmental agencies and all tribes. The permit writer must save the mailing list as part of the permit record.
    - Public hearing(s) – Hold a minimum of one within the area covered by the permit. Schedule a hearings officer well in advance of the State Register posting.
        - Although only one public hearing is required, three or four hearings are recommended for a new type of state-wide general permit.
        - One of the public hearings must occur at least 30 days after notice is published in the State Register (Chapter 173-226-130(3)(c) WAC).
        - Public hearings may be directly preceded by a public workshop on the draft permit. Discuss this with your hearings officer.
        - Testimony from the public hearing may be posted to the website as an audio file. The testimony must be transcribed if we receive a request for a transcription.
- Response to Comments (RTC) – After the close of the public comment period, prepare an RTC and make any required changes to the permit.
    - The RTC must note where significant changes were made in the draft permit as a result of comments. Similar comments may be grouped for response.
    - Consider making a 'redline' version of the permit available to show changes made. If

applicable, post the redline version of the permit with the final permit and response to comments.

  - Changes to the final permit should only be made in response to comments. If significant changes are made unrelated to comments received, another draft comment period may be required.
  - Schedule time for review of the RTC by any internal team who contributed to the permit, your supervisor, and legal review if necessary.
  - The RTC becomes an appendix to the fact sheet. It may also be posted as a separate document.
  - Include comments from the public hearing(s) in the RTC.

- PARIS setup – Work with the data steward/PARIS business lead to develop the final limit sets and schedules (for submittals, milestones, etc.) when in the final drafting stage. Provide the PARIS business lead with a copy of the final permit once it is complete and prior to issuance so the business lead can make any final changes on limit sets and the schedule. The business lead will provide you with access to the limit sets and schedule for your final review. This must be a team effort to ensure accuracy.
  - IT staff will upload the sets and schedules into each general permit coverage.
  - Any permit coverage specific limit sets, such as TMDLs or listed water bodies may have to be loaded individually unless the permit writer/administrators develop a list of permits that need an additional limit set. Anticipate some individual cleanup work for these permits.
  - The permit coordinators/administrators will upload these schedules and limit sets individually to any new coverages issued after the permit effective date.
- Final permit issuance – The Program Manager must sign a reissued permit at least three weeks prior to expiration of the current permit. Schedule the appointment for signing six weeks in advance. Complete a public notice for issuance of the final permit.
  - Public notice of the issuance of a general permit must be done in a manner similar to the public notice of the draft permit, including publication in the State Register (Chapter 173-226-130(4) WAC).
  - A general permit may become effective no sooner than 30 days after a notice of the issuance of the general permit is published in the state register. The effective date should be set with consideration of the monitoring requirements of the permit and the Ecology Permitting and Reporting Information System (PARIS).
  - Place the notice of issuance on the web page along with the permit, fact sheet, and response to comments. Consider a news release, focus sheet, newsletter, or frequently asked questions (FAQ). If the reissued permit is significantly different than the previous permit then consider conducting state-wide workshops.
  - Issue coverages with the permit to existing permittees on the issuance date. The transmittal letter should inform them of available documents, the permit appeal process,

and any workshops scheduled. Notify the Permit Fee Unit. They may need copies of the coverage letters. Coverage letters for renewals generated through WebDocs are automatically uploaded into PARIS and accessible to internal staff.

- Send a letter of issuance to all who commented by letter and those on the program mailing list wishing to be notified of issuance. The letter includes links to the web site with the permit, fact sheet, and response to comments as separate documents. The letter offers hard copies to be sent upon request. Response to any request as a result of this letter must be made within three days.
- Send email notice on the day of issuance to all who commented electronically. The email contains links to the web site containing the permit, fact sheet, and response to comments.
- Upload the final permit and fact sheet to PARIS. The data steward/PARIS business lead can provide guidance on the upload process.

6.4 Individual Coverages

Applications for new coverage under a general permit:

- May be submitted any time following the public notice of the draft general permit, or at a later date as specified by Ecology.
- Generally, do not require public notice from facilities previously covered under the permit unless the facility has an increase in volume or a change in the character of the effluent. A new application form may require that existing facilities may have to reapply or provide additional information.

Coverage under a general permit is automatic on the latter of the following:

- The effective date of the permit;
- 31 days following the end of any public notice and public comment period on an application for coverage under the general permit;
- 31 days after receipt of a completed application for coverage; ***or***
- A date specified in the general permit.

Permit writers must document all of the requirements above and place documentation in the permit file. This includes documentation of mail outs, public notices and transmittal letters to EPA and other required government agencies.

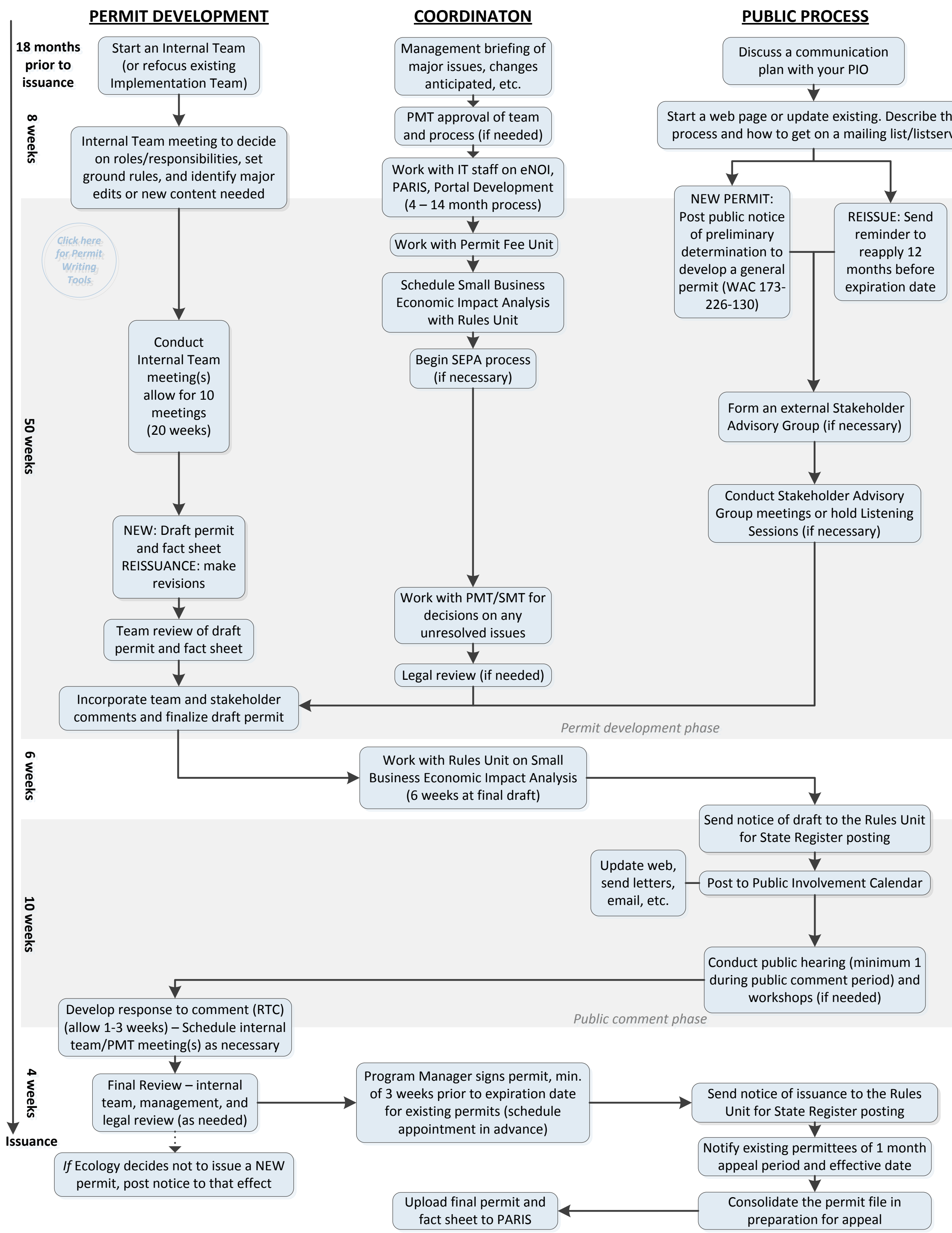


Figure 3. General Permit Process

7. QA/QC Process

The originating section and the Water Quality Program (WQP) Program Development Services Section (PDS Section) will conduct a consistency check for all proposed and draft permits through a combination of pre-issuance reviews.

The Water Quality Program Manager originally established the following procedure for centralized quality control associated with permit issuance by a memorandum dated April 8, 1994. Each issuing office must establish the implementation details of the required procedures for in-office internal quality assurance. All Ecology programs that issue wastewater permits under the authority of RCW 90.48 will adhere to the centralized quality control process for all NPDES and state waste discharge permits and major permit modifications issued. These programs typically include the Water Quality Program, Toxic Cleanup Program, Nuclear and Mixed Waste Management Program, Hazardous Waste and Toxics Reduction Program, and the Solid Waste and Financial Assistance Program (Industrial Section).

The regions and Ecology Programs identified above will also submit administrative orders establishing interim effluent limits issued under the authority of RCW 90.48 to the PDS Section for a quality control check. Actions initiated as "substantive requirements" of water quality permit requirements under CERCLA or MTCA will also undergo centralized quality control. The signatory authority must approve any variations to this procedure and must convey the reason or cause for the variation to the WQP Manager prior to adopting the specific procedure and issuing of the permit.

Responsibility for Quality Permits

The ultimate responsibility for the content and quality of a permit rests with the supervisor signing the permit. The unit supervisor and the permit writer are responsible for briefing the supervisor signing the permit on all significant issues raised from central QA/QC review, any EPA review, written review, and from an oral presentation. The unit supervisor and the permit writer will explain the resolution of these issues.

Resolution of Disagreements

Disagreements on significant issues may occur between the PDS Section Permit QA/QC Coordinator and the permit writer. The relevant unit supervisor, permit writer, and the QA/QC Coordinator will meet either directly or via a conference call as the first step towards resolution. If resolution does not occur, the relevant section supervisor and the PDS Section supervisor will discuss the issue. The final decision rests with the permit signature authority. The supervisor with signature authority and the PDS Section supervisor will determine the need for further management involvement in the decision.

7.1 Pre-Issuance Review

- **Internal Peer Review:** Internal peer review of all Water Quality Program draft permits, modifications, and relevant orders must take place within the section or regional office. Each issuing office must establish the implementation details of the required procedures for in-office internal quality assurance. The WQ Program encourages cross-region and cross-program review. The paragraphs below describe two in-office internal approaches used by some of the regional WQ sections as well as the required PDS Section Permit QA/QC review and EPA review.

- **Peer Review through Document Distribution:** The unit supervisor may assign the draft permit and fact sheet to one or more other permit managers for comments, suggested changes and additions.
- **Peer Review through Oral Presentations:** Peer review of industrial and municipal permits through an oral presentation may occur at the local regional office, at a permit writer training session, or other suitable forum prior to issuance of the permit.
- **PDS Section Central Permit QA/QC Review:** This PDS Section central review should occur after regional peer and unit supervisor review. The permit coordinators must submit the draft permit, any associated compliance order, fact sheet and appendices to the PDS Section Permit QA/QC Coordinator for Central Permit QA/QC Review ***prior to*** entity review and the Public Notice of Draft (PNOD). Permit writers can expect that the Permit QA/QC coordinator will complete the quality control check of minors and state permits within ten days (two weeks) and within three weeks for major permits.
- **EPA Review:** Permit writers ***must*** send all major and general permits to EPA Region 10 for review concurrent with public review. If the PDS Section Permit QA/QC reviewer believes that EPA may have concerns with a permit he/she will recommend that the region forward the permit to EPA during entity review so that Ecology and EPA have an opportunity to work out any issues prior to public review. Permit writers may contact the EPA reviewer at any time while drafting a permit to discuss issues if they foresee an objection by EPA of the permit terms and conditions.

The Permit QA/QC Coordinator will review as many permits as possible for consistency and fulfillment of policy, procedural, and legal requirements. The Permit QA/QC Coordinator will provide assistance to the permit writer in the form of constructive suggestions and advice on addressing relevant policy issues. The Permit QA/QC Coordinator will identify areas of inconsistency requiring new or revised policies, procedures, and guidance and will identify areas where lack of policies, procedures, and guidance cause permit issuance inefficiencies. The PDS Section supervisor will relay these issues to the Permit Writer's Workgroup (PWG) and/or as necessary to the Program Management Team for discussion and resolution.
The originating region/Program may publish the PNOD after consideration of comments received from the peer reviews, central QC check, any EPA review peer reviews and compliance with the pre-issuance review procedures.

7.2 Post Issuance PDS Section Central Review

The Permit QA/QC Coordinator will randomly review final permits after issuance for consistency, use of common guidelines, and incorporation of internal and external comments. The Permit QA/QC Coordinator will give special attention to review of permit elements driven by new requirements.

Communication of Findings

- When issues emerge that are of interest to permit managers, the Permit QA/QC Coordinator will communicate the issues to permit managers through emails, newsletters, PWG discussions, videoconferences, training sessions, and other appropriate methods.
- The Permit QA/QC Coordinator will route recommendations for changes to the permit shells to the chair of the PWG for inclusion in the shell update process.
- The Permit QA/QC Coordinator will discuss issues that require supervisory attention first with the appropriate unit supervisor and, when necessary, elevate issues to the PDS Section Supervisor for resolution.
- The PDS Section Supervisor will elevate issues involving the efficiency of permit writing and issues needing policy determinations or procedural guidance to program management.
- The Permit QA/QC Coordinator will, as necessary, prepare and distribute a summary of issues prior to each permit writer training session for discussion at the session.

7.3 PDS Central Permit QA/QC Review

Submittal of draft permit, any associated compliance order, fact sheet, and the permit application for PDS Section Central Permit QA/QC Review to the QA Coordinator in the PDS Section will occur prior to the Public Notice of Draft (PNOD). Ten days (two weeks) will be allowed for the quality control check of minor permits and three weeks will be allowed for major permits. The EPA review and PDS quality control check period should take place concurrently and before entity review for majors and general permits. Central quality control review will take place during, or prior to, any entity review period for state and minor permits.

The permit QA Coordinator will be reviewing as many permits as possible for consistency and fulfillment of policy, procedural, and legal requirements. The permit QA Coordinator will provide assistance to the permit writer in the form of constructive suggestions and advice on addressing relevant policy issues. A key role of the QA Coordinator will be to identify areas of inconsistency requiring new or revised policies, procedures, and guidance. Areas where lack of policies, procedures, and guidance are causing inefficiencies in permit issuance will be identified for management attention.

The PNOD may proceed after consideration of comments received from the peer reviews, central QC check, any EPA review peer reviews and compliance with the pre-issuance review procedures.

8. Permittee Review (also see Chapter 15, Section 4)

8.1 Procedures

1. Permit writers shall inform Permittees of significant changes to their renewed permits as early as possible in the permitting process.
2. The proposed fact sheet, permit, or permit and fact sheet should be forwarded to the Permittee for comment on factual content 30 days prior to the beginning of the formal public review period. A shorter review period may be used when acceptable to the Permittee or if permit deadlines require a shorter review period.
3. The Permittee shall be made aware that the proposed permit conditions could be changed during the public review process.
4. The draft permit transmittal letter shall specify a date certain by which comments are due, and be clear that the permit issuance process will not be delayed if the date is not met.
5. For permit renewals with significant changes, the permit writer may offer the Permittee an opportunity to meet two weeks or more after forwarding the proposed permit or fact sheet. The purpose of the meeting is to explain new or changed requirements, receive comments on factual content, and to discuss the practicality of compliance schedules.

Waste discharge permits are now very complex documents, and new more complex requirements in reissued permits have become the norm. It is extremely important that Ecology informs Permittees of significant changes proposed in their permit as soon as possible. It is also important that the proposed permit and fact sheet be factually correct with respect to facility information such as discharge locations, and process description before the public review.

The Permittee needs to know what the new permit requirements are and the basis for the requirements. The practicality of any proposed compliance schedules also needs to be discussed with the Permittee prior to setting a proposed schedule in the public review draft.

9. Public Review

Ecology is committed to implementing a more effective public involvement program and strongly supports public involvement in the review of and input on permit conditions during the public review.

If, during the public review period, members of the public wish to meet with Ecology staff to discuss new permit requirements and their basis, such a request should be granted. Early Permittee involvement ensures a correct draft permit for public review and avoids unnecessary delays in the public issuance process. It also ensures that Permittees are informed of the proposed permit requirements in a timely manner. It’s also important that the public has full access and opportunity to participate in the permit process during the public notice process.

10. EPA Review

Draft individual NPDES permits for major dischargers should be sent to the EPA Region 10 for review during the public review process.

11. An Example Permit

New permit writers who are not familiar with permits should review several recent permits from their section files or posted on the Internet. The permit writer may contact the QA/QC person for some exemplary permits.

12. Permit Shield Policy

Permittees are afforded some protection of liability from enforcement and citizen suit by having a discharge permit. This protection comes from language in Section 402(k) of the Clean Water Act. This section of the CWA says "Compliance with a permit issued pursuant to this section, shall be deemed compliance, for purposes of sections 309 and 505, with sections 301, 302, 306, 307, and 403, except any standard imposed under section 307 for a toxic pollutant injurious to human health." EPA has adopted a policy (EPA 1995) to clarify the circumstances of protection afforded by this policy. The policy states that if the pollutants in the discharge, the suspected pollutants in discharge and the manufacturing processes are fully disclosed during application, the Permittee is shielded from enforcement if it's subsequently discovered the discharge is causing a violation of water quality standards. Several courts have agreed with EPA on the legal interpretation of Section 402(k).

Occasionally, permit writers receive requests to place some explicit permit shield language in a permit. Ecology permit writers should <u>not</u> put permit shield language in permits. This is a protection afforded Permittees by the fact of receiving a permit and the circumstances surrounding the permit application and issuance. Nothing in the Clean Water Act or federal regulation or policy directs permit writers to place this language in permits. The language often suggested by Permittees grants far broader immunity than that afforded by Section 402(k). Permit writers who want to assure 402(k) protection for Permittees should require extensive analysis of the effluent for the permit application and be very explicit in the fact sheet about how each pollutant in the effluent was considered. Permittees who want the protection of 402(k) only have to make sure they disclose all relevant information on their discharge in their permit application.

13. CWA Jurisdiction on Tribal Lands

Jurisdiction within Indian Reservations is very mixed and is based on complex case law. Also terminology can be confusing. County-issued permits are not evidence of state NPDES jurisdiction.

The State does not have jurisdiction for any of the EPA delegated/approved programs on ***any*** lands (fee/trust, Indian owned/non-Indian owned) within any Indian Reservation, except the

Puyallup Reservation where we have received specific authorization.

EPA believes that it can only delegate/approve state programs within Indian Reservations if it makes a specific finding of state authority on those lands. On the Puyallup Reservation the tribe agreed and Congress approved a land claims settlement that provided that the state would have jurisdiction on fee lands within the Reservation. On this basis, EPA has approved Ecology's CWA, RCRA, and CAA programs on fee lands within the Puyallup Reservation.

On all of the other 25 reservations within the state, EPA has retained CWA jurisdiction or has delegated specific programs to tribes under its "Treatment as a State" (TAS) process. This is due to EPA's read of its authority and EPA's interpretation that tribes have inherent authority, for the purposes of the federal environmental programs, over all tribal members and their land and all non-member residents and their land within reservations.

A county may have taxing jurisdiction on fee land within a reservation and may have (or assert) zoning and building code authority on fee land. Ecology would still not have NPDES authority on fee land within the reservation unless EPA has specifically delegated CWA programs to the state within the reservation as it did on the Puyallup Reservation.

14. State Authority on Forest Service Land

Washington has concurrent jurisdiction with the US regarding both civil and criminal processes on national forest lands within the state (RCW 37.08.220). This means that the state has the authority to enforce our statutes and regulations on national forest lands in the state. However, Ecology's ability to take enforcement action against the federal government is limited. Consequently, if the federal government is the operator of the treatment plant discharging to land, Ecology can issue a state waste discharge permit for the facility, but Ecology's ability to enforce the permit may require a federal court action. If the plant is operated on USFS land by a private entity or public entity (other than a federal agency), Ecology can issue a permit to that entity and use all the usual enforcement tools (orders, penalties, etc.) to enforce the permit.

15. Antibacksliding

In general, Ecology may not renew, reissue or modify an existing NPDES with effluent limits that are less stringent. The requirements and exceptions are found in CWA 402(o), CWA 303(d)(4), and 40 CFR 122.44(l). The requirements are relatively straight forward but the exceptions are confusing.

Regardless of the exceptions given below, Ecology may not propose a less stringent effluent limit if any of the following apply:

1. It is less stringent than required by federal effluent guidelines.
2. It violates applicable water quality standards (including antidegradation requirements).
3. It violates State technology-based treatment requirements that are more stringent than federal requirements (see discussion below).

State law is silent on antibacksliding so the following does ***not*** apply to limits in State permits; however, the groundwater standards do have an antidegradation requirement which would apply for increased limits.

Ecology may propose less stringent water quality-based effluent limits if any of the following apply:

1. Material and substantial alterations to the permitted facility occurred after permit issuance justifying application of a less stringent effluent limit.
2. Information, not available at the time of permit issuance (other than revised regulations, guidance, or test methods), would have justified applying a less stringent effluent limit at the time of permit issuance. (This is available for listed waters only if the cumulative effect of these revisions assures attainment and the increase meets antidegradation requirements. This assumes that if limits for some dischargers to the impaired waters go up, others will go down to assure attainment of standards.)
3. Ecology made a mistake when it calculated limits or when it interpreted law or regulation when it issued the permit (available for listed waters only if the cumulative effect of these revisions assures attainment and increase meets antidegradation requirements).
4. When Ecology revises a TMDL and transfers a WLA to increases the limits after it had based limits on a TMDL in listed waters. Ecology must still ensure the water body attains water quality standards.
5. When Ecology changes the use designation so the criteria are less stringent after it had based limits on a TMDL in listed waters.

Ecology believes that situations 2 and 3 would most commonly occur. It's not clear how situation 1 would apply to water quality-based limits unless the material and substantial alterations changed the character of the effluent.

EPA also stated in its guidance memo (Elder 1993) that exceptions 1 through 5 also apply to "any other State treatment requirements more stringent than required by the CWA (e.g., technology-based State treatment requirements).

Ecology may increase technology-based limits based on applicable EPA effluent guidelines if:

1) Material and substantial alterations to the permitted facility occurred after permit issuance justifying the application of a less stringent effluent limitation.

Ecology may increase technology-based limits determined on a case-by-case (BPJ) basis [40 CFR 125.3(d)] if any of the following apply:

1. Material and substantial alterations to the permitted facility occurred after permit issuance justifying the application of a less stringent effluent limitation.
2. Information, not available at the time of permit issuance (other than revised regulations, guidance, or test methods), would have justified applying a less stringent effluent limit at the time of permit issuance. (This is available for listed waters only if the cumulative effect of these revisions assures attainment and the increase meets antidegradation requirements.

3. Ecology made a mistake when it calculated limits or when it interpreted law or regulation when it issued the permit (available for listed waters only if the cumulative effect of these revisions assures attainment and increase meets antidegradation requirements).

4. Ecology determines a less stringent effluent limitation is necessary because of events over which the permittee has no control and for which there is no reasonably available remedy.

5. The permittee has received a variance or exception under CWA sections 316(a) or 301(c), 301(g), 301(h), 301(i), 301(k), 301(m) and 301(n). These variances or exceptions are: 316(a) – Thermal discharge, 301(c) – Demonstration of maximum use of treatment technology, 301(g) – Modification for certain nonconventional pollutants, 301(h) – Marine waiver for secondary treatment, 301(i) – Municipal time extension, 301(k) – Innovative technology, 301(m) – Deep sea industrial discharge of BOD and pH, and 301(n) – Fundamentally different factors.

6. The permittee has installed the treatment facilities required to meet the BPJ limits and has properly operated and maintained the facilities but has, nevertheless, been unable to achieve the effluent limit, in which case, Ecology may revise the limits to reflect the level of pollutant control actually achieved.

Ecology believes antibacksliding applies to effluent limits developed on a case-by-case basis under authority of 90.48 (AKART) and placed in an NPDES permit. For example, Ecology develops a performance-based limit for an industrial discharger with obsolete effluent guidelines. The permit writer determines the treatment technology and the operation of that technology is AKART and develops appropriate technology-based effluent limits based on the monitoring data from the facility. EPA then revises the effluent guidelines for the industrial discharger. The guidelines are less stringent than the AKART limit. Even if antibacksliding did not apply, Ecology would still have an independent duty under state law to impose the more stringent AKART limit rather than the less stringent limit based on federal effluent guidelines.

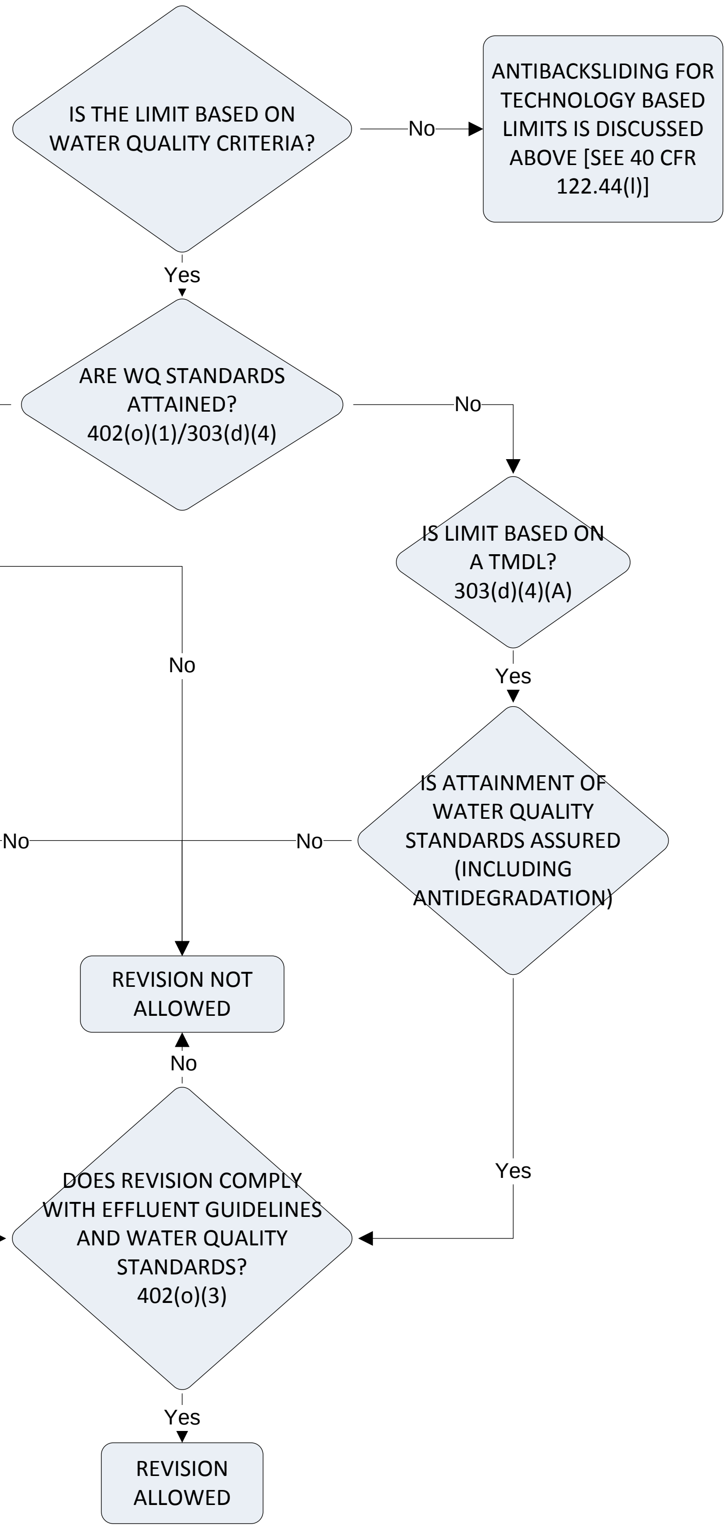


Figure 4. Antibacksliding

Reference:

Elder, James 1989. Draft Interim Guidance on Implementation of Section 402(o) Anti-backsliding Rules For Water Quality-Based Permits (Draft).

16. Reauthorization

A reauthorized permit is a wastewater discharge permit issued to an existing discharger that is virtually identical to the facility's expired permit. Ecology originally drafted the permit prioritization/reauthorization process to assist in reducing the number of expired permits, or backlog, in 1998. Since that time, regions have used the tool to help reduce the program's permit backlog percentage. Originally intended for minor NPDES permits and significant state permits, use of the reauthorization tool expanded over time to include to major NPDES facilities and individual industrial permits. This guidance works to standardize and clarify the appropriate use of permit reauthorization for backlog reduction. Reauthorizations in this section apply to NPDES permits, only. Ecology has developed a fact sheet shell for state waste discharge permits (SWDPs) in addition to the NPDES reauthorization. While this section directly addresses NPDES reauthorizations, similar logic applies to SWDPs. Direct questions on reauthorizations to the permit QA/QC lead in the PDS Section.

Permit reauthorizations must meet requirements promulgated in 40 CFR 122 as EPA considers a permit reauthorization to be a permit issuance. The permit administrative record, permit and fact sheet addendum must demonstrate that the permit writer reviewed data supplied with the application, data collected during the previous permit term, current water quality standards, changes in receiving water status, reasonable potential analyses, and compliance history. The new permit must also contain the original fact sheet so facility information can be readily located. Permit writers must ensure the reauthorized permit and factsheet addendum provide the information needed to comply with federal regulations. Permit writers and supervisors must also understand when the reauthorization tool ***should not*** be utilized and instead, pursue a formal reissuance.

The determination of which permits to reauthorize and which to reissue stems from existing facility knowledge and the significance of the discharge. Previously, staff and supervisors used a permit priority ranking process for identification of reauthorization candidates. Ultimately, the decision to reauthorize rather than renew or reissue the expired permit should be made by the section supervisor.

Permit writers must determine whether the reauthorized permit conditions will be identical to the current permit. A permit may be reauthorized only if the permit writer documents no significant changes to the individual facility's permit requirements. Permits should not be re-authorized more than once before full re-issuance.

While permit reauthorizations should save permit development time, the permit writer must still review permit compliance, characterize effluent data, reassess the receiving water body for any impairments, review the appropriateness of previous effluent limits (including a reassessment of reasonable potential), and provide other necessary documentation that supports the decision to reauthorize rather than reissue a permit. Permit writers must place the permit requirements in the most recent permit shell to capture any changes to Ecology's permitting program that may have occurred since the previous issuance. Other than use of the new permit shell, the only other changes should be to submittal, effective, and expiration dates. Minor changes to monitoring schedules are acceptable. Under no circumstances can the reauthorized permit be less stringent than the current iteration. The reauthorization fact sheet addendum must accompany the previously issued fact sheet, the reauthorized permit, and the updated coversheet complete with a new Section Manager signature.

The reauthorization addendum fact sheet template is available on the Permit Writing Resources SharePoint site along with the fact sheet and permit shells used for permit development. The addendum explains the reauthorized permit, implications of the reauthorization process, recommendations for the permit term, any changes to submittal dates, and updates to Ecology's public notice procedures. This addendum does not replace the expired permit's fact sheet as the previously issued fact sheet continues to be part of the permit record. It is imperative to keep the previous fact sheet as part of the permit record because it provides relevant facility history and the basis for permit requirements. In addition, packaging the fact sheet addendum with the previous fact sheet ensures compliance with 40 CFR 124.56.

Information required in the fact sheet addendum must include facility details, a compliance assessment, updated receiving water information (including any changes to listings), effluent characterization through the previous permit term, a discussion of reasonable potential using all new data, and a review of decisions made during the previous permit cycle related to effluent limit development. The effluent limit review discussed in the fact sheet addendum must include a revised reasonable potential analysis calculation. Permit writers must use the most recent version of PermitCalc to capture changes to water quality standards which may have occurred during the previous permit term. The revised reasonable potential analysis must use data collected during the previous permit cycle in addition to any data submitted with the application or otherwise. Results from the RPA should not change effluent limits. Failure to provide this required documentation undermines Ecology's use of reauthorization as a permitting tool.

When the following conditions exist, a discharge permit should not be reauthorized and should be reissued:

- Permit is under previous reauthorization.
- Design flows exceed 1 MGD.
- The discharge quality/quantity or production levels have significantly changed.
- A pollutant of concern is identified through the reapplication process or during the previous permit cycle.
- The facility is a known source of a pollutant to an impaired water body and reissuance will result in an overall water quality improvement due to tighter effluent limitations.
- A TMDL has been completed for the impaired receiving water and a WLA must be implemented.
- The current permit has a compliance schedule and interim (or performance based) effluent limits that must be reassessed.
- Significant changes are necessary to the compliance monitoring requirements.
- Significant concerns exist within the Agency or Public entities over current permit requirements.

- Reasonable potential exists to violate water quality standards and requires a more stringent limit based on review of the permit application and the previous permit cycle's performance data.
- Additional pretreatment requirements are necessary.
- Any permit requirement becomes less stringent.

Chapter 3. Application and Background Review

This chapter covers the process of permit application and background review including categories of application, forms, and time frames for application. A flow chart showing the tasks for permit writers is included at the end of the chapter. The objective of permit application and background review is for the permit writer to become as knowledgeable as possible about the circumstances of discharge and the characteristics of the proposed effluent discharge.

1. Who Needs Permits

Anyone who owns or operates a facility discharging or proposing to discharge wastewater (including some stormwaters) to the state waters must apply for an individual wastewater discharge permit. State and Federal regulations require a facility to apply for an individual permit to discharge to *surface waters* at least 180 days prior to the initial discharge. Ecology may allow a shorter time period by letter, however, 180 days is not enough time to work through engineering reports for new dischargers or complex issues for existing dischargers. Permit writers should alert their permit applicants to the realistic schedules for permit issuance and renewal. Major Permittees should be sent applications at the beginning of the fiscal year in which their permit expires. Permits should require reapplication one year prior to expiration.

Application for an individual state waste discharge permit must be made 60 days prior to the date on which it is desired to begin discharge but for complex discharge situations 60 days is insufficient time to develop a permit. State permits should also require reapplication one year prior to expiration.

Application times for coverage under a general permit are developed for the specific general permit.

Anyone who discharges wastewater or has a significant potential to discharge wastewater to the *surface waters* of the state must obtain a joint NPDES/state wastewater discharge permit (40 CFR 122.3). Ecology issues joint federal/state permits because the state's water pollution law requiring wastewater discharge permits preceded federal law.

Those exempted from obtaining an NPDES individual permit include:

- Anyone discharging domestic sewage only to a POTW,
- Anyone who is covered by a general permit (see Section 5 of Chapter 2 and Section 9 of this chapter),
- Anyone discharging industrial and commercial wastewater to a POTW,
- Discharges of pollutants from nonpoint source agricultural and silvicultural activities,
- Return flows from irrigated agriculture,
- Any discharge in compliance with the instructions of an On Scene Coordinator, ***and***
- Any discharge occurring under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (but these discharges must meet substantive requirements)

State waste discharge permits are required by:

- Anyone who discharges waste materials from a commercial or industrial operation to the waters of the state or to a municipal sewage system (RCW 90.48.160); ***and***,
- Any county or any municipal or public corporation operating or proposing to operate a sewage system which results in the disposal of waste material into the waters of the state (RCW 90.48.162).
- All lagoons containing wastewater, lined and unlined, require state waste discharge permits (see Chapter 8, Section 3 for the exception of double-lined, non-discharging lagoons).

The exemptions for the requirement for state waste discharge permits include discharges:

- To municipal sewerage systems of domestic wastewater (sanitary wastewater) from residential, commercial, or industrial structures.
- To a municipal sewerage system which are already permitted (subject to review and limitation) by the local authority.
- To a municipal sewerage system which are already permitted under a local pretreatment program (FWPCA section 307).
- To municipal sewerage systems from commercial or industrial operations if the waste strength and characteristics are the same as domestic wastewater (if it's not easily degradable or if its high strength, then the permit writer should examine it in the permit process to assure the waste will not cause an upset at the treatment plant).
- Which have an NPDES/state individual or general discharge permit for discharge to surface water.
- From small domestic on-site septic systems (design capacity less than or equal to 14,500 gallons per day) which discharge to the ground.
- From small (less than or equal to 3,500 gallons per day) aerobic, domestic treatment plants which discharge to the ground.
- During oil spill cleanup which have received prior authorization from Ecology.
- Under the State of Washington Model Toxics Control Act (MTCA). Note that discharges under MTCA are not exempt from NPDES permits (see below).
- From LUST sites and vehicle and equipment washing under some circumstances (see below).

1.1 NPDES Permit Requirements for Non-discharging Facilities Which Have Zero Discharge Limitations in Effluent Limitation Guidelines

Federal law is clear that any discharge of pollutants to surface waters of the United States requires an NPDES permit. Federal regulations [40 CFR § 122.21(a)] also impose on any facility that "discharges or proposes to discharge" a clear "duty to apply" for an NPDES permit. EPA has issued guidance interpreting these regulations to impose a further duty to apply on certain facilities (such as concentrated animal feeding operations) that have a "potential to discharge." However, facilities that do not discharge, do not propose to discharge, and do not have the potential to discharge have no obligation to apply for or to obtain NPDES permits.

EPA has developed categorical effluent limitation guidelines for a number of industries. The purpose of these guidelines is to establish for these categories the minimum technology-based requirements in terms of effluent limits in NPDES permits. A number of these federal effluent limitation guidelines (such as those for the Wood Preserving – Boulton Subcategory [40 CFR Part 429, Subpart H] and the Sawmills and Planing Mills Subcategory [40 CFR Part 429, Subpart K]) establish "zero discharge" requirements for process wastewater pollutants. Federal regulations require permits and permit applications from these facilities if they propose to discharge or have the potential to discharge to surface waters.

A facility subject to a "zero discharge" effluent limitation guideline may seek NPDES permit coverage to take advantage of the "unavoidable bypass" and "upset" defenses available to facilities with NPDES permit coverage. To the extent that the facility operator is "proposing to discharge" during these bypass and upset events, such a permit application is appropriate (and may in fact be required by 40 CFR § 122.21(a)).

However, some facilities subject to effluent limitation guidelines may (because of topography, process, etc.) have <u>no</u> potential to discharge pollutants to waters of the United States. For these facilities, Ecology has decided to follow the process demonstrated in practice by EPA Region 10. No permits will be issued solely because the facility falls within a zero discharge subcategory. If the determination is made that there is a substantial probability of process water discharge to surface waters, an individual NPDES permit may be issued.

1.2 Independent Leaking Underground Storage Tank (LUST) Cleanup Sites

Sites that are classified as "non-independent cleanup sites" are those under which cleanup activities are being conducted under the MTCA formal process of an agreed order or consent decree. A project proponent conducts a remedial investigation/feasibility study (RI/FS) to:

- Determine the site characteristics and define the extent and magnitude of contamination
- Evaluate potential human health and environmental impacts and establish cleanup criteria
- Evaluate cleanup activities

Ecology’s Toxic Cleanup Program (TCP) makes this document available for public review and comment. Once this is complete a Cleanup Action Plan (CAP) is prepared that describes the selected cleanup methods and specifies cleanup standards and other requirements. A draft of this plan is also made available for public review. The project proponent then prepares detailed plans and specifications for the selected cleanup alternative. These steps are formalized in an agreed order between Ecology and potentially liable persons (PLPs) or in a consent decree approved and issued by a court. More information is available on the TCP’s website: https://ecology.wa.gov/Spills-Cleanup/Contamination-cleanup/Cleanup-process

Sites that are classified as “independent cleanup sites” are those under which cleanup activities are being conducted under MTCA’s Voluntary Cleanup Program by choice through Ecology TCP involvement, and those cleanup activities being conducted voluntarily without involvement from TCP. Both types of sites, if they have a discharge resulting from their cleanup activities, must follow the guidance below or contact Ecology directly for case-specific exemptions that may apply.

Independent Leaking Underground Storage Tank (LUST) cleanup sites are allowed an exemption from permits for short term discharges that meet high treatment standards. The following conditions apply:

- **The proponent must submit a letter to Ecology**. If the discharge is to a POTW, a copy of the letter must be delivered to the POTW. The letter shall include the following items:
    1. A project description, including treatment method, disposal method, rate of discharge (gpm), dates of discharges, and duration of discharge (days).
    2. Analytical data from an accredited laboratory showing analysis of pollutants of concern (see Table C following) from the proposed treatment system.
    3. A street map indicating the extent of the site, location of the treatment equipment, address of the site, and point of discharge to the sewer or storm drain.
    4. The name and telephone number of the project manager or person who should be contacted about the project.
- All discharges to groundwater, that use UIC wells, at LUST cleanup sites must also register with the state Underground Injection Control (UIC) program. The UIC coordinator will evaluate the registration and will refer the owner/operator to the regional permit coordinator if a permit is required.
- All long-term discharges (>60 days) to surface waters must contact the regional office.
- All **long-term** dischargers to ground water must submit an engineering report which includes a hydrogeological investigation. The Remedial Investigation/Feasibility Study (RI/FS) and the Cleanup Action Plan (CAP) should include this information for non-independent cleanups
- The facility must notify Ecology when the discharge stops or effluent quality meets Level 2 and a permit is no longer required.
- For Independent LUST sites involving gasoline or diesel (only) go to Table A if there is a

short-term discharge (<60 days), otherwise go to Table B for discharges longer than 60 days.

A facility manager may require a permit in a situation that otherwise may be exempted if monitoring and reporting is required.

Table A. Short Term <60 day Discharge

Discharge Location	Conditions	Permit Requirement
Surface Water	Meet Table C level 1 treatment Local approval required if discharge is to municipal stormwater system	Generally no permit required. Permit writers should make determination based on circumstances (e.g., if hydraulic capacity is a concern).
POTW	Meet Table C level 3 treatment Local approval required	Generally no permit required. Permit writers should make determination based on circumstances (e.g., if hydraulic capacity is a concern).
Ground Water by injection well or UIC, hydraulically contained* on-site	Meet Table C level 1 treatment	UIC Rule Authorization No permit required
Ground Water, but not contained on-site	Option A: Meet Table C level 2 treatment	UIC Rule Authorization (if it meets UIC well definition) No permit
	Option B: Meet Table C level 1 treatment	Temporary Permit Discharge to an injection well is not allowed

*Hydraulically contained means that the aquifer is recharged in such a manner as to prevent the injected water from leaving the site.

Table B. Long-Term ≥60 day Discharge

Discharge Location	Conditions	Permit Type
Surface Water	Meet Table C level 1 treatment Local approval required if discharge is to municipal stormwater system	NPDES Permit
POTW	Meet Table C level 1 treatment Local approval required	State Industrial User (IU) Permit, or Temporary Permit
Ground Water by UIC, hydraulically contained on-site	Option A: Meet Table C level 2 treatment	UIC Rule Authorization - No permit
	Option B: Meet Table C level 1 treatment	Temporary Permit
Ground Water by UIC, but not contained on-site	Meet Table C level 2 treatment	Temporary Permit

Table C. Discharge Quality Maximum Concentration Levels

Parameter	Level 1 (discharge to surface water)[a]	Level 2 (discharge to groundwater)[b]	Level 3 (discharge to POTW)[c]
pH	6.0 -9.0	6.5 -8.5	6.0 to 9.0
TPH-G	1 ppm	1 ppm	2 ppm
TPH-D	5 ppm	1 ppm	10 ppm
Total Lead	15.0 ppb	15.0 ppb	20 ppb
BTEX	100 ppb	N/A	200 ppb
Benzene	5.0 ppb	1.0 ppb	10 ppb
Toluene	N/A (see BTEX)	40 ppb	N/A
Ethylbenzene	N/A (see BTEX)	30 ppb	N/A
Xylene	N/A (see BTEX)	20 ppb	N/A

[a] Level 1 limits are performance and technology based.
[b] Level 2 limits are based on the ground water standards or MTCA method A value, whichever is more stringent.
[c] Level 3 limits are based on King County pretreatment levels and best professional judgment to prevent explosives in the collection system and to prevent interference or upset at the wastewater treatment plant. Permit writers should confirm that these levels meet local pre-treatment levels before using in permit.

1.3 Vehicle and Equipment Washing

Ecology will generally not require discharge permits for vehicle or equipment wash water to ground, to POTWs, or if it is non-discharging or regulated by the Hazardous Waste and Toxics Reduction Program. Instead of a permit, Ecology relies on education and outreach for these types of discharges. This education and outreach approach relies on the business community's cooperation in using best management practices (BMPs) identified in *Vehicle and Equipment Washwater Discharges* (WQ-R-95-56). Permit writers should observe the following:

- A state waste discharge permit will not be issued to cover vehicle/equipment washing operations described in *Vehicle and Equipment Washwater Discharges* (WQ-R-95-56) if they are using BMPs consistent with this document.
- A state waste discharge permit may be issued under exceptional circumstances, such as, for a discharge to the ground over a sole source aquifer where there is reason to believe that the discharge needs to be controlled to protect the ground water resource. Also, where there is an obvious non-compliance with the appropriate BMPs, Ecology may require a wastewater discharge permit to prevent and/or control pollution from the discharge.
- Discharges to surface waters or to storm sewers require individual NPDES permits, however, in order to avoid the resource intensive process for an NPDES permit, alternatives to surface water or storm sewer discharges should be strongly encouraged where appropriate. Permits should only be issued where absolutely necessary to control pollution.

1.4 Petroleum Bulk Plants, SIC 5171

Facilities with product storage over 100,000 gallons should be issued an individual NPDES or State waste discharge permit

Facilities with product storage under 100,000 gallons are usually covered by the Industrial Stormwater General Permit with a companion order to cover any monitoring and reporting requirements. An individual permit may also be issued.

1.5 Model Toxics Control Act (MTCA)

Revised Code of Washington (RCW) 70.105D.090(1) exempts parties conducting MTCA cleanups under order or decree from obtaining certain permits. This includes state waste discharge permits under 90.48. However, it does not exempt discharges to waters of the U.S. from NPDES permit requirements. Parties discharging to surface water, including those operating under MTCA order or decree must obtain NPDES permit coverage for applicable discharges.

Ecology determined that an exemption from NPDES permits …*would result in loss of approval from a federal agency necessary for the state to administer any federal law*… a provision of RCW 70.105D.090(2) limiting exemptions for MTCA remedial actions. This July 14, 2008 determination is documented in Toxics Cleanup Program Policy 710 (available on SharePoint).

2. Application Forms for Individual Permits

When it is determined that a facility needs a permit, the facility must make an application for a permit; however, the facility must be allowed 30 days to submit. Applications are made on forms which are specific to the type of discharge. Discharges to surface waters are usually made on federal NPDES forms as shown in Table 5.

There are also application forms for state waste discharge permits. These include:

- Application for POTW Discharges to Land,
- Application for Industrial Discharge to Land, and
- Application for Industrial Discharge to POTW (for POTWs without a delegated pretreatment program).

A general instruction page is used with each of these state application forms.

In the past an applicant could renew a permit by submitting a letter stating there had been no significant change at the facility during the term of the expiring permit. Federal Regulation changes in 1980 no longer allow the use of these letters for NPDES permits. An applicant must apply on a permit application form as given in Table 5 or its equivalent.

There is nothing in regulation that prohibits alternative applications as long as the minimum amount of information submitted is equivalent to that required by the federal application form. This is sometimes an issue for new facilities that submit engineering reports. An engineering report prepared in compliance with WAC 173-240 and Ecology supplementary guidance will have all of the information in the body of the report that is required on the permit form. In this case it is allowable to have the facility make out Form 1, the first page of the application, sign it, and attach it to the engineering report.

Table 1. NPDES and State Permit Application Forms

Federal Forms

Type of Facility	Form
Municipally Owned Wastewater Treatment Plants	Form 2A
Commercial Facilities New source New source with discharge of non-process wastewater only	 Forms 1 and 2D Forms 1 and 2E and follow-up data
Industrial Facilities New source New source with discharge of non-process wastewater only Existing source Reapplication	Forms 1 and 2D Forms 1 and 2E and follow-up data Forms 1 and 2C Forms 1 and 2C
Mining New source Reapplication	Forms 1 and 2D and mining plan Forms 1 and 2C
Feedlot	Forms 1 and 2B
Fish Hatchery	Forms 1 and 2B
Stormwater	Form 2F

State Forms

Type of Facility	Form
Industrial discharge to land	Ecology form 040-179
Industrial discharge to POTW	Ecology form 040-177
POTW discharge to land	Ecology form 040-178
Industry to industry	Ecology form 040-177

All of the wastewater discharge permit application forms are available as electronic fill-in forms at: https://ecology.wa.gov/Water-Shorelines/Water-quality/Water-quality-permits/Water-Quality-individual-permits#forms.

3. Application Process

The process of applying for a wastewater discharge permit is often frustrating for both the applicant and the permit writer. The key to making it go as smoothly as possible is to communicate the requirements to the applicant as early and as in as much detail as possible. Many large industries are very knowledgeable about the permit process and only need direction on their specific application process. Smaller dischargers may require some background information on application requirements. For example, many smaller dischargers may not be familiar with the objective and process of whole effluent toxicity testing. The NPDES requirements for permit application are given in 40 CFR 122.21. The processes of application and background review are illustrated in Figures 5 and 6.

The permit application is reviewed by the permit writer for completeness and accuracy. Reviewing an application for completeness is a fairly simple task but there's only one way to do it. Go over it item by item, making sure each blank is filled in. Each part of the form should have the requested information or an indication that it is not applicable. The instructions for both the EPA forms and the state forms instruct the applicant to place an "NA" in a blank to show it has been considered but the question is not applicable. Many times an application is incomplete and the question is how to deal with it. Do not fill in any information yourself unless it's information commonly available from public sources. Substantial time is saved by simply getting the information over the telephone and then writing in the answer. This information will not be certified as correct by the person who signed the application. Send the application back to the applicant for completion if there is any uncertainty. This is the legally correct procedure.

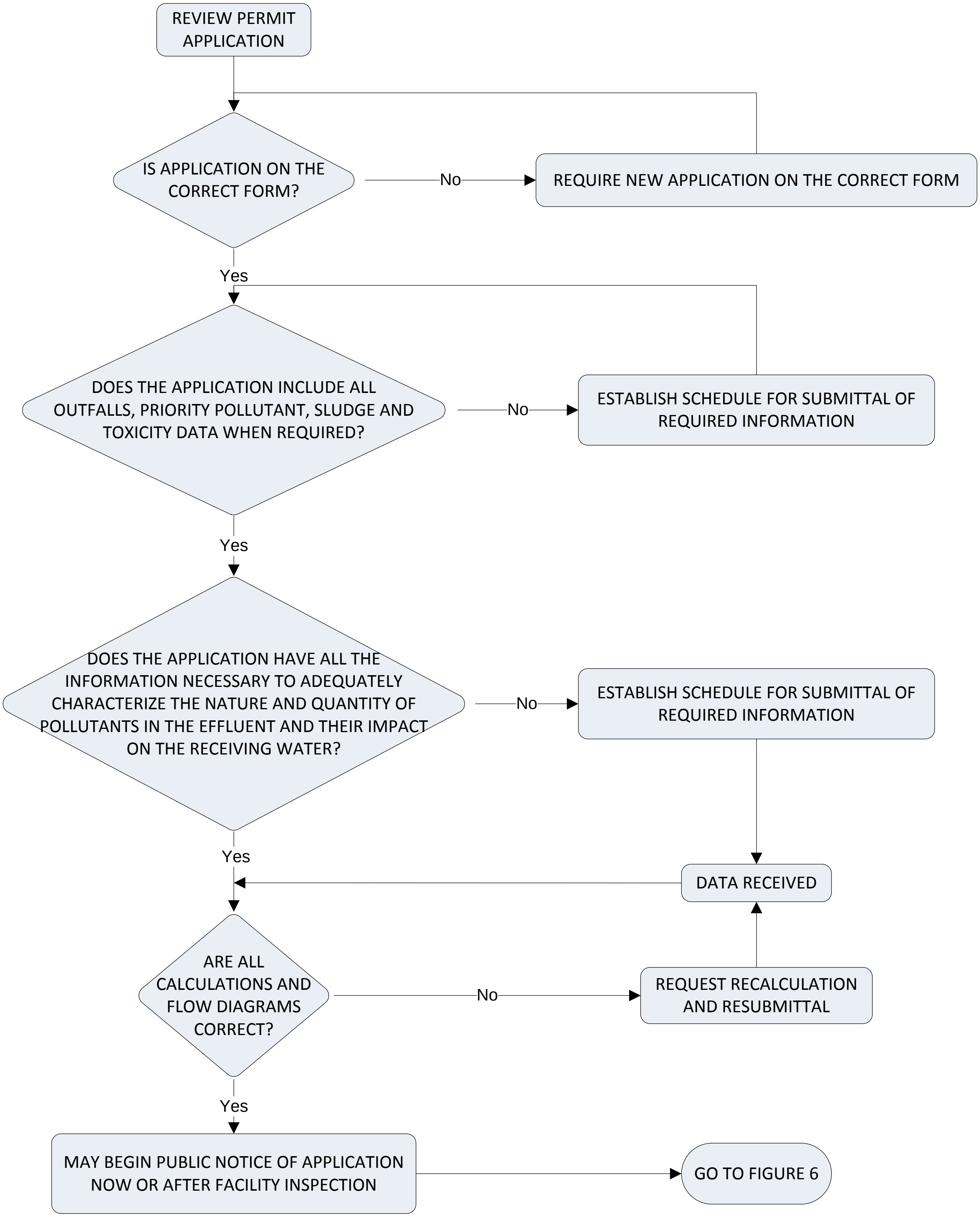


Figure 5. Permit Application Review

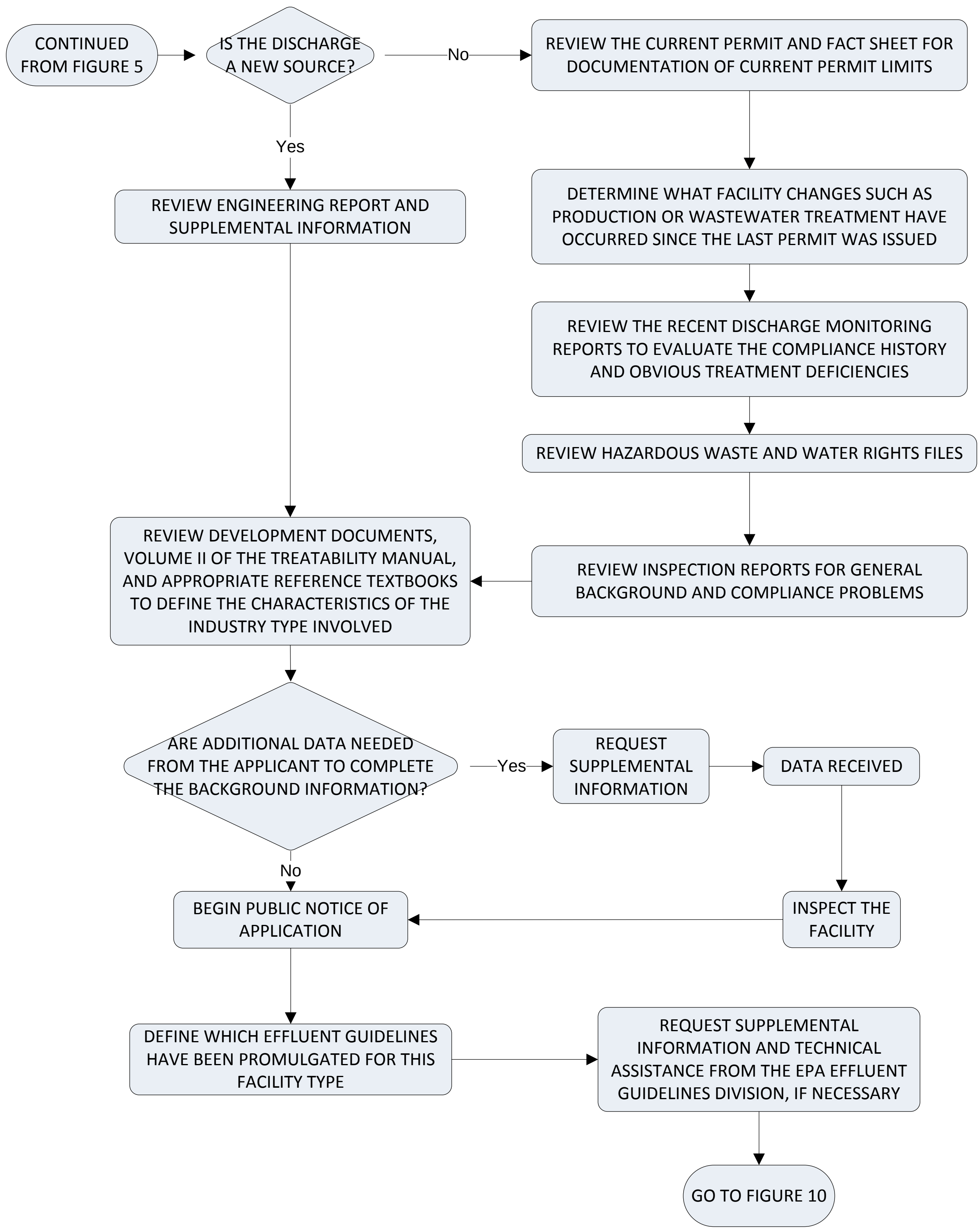


Figure 6. Background Information Review

Some requirements that are often overlooked in applications are:

- Grab samples must be used for pH, temperature, cyanide, total phenols, residual chlorine, oil and grease, fecal coliform, and fecal streptococcus. All others are collected by 24-hour composite unless waived by Ecology. If the 24-hour composite sampling is waived, the applicant is then required to collect a minimum of four grab samples that are representative of the effluent. The four grab samples can be combined for analysis.

- Every applicant must submit data for BOD, COD, TOC, TSS, Temperature (winter and summer) and pH. Ecology may waive these test requirements if the applicant can demonstrate they are not necessary for characterizing the effluent.

- Primary industries have some mandatory testing requirements for toxic pollutants (40 CFR 122.21 Appendix D, Table I and Table II; also listed in Application Form 2C). Primary industries that are also small businesses [122.21(g)(8)] may be exempted from these testing requirements. Existing dischargers who believe certain pollutants may be present in their effluent must test for those pollutants (122.21 Appendix D, Table IV, Table V).

- Municipalities also have some mandatory application requirements for whole effluent toxicity and sludge. POTWs larger than 1 MGD or those with pretreatment programs are required to submit valid whole effluent biological toxicity testing. This requirement may be satisfied if the expiring permit contains a requirement for effluent characterization of whole effluent toxicity (see Chapter 6, Section 5). The permit writer should note the use of this option in the fact sheet.

The following are application requirements for municipalities under the Form 2A. Permits should contain the appropriate monitoring requirements to assure the data are available at time of reapplication.

NPDES Application Testing Requirements for municipalities with design flow< 0.1 MGD (a minimum of three values for each parameter collected within 4.5 years prior to submission of the application)

- pH (min and max)
- Flow rate
- Temperature (winter and summer)
- BOD (or CBOD)
- Fecal Coliform
- Total Suspended Solids

Additional NPDES Application Testing Requirements for municipalities with design flow ≥ 0.1 MGD (a minimum of three values for each parameter collected within 4.5 years prior to submission of the application).

- Ammonia
- Total Residual Chlorine
- Dissolved Oxygen
- Total Kjeldahl Nitrogen

- Nitrate plus Nitrite Nitrogen
- Oil and Grease
- Phosphorus (Total)
- Total Dissolved Solids

NPDES Additional Application Requirements for municipalities with design flow ≥ 1.0 MGD or with Pretreatment Program (a minimum of three values for each parameter collected within 4.5 years prior to submission)

- Metals, Cyanide, Phenols, and Hardness
- Volatile Organic Compounds
- Acid-Extractable Compounds
- Base-Neutral Compounds
- Toxicity Testing:

  Quarterly testing in the past year using two species

  Or

  Results from four acute or chronic tests performed at least annually within the 4.5 years prior to application.

Upon request, the applicant must submit other information which may be needed in deciding whether to issue a permit. The requested information may include additional quantitative data on the effluent or receiving water.

3.1 Analytical Requirements

Ecology has defined the analytical requirements (detection and quantitation levels) for permit application and for compliance monitoring of effluent. The objective is to reduce the number of non-detects when effluent is analyzed. The current table is posted with the other permit writer's materials in SharePoint.

3.2 Reviewing an Application

When a permit application is completed it must be reviewed for accuracy. The accuracy of the permit application can be assessed by checking the numbers on the application, and, for existing dischargers, by reviewing the files and inspecting the facility.

- Everybody makes mistakes in arithmetic. Review the concentrations of pollutants reported in the effluent to make sure they're reasonable. Then add the flows to ensure the total is correct, and then do the mass loading calculations.

- Check the files for information. If the application is for an existing facility there is probably a large amount of information in the files. A reporting facility will have a previous permit file, discharge monitoring reports, correspondence and inspection reports.

In addition to the water quality files, there may be some good information in other files such as the Dangerous Waste files. The Dangerous Waste Regulations (Chapter 173-303 WAC) require anyone who generates, transports or treats dangerous waste to have an EPA/state identification number and to report their activities annually. There may also be some inspection reports in this file. The information in this file may indicate some pollutants or problems that need attention in the permit process. (See Section 8, following, which discusses the domestic sewage exclusion for hazardous waste.)

- Check to see if the facility has a water right and if it corresponds to the water use in the application.
- If you're new to the office, check with the compliance inspectors to see if there is a history of complaints on the facility.
- Check any additional information available on similar types of discharges (EPA Development Documents) to see if the reported effluent concentrations seem reasonable.
- Check with other permit writers in Ecology who have permitted this type of facility to see if there are any special considerations in the application process.
- Inspect the facility. An existing facility that is being permitted should be inspected at least once, except those being covered under a general permit. A facility inspection acquaints you with the facility, the people you'll be dealing with, and verifies the information in the permit application. If you're not an experienced inspector, review the Ecology Inspection Manual beforehand.

The things you want to determine or verify during this inspection are:

- The application's accuracy in describing the production processes;
- The number and type of outfalls (storm drains are frequently omitted);
- The raw materials and chemicals used;
- The operation and maintenance of the treatment equipment;
- Production; and,
- The company attitude toward environmental compliance.

Go over the facility from roof to basement. Air pollution equipment may be discharging pollutants to the roof, which washes off in the rain. Piping in basement areas may be neglected and have a potential for leakage. Pay particular attention to those things (such as the need for spill prevention and housekeeping) that can be used as preventative mechanisms in permits but are not described very well in permit applications. Take photographs of key processing areas or problem areas.

For those permit managers who have been dealing with a facility for a long time, this is a good time to take a fresh look and ask all the questions that you would ask if you were seeing the facility for the first time.

You may wish to include a sit-down meeting at this time to discuss the general direction of the new permit and any new regulatory requirements that might be included in the permit. Avoid discussion of specific numbers at this time.

If you have discovered inaccuracies in the application, point out the need to get correct information. Remind them of the statement on the signature block of the application if necessary.

4. Application and Expired Permits

4.1 NPDES

If a permittee has made "timely and sufficient application" for permit renewal, an expiring permit remains in effect until Ecology has either denied the application or issued a new permit (individual permits, WAC 173-220-180(5), general permits WAC 173-226-220). Consequently, an expired NPDES permit remains in effect while Ecology reviews an application for a permit renewal, so long as the application is "timely and sufficient." For individual permits, Ecology will notify the permittee of the extension, by letter, that they have made timely and sufficient application and that the permit remains in effect until reissued.

4.2 State

A permittee must submit a satisfactory application at least 60 days prior to expiration of an existing permit (RCW 90.48.170) (WAC 173-216-070) or as specified in the existing permit, unless the requirement is waived by Ecology. A satisfactory permit application consists of a completed form including the proper signature and any other information determined as necessary by the Department (WAC 173-216-070(4)). In the event that Ecology takes no action on an application within 60 days, the applicant receives a temporary permit based on information in the application (RCW 90.48.200). The temporary permit is effective until Ecology acts on the application or for a period of five years. This process is illustrated for new and renewal state individual permits respectively in Figures 7 and 8.

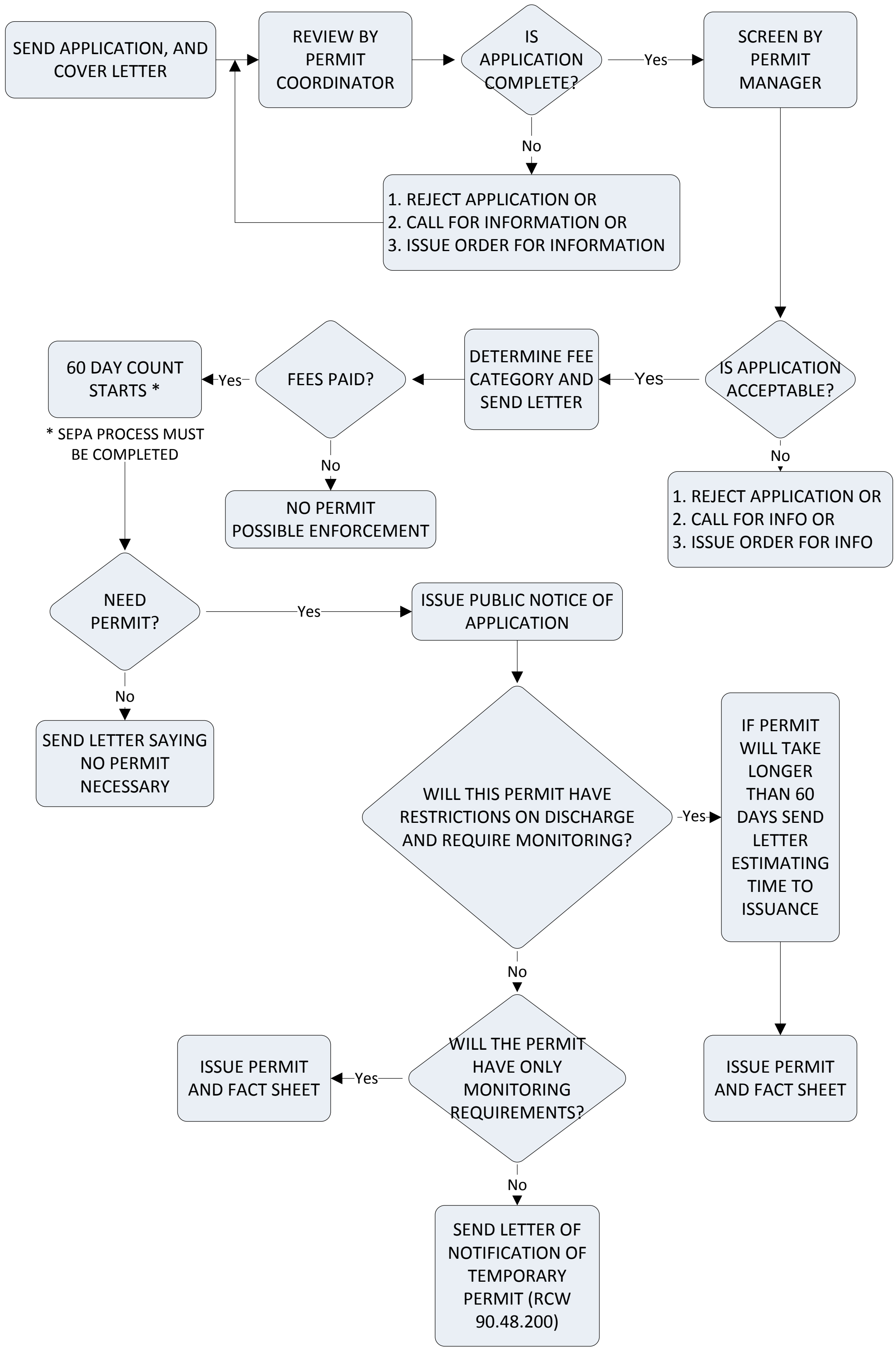


Figure 7. Application Process for a New State Wastewater Discharge Permit

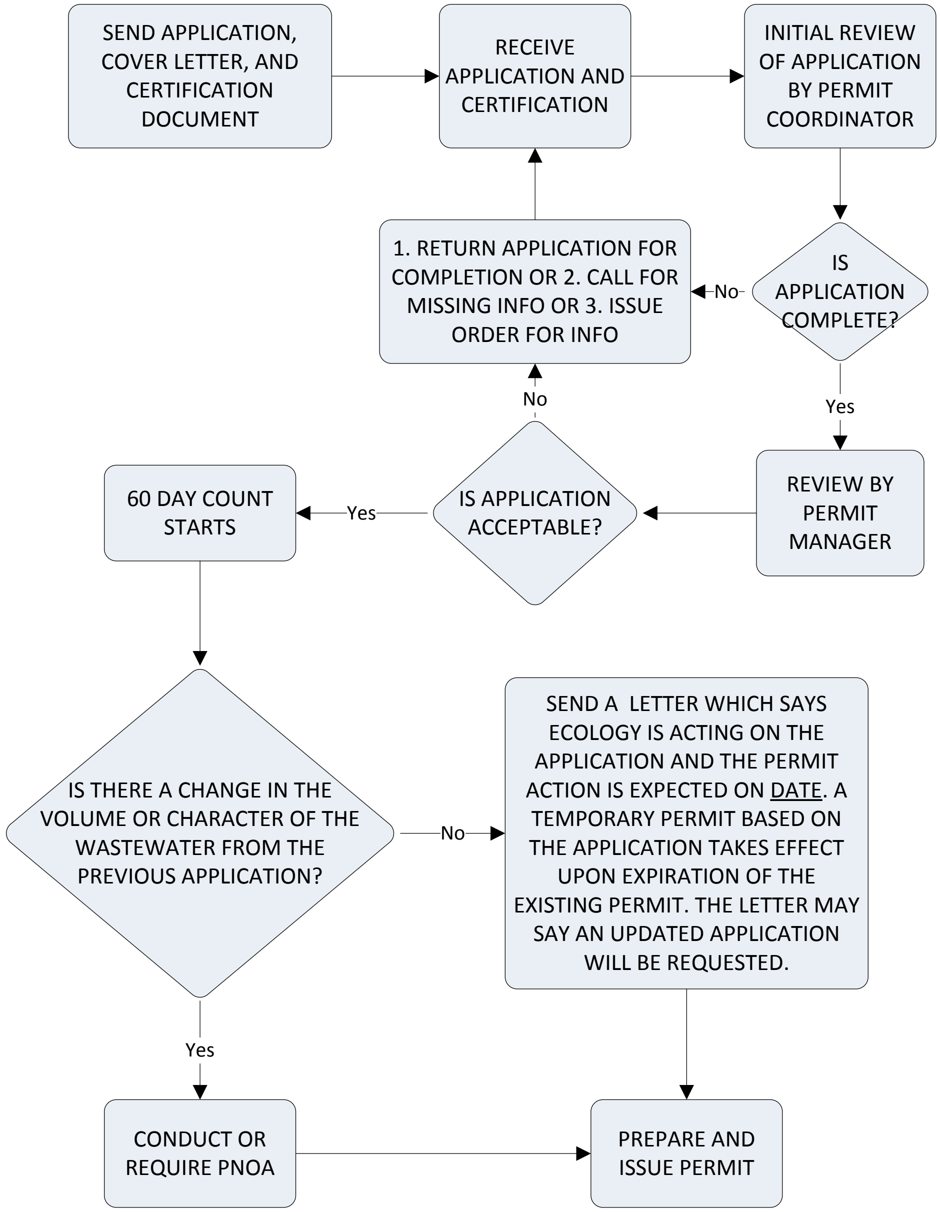


Figure 8. Application Process for Renewal of a State Wastewater Discharge Permit

5. Application for New Permits

5.1 NPDES

Applicants must submit an application at least 180 days before the date they wish to begin discharging or, with Ecology's agreement, in sufficient time prior to commencement of discharge to allow Ecology to formulate technology-based and water quality-based limitations. No discharge is authorized until the effective date of the permit.

5.2 State

Applicants must submit a satisfactory permit application at least 60 days before the date of the proposed discharge. The applicant will receive a temporary permit if Ecology fails to act upon the application within 60 days. The temporary permit is conditional upon the applicant having completed the SEPA process. Any action within the 60-day period from the time of filing may prevent the temporary permit from becoming effective. Typically, this action would be a notification to the applicant that the application was not satisfactory for Ecology to process the permit.

6. Time of Reapplication

All Permittees must reapply for permits every five years (40 CFR 122.46(a)) (RCW 90.48.180). This includes temporary permits and permits extended during application if the application period extends for five years. An NPDES permit extended for 5 years during application must be reissued upon the second application.

7. Confidentiality of Information

A permit writer is occasionally requested to keep confidential the information obtained during the permit application process. A permit writer cannot grant confidentiality because the authority is vested only to the director or those delegated the authority by the director.

The federal regulations (40 CFR 122.7(c)) state that information required by NPDES application forms may not be claimed as confidential. Information not explicitly required on the NPDES forms and information required on forms for state waste discharge permits is subject to the state Public Disclosure Act codified in Chapter 42.17 RCW. Confidentiality is also addressed in Chapters 43.21A and 90.52 RCW.

The Public Disclosure Act generally makes all information normally submitted to Ecology as part of the permit process subject to public disclosure except "Valuable formulae, designs, drawings, and research data obtained by (Ecology) within 5 years of the request for disclosure when disclosure would produce private gain and public loss."

RCW 43.21A.160 provides that upon request, the director of Ecology may treat certain information furnished as confidential if such information relates to processes unique to the person providing the information, or if such information might adversely affect the competitive position of that person if released to the public, provided that such action would not be detrimental to the public interest.

RCW 90.52.020 states that Ecology shall provide proper and adequate procedures to safeguard the confidentiality of manufacturing processes. The confidentiality shall not extend to waste products discharged into the waters or air of the state.

The request for confidentiality must accompany the information for which the request is made. If the information is a part of the NPDES application form then no confidentiality can be granted. Other information is considered by the appropriate section head, as a delegate of the Director, as to whether it may be deemed confidential. The AG's have not provided guidance as to the interpretation of "public loss" or "detrimental to the public interest". Determination of "public loss" or "detrimental to the public interest" will therefore be made on a case-by-case basis.

8. Domestic Sewage Exclusion

In some instances industrial dischargers to POTWs are allowed to discharge dangerous waste if the waste is treated in the POTW. The judgment on treatability is made by conferring with the regional hazardous waste and toxics reduction section.

Section E, question 9 of the state permit application for discharge to a POTW asks if the wastewater to be discharged designates as a dangerous waste according to procedures in Chapter 173-303 WAC. The applicant may answer yes, no, or don’t know. If the applicant answers yes, they complete question 10 on the application which asks for details on how the waste designated.

In some cases it will be immediately apparent that some dangerous wastes cannot be discharged. For example, any wastewater that designates because of characteristics (ignitable, reactive, corrosive, TCLP) would not be allowed to be discharged without treatment. In other cases, such as with dilute listed waste or state-only toxic waste, it will not be immediately apparent if the discharge is allowable. In these instances the permit writer should confer with the regional hazardous waste and toxics waste reduction section.

If the applicant answers question 9 “no” or “don’t know”, the permit writer must use information from other parts of the application and from experience to judge the presence of dangerous waste in the wastewater. If dangerous waste potential exists the permit writer should confer with the regional HWTR section about the course of action on the permit.

Dangerous waste discharges are subject to source reduction (pollution prevention) measures under:

- HWTR interpretive policies for the Domestic Sewage Exclusion.
- 40 CFR Part 403.12(p)(4), referenced in WAC 173-208.

The permit writer should confer with Regional Hazardous Waste and Toxics Reduction staff for information on source reduction opportunities. In many cases, source reduction can offer the applicant a variety of attractive benefits.

8.1 Case Study Examples for Some Common Pollutants

1. Formaldehyde--treatable

Formaldehyde is an animal carcinogen, suspected human carcinogen, and mutagen which is a State toxic dangerous waste at 10% concentration. Fate modeling indicated that formaldehyde would probably be 84% biodegraded in an extended aeration activate sludge sewage treatment plant. King County has chosen to accept this waste based on its treatability (i.e., biodegradability) and low potential for interference.

2. Antifreeze--recyclable

Ethylene glycol antifreeze is a State toxic waste that can be economically recycled through on-site filtration or off-site re-refining. Rather than accept this high-BOD waste, King County has established recycling of antifreeze as a best management practice.

3. Dry Cleaner Separator Water--dilute listed waste

Dry cleaner separator water is saturated with perchlorethylene (tetrachlorethene), a listed waste. Because the concentration of the solvent can range from 300 to 3,000 mg/l, it does not meet the HWTR policy criteria for "dilute listed wastes" mentioned in the regulatory language of the domestic sewage exclusion. The WQ and HWTR programs have agreed not to allow disposal of separator water to the sewer.

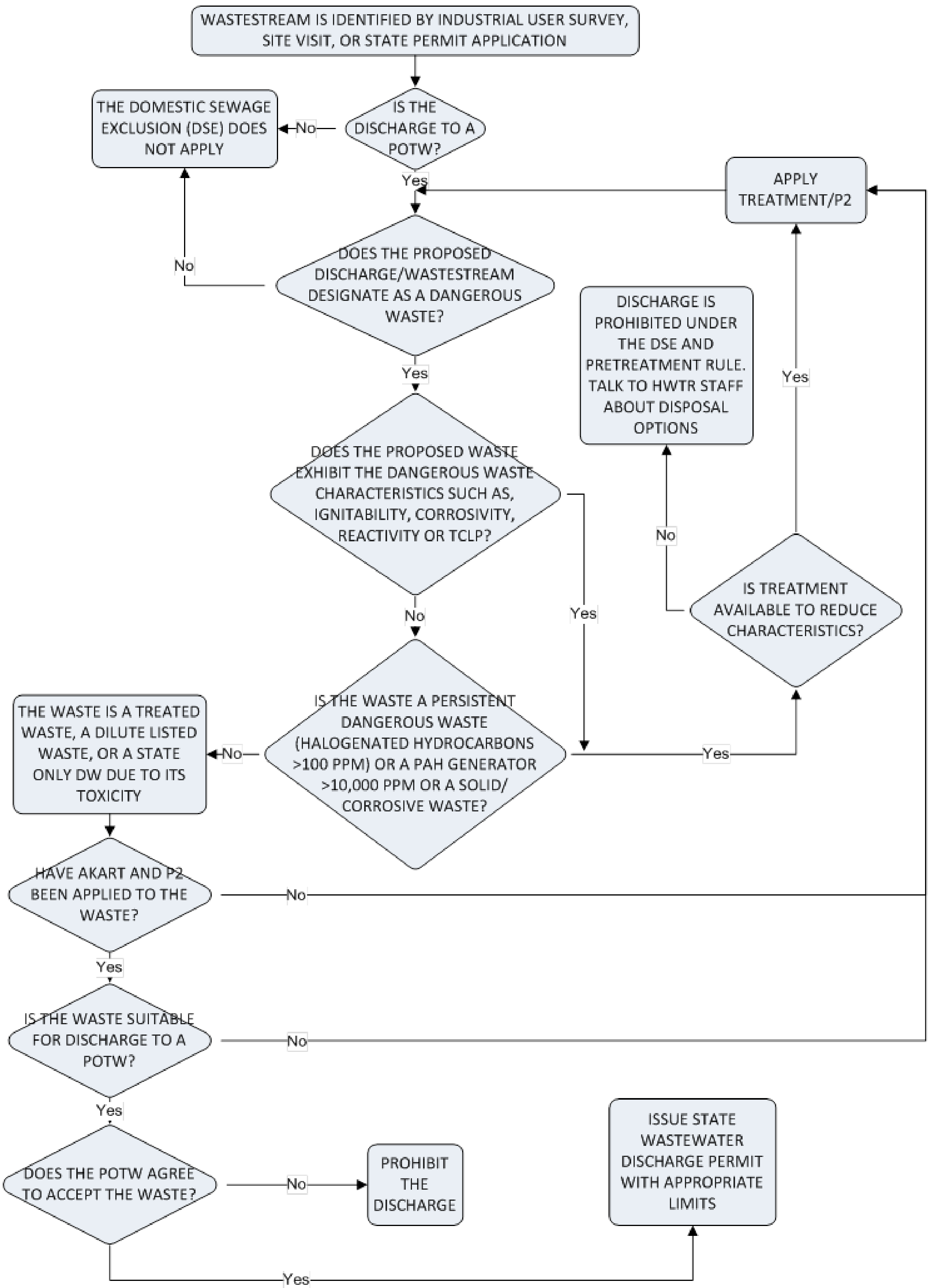


Figure 9. Interpreting the Domestic Sewage Exclusion (DSE)

9. Owner/Operator Agreements

Municipalities frequently contract the operation and maintenance of the wastewater treatment plant. This requires some special consideration from Ecology.

9.1 Ecology Must Review Agreements

RCW 70.150 authorizes a public body to enter into service agreements to design, finance, construct, own, operate or maintain water pollution control facilities. Before a public body enters into a service agreement to provide any of these services, the agreement "shall be reviewed by the department of ecology to ensure consistency with the purposes of Chapters 90.46 and 90.48 RCW." RCW 70.150.040(9). Ecology does not have the resources to review all municipal agreements pertaining to water pollution control facilities; therefore, Ecology will only review contracts for operation of wastewater treatment facilities.

9.2 NPDES Permittee under Owner/Operator Agreement

Under section 301(a) of the Clean Water Act, 33 USC section 1311(a), "the discharge of any pollutant by any person shall be unlawful" unless the discharge is authorized by an NPDES permit. This prohibition suggests that both the public owner and the private operator need to be permitted since both the owner and operator are "persons" who will be discharging pollutants. However, under 40 CFR section 122.21(b), when a facility is owned by one person but operated by another, it is the operator's duty to obtain a permit. While this regulation suggests that only the private operator needs to be permitted, the regulation only says it is the operator’s duty to obtain a permit. It does not address who should be listed as permittee(s) on the permit.

In general, it is the Water Quality Program’s policy to identify contract operators as co-permittees on individual municipal NPDES permits, to address both state and federal requirements for permittees. The policy is based on advice from the Attorney Generals’ Office and was accepted by the PCHB in its Hartstene Opinion (*Order on Summary Judgment, PCHB No. 09-152, WSUD and Hartstene Pointe WSD v. Ecology).*

However, in the Hartstene Opinion, the Board stopped short of stating that in every case, co-permittee status for owners and operators is appropriate. As a result, Ecology must decide on a case-by-case basis if identifying the operator as a co-permittee is appropriate.

In reviewing any service agreement for wastewater operating services, Ecology staff should:

- Review the service agreement using the recommended contract provisions following Section 9.3 as a guide.
- Discuss with a supervisor any need for AG assistance, and if necessary, request that an AAG review the service agreement. An AG review may be helpful for complicated contracts.

Within 30 days of receipt of the agreement, respond in writing to the municipality.[1 2]
In deciding whether to identify a contract operator as a co-permittee, Ecology staff and managers should:

- Consider the extent of the operator's control over the treatment system, as described in the service agreement.
- Consider the experience and record of the operator at other facilities.
- Consider the performance and enforcement provisions in the service agreement between the owner and the operator.
- Review the recommendations or comments from the Attorney General's office.
- Make a reasoned decision based on the facts, Ecology guidance, and the manner in which the entities' service agreement defines the responsibilities each will have (see the Hartstene Opinion, pages 8 and 9).

The nature of these service agreements is commonly one of shared responsibility for the facility. As a result, Ecology may commonly identify the operator as a co-permittee. In the Hartstene decision (pages 7-8), the PCHB noted:

> The undisputed facts establish that both Hartstene and West Sound are responsible for operation and maintenance of the plant…. Hartstene, as owner of the physical plant, is responsible for capital improvements and expenditures related to maintenance, and is "ultimately responsible for compliance" with permits issued by Ecology and other agencies. However, the Interlocal Agreement between Hartstene and West Sound for the operation of the Plant is premised on the fact that Hartstene lacks qualified employees to operate the plant, and therefore looks to West Sound to manage and operate the sewer system. Indeed, the very purpose of the agreement is to have West Sound provide its expertise and staff to Hartstene for Plant operation.… Both the owner and the operator have duties in relation to Plant operations, and those operations result in discharges to state waters. Discharges must be consistent with permit terms, and both parties must ensure compliance with the same. Given the facts, and Ecology's broad authority under the NPDES program to control the discharges of pollutants to waters of the state, Ecology was well within its authority to require both entities to be named as permittees on the NPDES permit.

Ecology staff and managers should assume that co-permittee status will be necessary to ensure permit compliance when inspections or compliance reviews reveal un-resolved management, operation or maintenance issues, especially those that have caused permit violations. As with any "co-permittee" designation, the service agreement must support the co-permittee determination.

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[1] Ecology does not need to approve the contract. RCW 70.150.040 (9) reads in part: *Before any service agreement is entered into by the public body, it shall be reviewed by the Department of Ecology to ensure consistency with the purposes of chapters 90.46 and 90.48 RCW. The Department of Ecology has thirty days from receipt of the proposed service agreement to complete its review and provide the public body with comments….*

[2] The Attorney General may not be able to respond within Ecology's 30-day statutory deadline. In such cases, Ecology staff should respond within the 30-day statutory deadline and if the agency has requested review by the AG, note that the agency may forward additional comments or make a decision on co-permittee status once that review is complete.

There are also facilities where Ecology staff and managers may consider issuing the permit to the owner only, including facilities where:

1. Listing the contractor as a co-permittee would create a disproportionate burden for a small community to attract an operator, due to location or other factor; or
2. The service agreement is for a limited duration; for example, to provide temporary service until the owner can hire a permanent contractor, or to train staff; or
3. The need for enforcement has been or is expected to be low; for example, at larger facilities where owner resources and planning have historically addressed capacity or operational problems before they arise; or
4. The operator has a superior record of compliance at the facility or other facilities; and the service agreement allows the owner to enforce on permit requirements as a matter of service agreement compliance.

In cases were Ecology issues the permit to the owner only, the service agreement should address the recommended provisions that follow Section 9.3 (*Recommended Service Agreement Provisions for Wastewater Treatment Plant Operations*).

Naming a contract operator as a co-permittee is an important decision with ramifications for both the operator and the owner. Operators that are co-permittees:

- Are subject to Ecology enforcement and third party liability.
- Face potential capital expenditures (the contract should clearly identify the owner as responsible for capital costs) that logically should fall on the owner.
- May turn down contracts that result in exposure, especially at small facilities where problems arise from a lack of resources.

Contract operators facing a greater risk may pass their risk-related costs (including insurance) onto the owner. While exposure can be handled via contract, there is a transactional cost associated with contract enforcement. Co-permittee status complicates the owner-contractor relationship in a manner that Ecology staff may not appreciate.

Accordingly, when Ecology is proposing co-permittee status at a facility, Ecology staff and management (i.e. the Section or Field Office Manager) should consider meeting with the facility owner and the contract operator, to discuss concerns and consider alternatives.

In all cases, the decision to identify the operator as a co-permittee resides with the Section or Field Office Manager, as delegated by the Program Manager.

Finally, it is critical that permit writers note the contractor's responsibilities in the fact sheet (using the service agreement as a reference) and document the decision to identify (or not) the operator as co-permittee.

9.3 State Permittee under Owner/Operator Agreement

With respect to state waste discharge permits, under WAC 173-216-110(8), permits for domestic wastewater facilities shall be issued only to a public entity, however, if a domestic wastewater facility is owned by a nonpublic entity under contract to a public entity, a joint permit shall be issued to both the public and non-public entity.

Recommended Service Agreement Provisions for Wastewater Treatment Plant Operations

The service agreement should define the facilities covered by the agreement (e.g., treatment plant, pump stations, collection system, pretreatment program), and include provisions addressing:

- Responsibility for management, operations, maintenance, and capital improvements
- Permit compliance
- Permit renewal process (application and entity review)
- Monitoring and reporting
- Record keeping
- Solids handling
- Coverage including vacation coverage, emergency and non-routine operations.
- Ordering and payment for supplies and equipment
- Capital improvements
- Communication between the contractor and owner addressing the state of the facility
- Contractor transitions
- Penalty responsibilities
- Responsibility for implementing pretreatment requirements
- Compensation, insurance, indemnification, and Force Majeure.

Ecology recommends that the owner/operator write the service agreement in the “active voice” to make it clear which party is responsible for each activity.

The service agreement should ensure that the contractor will:

1. Manage and operate the plant to meet permit requirements and prevent nuisance conditions.
2. Notify Ecology as required by the permit reporting conditions, in particular reporting for non-compliance.
3. Calibrate, maintain and repair all equipment to manufacturers’ specifications, and to preserve warranties.
4. Operate the facility according to the Ecology-approved operation and maintenance manual.
5. Repair equipment in an expeditious manner to ensure that it is serviceable at all times.
6. Staff the plant with certified operators, at the appropriate level.

7. Obtain and maintain laboratory certification for permit-required analysis, unless the facility uses a contract laboratory; and use the appropriate test methods as defined in the permit and as accredited.
8. Prepare monthly DMRs and any other DMRs at the permit-required frequency. The owner may retain or delegate signature authority, and may take responsibility for other reporting.
9. Allow Ecology to inspect the facility, inspect and copy records, and sample any substances or parameters necessary to determine compliance with the permit, at reasonable times, with or without prior notification. Reasonable times include after-hours site visits during non-routine operations.
10. Cooperate with the owner on planning, design, construction and audits.
11. Keep permit-related records for three years or longer for records related to any unresolved litigation regarding the discharge of pollutants by the Permittee, or when requested by Ecology.
12. Provide for termination of the service agreement for cause or convenience.

Chapter 4. Deriving Technology-Based Effluent Limits

This chapter, Chapter 6, and Chapter 7 discuss the major task of writing a wastewater discharge permit - deriving the effluent limits. The effluent limits restrict the amount of pollutants that may be discharged. Effluent limits may be based on the technology which is available to treat the pollutants at a reasonable cost (technology-based) or they may be based on the effect of the pollutants in the receiving water (water quality-based), whichever is most stringent. Derivation of the effluent limits, whether they're based on technology, as discussed in this chapter or on water quality, as discussed in following chapters, is the core task of permit writing and often the most complex task.

Effluent limits are process control parameters or numbers which indicate that a process, which in this case is wastewater treatment, is functioning properly.

Not all of the pollutants in an effluent are limited with numeric limits. A pollutant may not require an effluent limitation if it meets all of the following:

- Its concentration is too low to be treated at a reasonable cost.
- It can't be eliminated by production changes or best management practices.
- There is no potential for causing surface or ground water quality or sediment quality standards violations.
- It is not listed in regulations, such as effluent guidelines.

There are two general approaches to deriving technology-based effluent limits. A permit writer can use Federal effluent guidelines, if they are applicable and appropriate, or develop effluent limits specifically for an individual discharger or pollutant (case-by-case). In some cases a permit may contain both types of effluent limits.

This chapter discusses the derivation of technology-based effluent limits from the federal effluent guidelines, provides a step-by-step process on how they're used and details some problems with them. An example is provided to demonstrate the use of effluent guidelines. This chapter also discusses the development of technology based effluent limits on a case-by-case basis under state (AKART) and federal authority.

Flow charts at the end of the chapter illustrate the process of developing technology-based effluent limits (TBELs).

Adjustment of effluent limits to account for autocorrelation is discussed in Part 4 of this chapter.

1. Effluent Limitation Guidelines

The Federal Water Pollution Control Act of 1972 (Clean Water Act) directed EPA to develop standards of performance (effluent limitations) for industrial categories. Specifically, the law required existing industrial dischargers to achieve "effluent limitations requiring the application of the best practicable control technology currently available (BPT)" by July 1, 1977. The law also required dischargers to achieve "effluent limitations requiring the application of the best available technology economically achievable (BAT)" by July 1, 1983. Other performance standards to be developed were new source performance standards (NSPS) for new direct dischargers and pretreatment standards for indirect dischargers. The Administrator (of EPA) was given one year to develop and implement these performance standards.

EPA was unable to complete all effluent guidelines within the statutory deadline due to technical problems and pressure from various trade associations. In addition, EPA did not fully address toxic discharges in the guidelines it did promulgate. As a result, in 1976, EPA was sued by several environmental groups for failing to accomplish the promulgation of effluent guidelines as directed in the Clean Water Act. The EPA and the environmental groups reached a settlement agreement which required EPA to develop a program and adhere to a schedule for promulgating BAT effluent guidelines, pretreatment standards and new source performance standards for 65 priority pollutants and classes of pollutants.

This agreement was limited to a group of 21 major categories of industries which became known as the primary industries. These are listed in 40 CFR 122 Appendix A. This settlement was incorporated into the 1977 amendments of the Clean Water Act. The 1977 amendments also redefined BAT to include only toxic and nonconventional pollutants. The deadline for meeting BAT limits was 3 years after their promulgation but no later than July 1, 1987 (The 1987 amendments to the Clean Water Act have moved this deadline to March 31, 1989). The 1977 amendments also redefined BAT for conventional pollutants to become "best conventional pollutant control technology (BCT)." The deadline for achieving BCT was July 1, 1984 but the date was amended to become March 31, 1989.

When Congress enacted the 1977 amendments, they also required that a cost test be applied to any treatment that was proposed for BCT (more on the cost test later, in the case-by-case permits section). The EPA developed and published the regulations for BCT in 1979. At the same time the EPA published BCT limits for 41 industrial subcategories. This 1979 regulation was challenged and the final BCT methodology was not adopted until 1986.

All of the proceeding is to show some of the gyrations on the way to achieving the intent of Congress to develop technology-based performance standards. It also helps to explain why some of the effluent guidelines, such as feedlots, contain BAT requirements for conventional pollutants or BCT limits that were never imposed. For more information on the history of the promulgation of effluent guidelines (see Miller, et al. 1990).

1.1 A Summary of Treatment Standards as Currently Defined

BPT - Best Practicable control Technology currently available - applicable to conventional pollutants - to be achieved by July 1, 1977.

BCT - Best Conventional pollutant control Technology (BCT) - the level of treatment that succeeds BPT for conventional pollutants. The deadline for achieving BCT was July 1, 1984 but was changed in the 1987 amendments to March 31, 1989.

BAT - Best Available Technology economically achievable - applicable to toxic pollutants. The deadline for achieving BAT was July 1, 1983, but was changed by the 1987 amendments to March 31, 1989.

We now have performance standards (effluent limitation guidelines) for 52 groups or categories of industries and over 1,000 performance standards for all the subcategories. EPA typically developed these performance standards after completing the following tasks:

- Performing a literature search to obtain the latest information on treatment processes;
- Conversing with regional and state staff with experience pertaining to the industry;
- Reviewing any comparable industrial limitations;
- Conducting industrial plant surveys to collect statistical data on operations;
- Conducting site visits, sampling, and evaluation of selected industrial sites;
- Soliciting public comment from industrial representatives and the public at large;
- Conducting an economic analysis of the impact of the identified treatment technology on the industry.

EPA estimated that it required 2-5 years to develop each set of standards. The cost for each set of standards ranged from two million to 20 million dollars for technical contractors plus between 3 and 25 person-years of EPA staff effort. The list of industries for which EPA has developed effluent guidelines is given in 40 CFR 122 Appendix A. The information that EPA developed is available in several forms. The most informative are the development documents prepared by EPA. These documents contain the technical and economic information from which the effluent guidelines were developed. The effluent guidelines are summarized in 40 CFR Parts 400-471.

1.2 Steps for Using Effluent Guidelines

Step 1. Categorize the discharger

To be able to use the effluent guidelines it's necessary to know the processes at the facility you're permitting. Then if you're lucky, the facility will fit cleanly into a category and subcategory.

Step 2. Learn about the category of discharger

To be able to write an effective permit, the permit writer must know the pollutants that are being discharged or have the potential to be discharged. This usually requires an understanding of the manufacturing processes that take place at a facility. There are several sources of information available to a permit writer to learn about an industry.

- The EPA Development Documents that were discussed previously are an excellent source of information. More recent literature is sometimes available. Contact the Ecology library for a search.

- EPA has industry experts located in Washington, D.C. and in the regional offices. EPA lists these experts in the training manual for the permit writing course. Call the Program

Development Services Section for assistance if you have difficulty finding or contacting these people.

- Trade associations for the category of discharger can be sources of information.
- The pre-permit inspection of the facility being permitted is informative. This inspection is most valuable if the permit writer has done some background work before the inspection.

Step 3. Decide on category

This is a decision point for the permit writer. The permit writer must decide after reading the development document, reviewing the application, and inspecting the facility whether the facility being permitted has essentially the same kind of manufacturing processes as described in the development document. If the manufacturing process and the pollutants which are generated have changed to the extent that it is no longer described in the development document, the permit writer must do case-by-case development of effluent limits. Outdated development documents may become more common as time goes by.

Step 4. Decide on treatment

This is another decision point for the permit writer. The permit writer must decide if the treatment process described in the development document is currently the best available. If it is not then the permit writer must do a case-by-case determination of the effluent limits.

Step 5. Decide on the production base

Most of the EPA effluent guidelines are mass limits based on production as opposed to concentration limits (see the example at the end of the chapter). Production-based limits cause a problem for permit writers in verifying the production base. The company may want to claim as high a production as possible to get higher effluent limits and thus not have to worry about compliance problems. The permit writer wants the production estimate to represent, as accurately as possible the production during the life of the permit. The Federal permit application asks the applicant for the facility maximum production but what the permit writer needs is an estimate of future average annual production. The derivation of the effluent guidelines incorporates an allowance for the daily and monthly variations.

The best estimate of future production is generally the production of the past year. In some cases the past year may have been a boomer for them and the next few are going to be bust. In that case, by basing the effluent limits on the past years production you would be allocating more pounds of discharge than necessary. You may wish to use the highest yearly production of the last five years as the production base. If the company knows that there will be a substantial (25%) increase in production sometime during the course of the new permit, you may offer them alternate limits to be effective at the time they begin increased production. The company should have committed the capital expenditure and completed the design before alternate limits are used, otherwise, modify the permit at the time of increased production.

Production levels may be verified by checking the previous year’s monitoring data. Assuming that water usage is proportional to production, you should be able to detect any changes. The development document for the industry may have some water use/production data. The production data that you receive on the application is certified by the signature of the responsible official to be correct and subject to criminal enforcement if deliberately false. This creates a strong incentive for not falsifying information. That person should understand that any information submitted subsequently during the permit process is also certified. If you have a basis to suspect that any production information is incorrect, you may ask to review their books or ask for some other verification.

Step 6. Apply the effluent guidelines to derive limits

The final calculations of the effluent limits should be done from the effluent guideline summaries found in 40 CFR Parts 400-471. Although the effluent limits in the development documents and the CFR are usually the same, the CFR's are the most current regulatory version.

In this state there is another decision to be made at this point. The decision is whether the effluent guidelines also constitute all known, available and reasonable methods of treatment (AKART). AKART is discussed in detail in Part 3 of this Chapter. As a general rule, if the effluent guidelines for a particular category are 5 years old or less they will be AKART and this will be immediately apparent in reviewing the development document. If the effluent guidelines are between 5 and 10 years old they are probably AKART but the permit writer should review the treatability data base for a determination. If the effluent guidelines are over 10 years old, the permit writer should, at the minimum, conduct an analysis of unit processes design and efficiencies at the facility to determine if the effluent guidelines constitute AKART.

1.3 Multiple Processes

For industries with only one process and relatively constant production, the production-based effluent limits are simple to calculate and monitor. Now consider the Seafood Processors as a good example of some problems with production-based effluent limits. In our state, many seafood processors work on a variety of seafood. A typical processor in the coastal area might work on shrimp, salmon, bottom fish, and crab. On any given day the processor might be working on one or all of these products depending on what's available and the market demand. Each of these products has production-based effluent limits within Part 408 - Canned and Preserved Seafood Processing Point Source Category for the pollutants TSS, oil/grease, and pH for existing sources.

The treatment process identified as BPT treatment is screening of solids from the waste stream. Some product subcategories also include some management practices to reduce pollutants. To verify that the process is within the production-based effluent limits requires daily monitoring of effluent and a daily production report. The purpose of monitoring is to verify that the treatment process is working properly. Therefore, some permit writers have simply placed requirements in the seafood permits for a daily check on the condition of the screen but with no effluent monitoring. This is contrary to regulations which require sampling at least once per year for those parameters in the effluent guidelines. This has also resulted in another problem because the permit writer has not built a data base to determine the potential for water quality standards violations from the discharges.

A similar difficulty exists with fruit and vegetable processors who run a mix of products and then treat the wastewater in a lagoon system with a 30-day detention. The effluent which is analyzed is not representative of the production process for that month.

1.4 Mass vs. Concentration

Effluent limits expressed as mass (pounds or kilograms per day) create an opportunity for inefficient operation of a treatment process. A permit writer should consider using concentration limits (milligrams per liter) in addition to the mass limits.

An example would be a company that has effluent limits for pollutant X of 390 pounds/day daily maximum and 260 pounds/day monthly average. These limits are based on annual production of widgets. The annual average flow is 0.9 MGD and the maximum daily flow is 1.6 MGD.

During periods of reduced production and flow (0.5 MGD) the company is able to reduce the efficiency of their treatment apparatus and still meet the monthly average mass limit of 260 pounds/day.

Under Average Production and Flow (0.9 MGD)
260 LBS/DAY /[(8.34)(0.9 MGD)] = 35 mg/L

Under Reduced Production and Flow (0.5 MGD)
260 LBS/DAY/[(8.34)(0.5 MGD)] = 62 mg/L

The number 8.34 in the formulas above is a conversion factor to get from pounds per million gallons to milligrams per liter. The first formula for Average Production and Flow with the units expressed as follows:

$$\frac{\frac{260 \bullet lb}{day}}{\frac{0.9 \bullet MG}{day}} x \frac{1 \bullet MG \bullet mg}{8.34 \bullet lb \bullet l} = \frac{34.64 \bullet mg}{l}$$

Unit cancellation results in mg/l. Note that MGD (millions of gallons per day), is expressed as MG divided by day(s) so day(s) will cancel correctly.

1.5 Some Solutions

The regulatory objective of effluent limits is to assure that the wastewater treatment process is being run as efficiently as possible and meeting the long-term average (LTA). Some solutions to the problems identified above include the use of concentration limits, requiring a statement of production, specifying the efficiency of the treatment process and doing an annual balance.

In the example above the permit writer could have specified an effluent limit of 35 mg/L in addition to the 260 lbs/day limit. This would have forced continued efficiency during periods of reduced production. Incorporating concentration limits might discourage a facility from practicing water conservation. By reducing water usage in a process while continuing to provide good waste treatment the mass discharge might be reduced but the concentrations exceed monthly and daily limits, therefore, a permit writer who places concentration limits in a permit in addition to the mass limits, should allow some exclusion from those concentration limits if there is a demonstration of water conservation.

Another option for the permit writer is to specify treatment efficiency by mass and concentration. This is already incorporated into the municipal effluent limits for secondary treatment. The percent removal efficiency could be based on the design efficiency of the plant as specified in the approved engineering report.

A third option that is especially suitable for mixed production such as the seafood processors above is to require a statement of monthly production. This is commonly required in the permits for pulp mills which have a mix of products.

A fourth option to assure the efficient operation of the treatment process is to place some type of operating parameter as the daily control mechanism and then to run the balance sheet at the year end. This might be appropriate for the food processor example above. This option would be consistent with the way effluent limits were derived. As noted earlier, the production based effluent limits may have been derived on an annual basis and the monthly and daily limits calculated with the use of variability factors. This annual balance sheet creates a great deal of uncertainty for both the regulator and the regulated.

1.6 Outdated Effluent Guidelines

Frequently, the permit writer will find that the effluent guidelines are outdated such that the industrial processes or process pollutants are no longer accurately described. In this case the permit writer must derive effluent limits on a case-by-case basis as described previously in this chapter.

EXAMPLE IV-1 WOOL FINISHING EFFLUENT LIMITS

This example is a company that receives cleaned wool, wool yarn, and wool fabric and produces finished wool yarn and fabric. This example is typical of the type of problems encountered when using effluent guidelines.

This company belongs to the category of industries called "textile mills". For this company the category is apparent. For some industries it's not so easy to determine the industrial group. For an industry that's not obvious, the permit writer may be able to use the SIC (Standard Industrial Classification) code information that the company supplies on the permit application form. The SIC numerical system was originally developed and used by the Federal government for tax and data gathering purposes. EPA adopted it as part of their categorization system.

The Ecology library contains the EPA documents relating to the development of effluent limits for textile mills.

For this industry there are several documents dated from 1974 to 1982. The earliest document is called "Development Document for Effluent Limitations Guidelines and New Source Performance Standards for the TEXTILE MILLS Point Source Category" (June 1974).

This 1974 document proposed BPT limits to be imposed by 1977, BAT limits to be imposed by 1983 and New Source Performance Standards (NSPS). The BAT parameters included fecal coliform and color (remember the discussion from the earlier section that BAT was initially for conventional pollutants). The proposed BAT guidelines were rescinded as a result of a successful challenge in court by the industry.

The next two documents were released by EPA in 1979. They are the "Proposed Effluent Limitations Guidelines, New Source Performance Standards and Pretreatment Standards for TEXTILE MILLS Point Source Category" and "Economic Impact Analysis of Proposed Effluent Limitations Guidelines...". These guidelines redefined the industry and added some additional subcategories. BAT was now defined by the CWA as control of toxic pollutants. For textiles BAT is defined as the existing BPT. The NSPS is changed in this document and the pretreatment standards are given.

These early documents are interesting from a historical perspective but the most pertinent and current document is the one released in 1982. This final "Development Document for Effluent Limitations Guidelines and Standards for the Textile Mills Point Source Category" EPA 440/1-82/022 contained very few changes from the 1979 proposed guidelines.

The effluent limitations are summarized in 40 CFR Part 410 which are reproduced on the following two pages. These regulations also include definitions that sometimes become important criteria for application of the regulations. Occasionally a question will arise that cannot be answered by reviewing the development document or the regulations. In this case the permit writer should review the Federal Register in which the effluent limits were promulgated. Many times, the EPA response to comments will clarify the regulatory intent. These effluent guidelines were published in 47 FR 38819 on September 2, 1982 as noted in the CFRs.

The current development document describes how the industry was categorized and subcategorized. In addition, there are sections on wastewater characteristics, the pollutants of concern, control and treatment technology, non-water quality aspects including costs, and recommendations for BPT, BAT, and NSPS effluent limits.

For more information about a particular aspect of the industry process, get the appropriate references listed in the development document and request a computer search from the department library for more recent papers. Contact the Program Development Services Section to see if there is someone there or elsewhere in Ecology knowledgeable about the industry.

The production processes at this example facility fit the subcategory called wool finishing. In this case, it's particularly easy to determine because there is a flow chart describing the process (Figure 10). The other subcategories that are described are wool scouring, low water use processing, woven fabric finishing, knit fabric finishing, carpet finishing, stock and yarn finishing, nonwoven manufacturing, and felted fabric processing.

The permit writer in this example reads the development document and inspects the facility. The permit writer decides that this particular woolen mill is adequately described by the development documents and the processes are essentially the same as described in the development document.

The company claims they are an integrated facility because in addition to being covered under wool finishing they are covered under the woven fabric finishing subcategory. A review of the development document reveals that wool and wool blends are not covered in the woven fabric finishing subcategory because fabric finishing was included as a process in the wool finishing subcategory. There is no additional discharge allowance on that basis.

EXAMPLE IV-1 (continued)

THIS PAGE CONTAINS A REPRODUCTION OF THE CFR

§ 410.17 Effluent limitations representing the degree of effluent reduction attainable by the application of the best conventional pollutant control technology (BCT). [Reserved]

Subpart B—Wool Finishing Subcategory

§ 410.20 Applicability; description of the wool finsihing subcategory.

The provisions of this subpart are applicable to process wastewater discharges resulting from the following types of textile mills: wool finishers, including carbonizing, fulling, dyeing, bleaching, rinsing, fireproofing, and other such similar processes.

§ 410.21 Specialized definitions.

In addition to the definitions set forth in 40 CFR part 401 and § 410.01 of this part, the following definition applies to this subpart:

(a) The term *fiber* shall mean the dry wool and other fibers as received at the wool finsihing mill for processing into wool and blended products.

§ 410.22 Effluent limitations representing the degree of effluent reduction attainable by the application of the best practicable control technology currently available (BPT).

(a) Except as provided in 40 CFR 125.30 through 125.32, any existing point source subject to this subpart must achieve the following effluent limitations representing the degree of effluent reduction attainable by the application of the best practicable control technology currently available (BPT):

Pollutant or pollutant property	BPT limitations	
	Maximum for any 1 day	Average of daily values for 30 consecutive days
	Kg/kkg (or pound per 1,000 lb) of fiber	
BOD5	22.4	11.2
COD	163.0	81.5
TSS	35.2	17.6
Sulfide	0.28	0.14
Phenol	0.14	0.07
Total chromium	0.14	0.07
pH	(¹)	(¹)

¹ Within the range 6.0 to 9.0 at all times.

(b) Additional allocations equal to the effluent limitations established in paragraph (a) of this section are allowed any existing point source subject to such effluent limitations that finishes wool or blended wool fabrics through "commission finishing" as defined in § 410.01.

§ 410.23 Effluent limitation representing the degree of effluent reduction attainable by the application of the best available technology economically achievable (BAT).

(a) Except as provided in 40 CFR 125.30 through 125.32, any existing point source subject to this subpart must achieve the following effluent limitations representing the degree of effluent reduction attainable by the application of the best available technology economically achievable (BAT):

Pollutant or pollutant property	BAT limitation	
	Maximum for any 1 day	Average of daily values for 30 consecutive days
	Kg/kkg (or pounds per 1,000 lb) of fiber	
COD	163.0	81.5
Sulfide	0.28	0.14
Phenols	0.14	0.07
Total Chromium	0.14	0.07

(b) Additional allocations equal to the effluent limitations established in paragraph (a) of this section are allowed any existing point source subject to such effluent limitations that finishes wool or blended wool fabrics through "commission finishing" as defined in § 410.01.

EXAMPLE IV-1 (continued)

§ 410.24 Pretreatment standards for existing sources (PSES).

Any existing source subject to this subpart that introduces process wastewater pollutants into a publicly owned treatment works must comply with 40 CFR part 403.

§ 410.25 New source performance standards (NSPS).

Any new source subject to this subpart must achieve the following new source performance standards (NSPS):

Pollutant or pollutant property	NSPS	
	Maximum for any 1 day	Average of daily values for 30 consecutive days
	Kg/kkg (pounds per 1,000 lb) of fiber	
BOD5	10.7	5.5
COD	113.8	73.3
TSS	32.3	14.4
Sulfide	0.28	0.14
Phenols	0.14	0.07
Total Chromium	0.14	0.07
pH	(1)	(1)

Note: Additional allocations for "commission finishers" are not available to new sources.
[1] Within the range 6.0 to 9.0 at all times.

§ 410.26 Pretreatment standards for new sources (PSNS).

Any new source subject to this subpart that introduces process wastewater pollutants into a publicly owned treatment works must comply with 40 CFR part 403.

§ 410.27 Effluent limitations representing the degree of effluent reduction attainable by the application of the best conventional pollutant control technology (BCT). [Reserved]

Subpart C—Low Water Use Processing Subcategory

§ 410.30 Applicability; description of the low water use processing subcategory.

The provisions of this subpart are applicable to process wastewater discharges resulting from the following types of textile mills: yarn manufacture, yarn texturizing, unfinished fabric manufacture, fabric coating, fabric laminating, tire cord and fabric dipping, and carpet tufting and carpet backing. Rubberized or rubber coated fabrics regulated by 40 CFR part 428 are specifically excluded.

§ 410.31 Specialized definitions.

In addition to the definitions set forth in 40 CFR part 401 and § 410.01 of this part, the following definitions apply to this subpart:

(a) The term *general processing* shall mean the internal subdivision of the low water use processing subcategory for facilities described in § 410.30 that do not qualify under the water jet weaving subdivision.

(b) The term *water jet weaving* shall mean the internal subdivision of the low water use processing subcategory for facilities primarily engaged in manufacturing woven greige goods through the water jet weaving process.

§ 410.32 Effluent limitations representing the degree of effluent reduction attainable by the application of the best practicable control technology currently available (BPT).

Except as provided in 40 CFR 125.30 through 125.32, any existing point source subject to this subpart must achieve the following effluent limitations representing the degree of effluent reduction attainable by the application of the best available technology economically achievable (BPT):

GENERAL PROCESSING

Pollutant or pollutant property	BPT limitations	
	Maximum for any 1 day	Average of daily values for 30 consecutive days
	Kg/kkg (pounds per 1,000 lb) of product	
BOD5	1.4	0.7
COD	2.8	1.4
TSS	1.4	0.7
ph	(1)	(1)

[1] Within the range 6.0 to 9.0 at all times.

EXAMPLE IV-1 (continued)

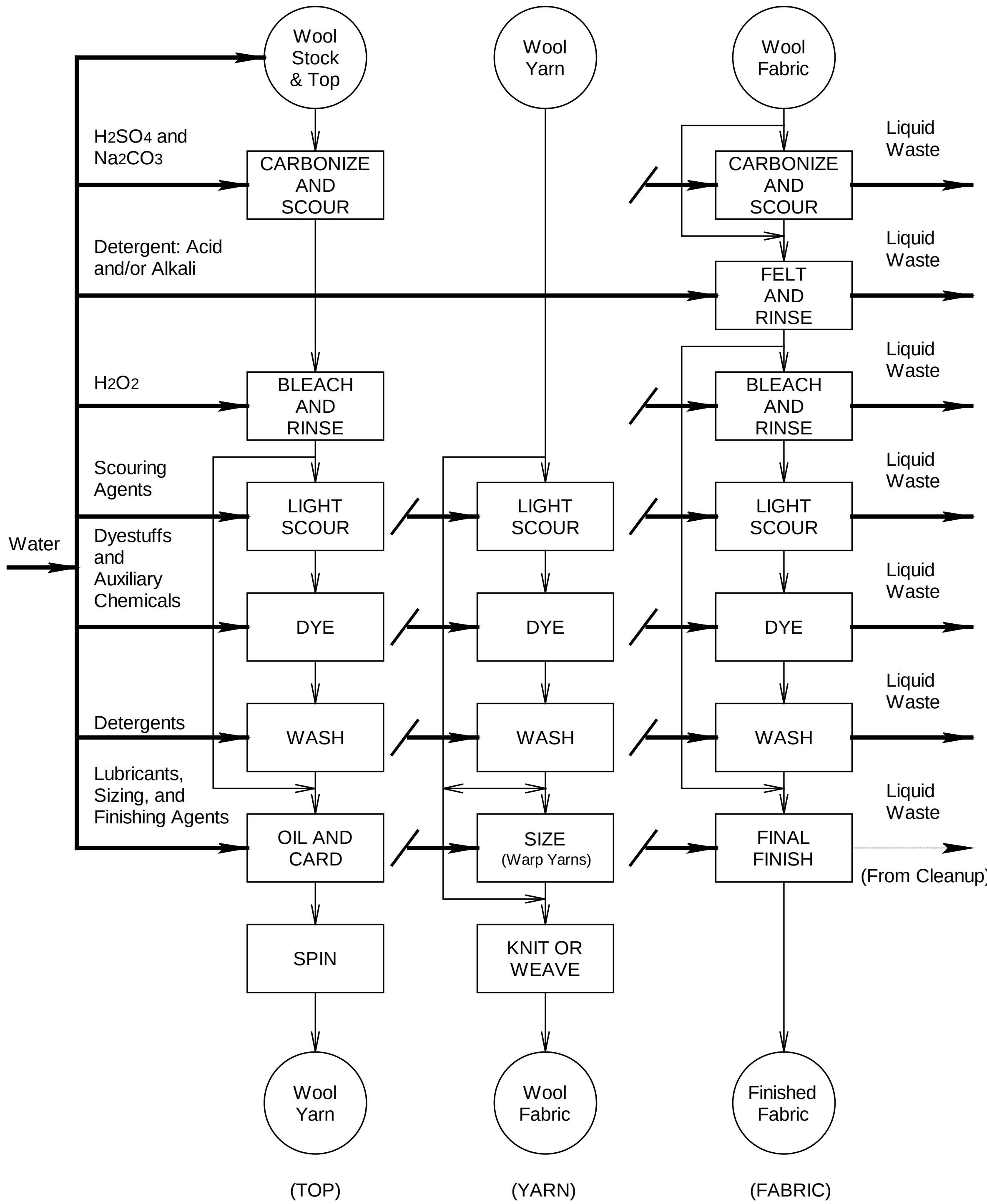


Figure 10. Wool Finishing Production Processes

EXAMPLE IV-1 (continued)

When industry requests to be included in a different category that would allow higher pollutant discharge and the permit writer determines that the request is not justified, the reasons should be explained in the fact sheet.

The effluent limits for the wool finishing subcategory are given as pounds of pollutant per 1000 pounds of fiber processed (this type of limit is called a production-based effluent limit as opposed to a concentration limit). The regulated pollutants for BPT are BOD5, COD, TSS, Sulfide, Phenol, Total Chromium and pH. The regulated pollutants for BAT are COD, Sulfide, Phenols, and Total Chromium with the same effluent limits as for BPT. The limits for BCT haven't been promulgated. This is noted in 40 CFR 410.27 by the words "reserved".

A textile mill submits the following information on an application for permit renewal:

FORM 2C NPDES

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY
APPLICATION FOR PERMIT TO DISCHARGE WASTEWATER
EXISTING MANUFACTURING, COMMERCIAL, MINING AND SILVICULTURAL OPERATIONS
Consolidated Permits Program

I. OUTFALL LOCATION

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

A. OUTFALL NUMBER *(list)*	B. LATITUDE			C. LONGITUDE			D. RECEIVING WATER *(name)*
	1. DEG.	2. MIN.	3. SEC.	1. DEG.	2. MIN.	3. SEC.	

[redacted]

II. FLOWS, SOURCES OF POLLUTION, AND TREATMENT TECHNOLOGIES

A. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more detailed descriptions in Item B. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined *(e.g., for certain mining activities)*, provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures.

B. For each outfall, provide a description of: (1) All operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and storm water runoff; (2) The average flow contributed by each operation; and (3) The treatment received by the wastewater. Continue on additional sheets if necessary.

1. OUT-FALL NO *(list)*	2. OPERATION(S) CONTRIBUTING FLOW		3. TREATMENT		
	a. OPERATION *(list)*	b. AVERAGE FLOW *(include units)*	a. DESCRIPTION	b. LIST CODES FROM TABLE 2C-1	
001	Dye House	0.5 MGD	Activated Sludge	1-T	3-A
	Wool Mixing Department	300 GPD			
	Boiler House	10,000 GPD			
	Wool Finishing Department	0.3 MGD			
002	Waste Activated Sludge	8,000 GPD	Screened	1-T	
			Land Irrigation	5-P	
003	Sanitary Wastewater	24,000 GPD	None	XX	
	Laboratory Wastewater	1,000 GPD			
004	Air Conditioning Condensate	7,000 GPD	None	XX	
	Roof Drains				
	Storm Drains				
005	Storm Drains		None	XX	
006	Air Conditioning Condensate	3,000 GPD	None	XX	
	Roof Drains				
	Storm Drains				

OFFICIAL USE ONLY *(effluent guidelines sub-categories)*

EPA Form 3510-2C (Rev. 2-85)

CONTINUE ON REVERSE

EXAMPLE IV-1 (continued)

The company also indicates in their application that the maximum raw material usage at the facility is 19,500 pounds per day. The permit writer requests more information on the raw material usage, including some supporting data. The company replies that the 19,500 pounds includes the maximum daily usage and a planned increase during the next 5 years. The permit writer requests detailed raw material usage and tells the company the permit will be based on current production with a permit modification later, if necessary to accommodate increased production. The typical materials taken in for processing in the wool finishing operation are washed and dried wool (stock), yarn, and fabric. The applicant, mill X, submits information showing they receive and process 12,627 pounds of stock, 3,294 pounds of cloth, and 1,306 pounds of yarn per day. It receives the cloth and yarn from company mill Y located in another state. The applicant claims that the 3,294 pounds of cloth represent 3,765 pounds of original stock and the difference is wastage. Similarly they claim the 1,306 pounds of yarn represents 1,606 pounds of stock. The applicant claims 17,998 pounds as the production base (12,627 + 3,765 + 1,606). The permit writer allows 17,281 pounds as the production basis. The definition of fiber in 40 CFR 410.21 is wool and other fiber as received at the mill. The production base for facility X does not include material processed or partially processed at facility Y.

The effluent limits for the permit are calculated as:
22.4 X 17.281 = 387 pounds per day maximum BOD
11.2 X 17.281 = 193.5 pounds per day average BOD

and so on for the other parameters. Note that BAT limits are the same as BPT and that BCT limits have not been promulgated for this industry.

1.7 Integrated Facilities

In the previous example, if the facility X above also produced nonwoven fabric by an adhesive process, the facility would be an integrated facility and receive an additional effluent allowance in the nonwoven subcategory.

In the nonwoven subcategory, the limitation is based on pounds of product produced. Therefore, the facility in the example would have to separately track that wool fiber used for nonwoven production so as not to get dual credit.

1.8 Converting Performance to Limits

EPA derived the BPT limits for wool finishing mills by determining the pollutants produced and the potential treatment methods available for treating those pollutants. EPA then examined the performance of two existing "exemplary" biological treatment plants at wool finishing mills (BPT = average of the best for conventional pollutants). The average effluent concentrations from the two treatment plants were then increased by 50% to derive the 30-day average maximum limit. This 30-day limit was multiplied by 2 to derive the maximum daily limit.

Sometimes more sophisticated statistical methods were used for deriving effluent limits when the data were available. The first step was to determine if the data was normally distributed and if not then to do a transformation. The transformation if done correctly enabled the use of normal distribution statistical techniques. The data or transformed data were then used to calculate a mean and standard deviation. The effluent limits for daily maximum may be set at $Z + 3s$. The probability of any measurement randomly exceeding this limit is 0.00135, so any exceedance means the treatment process is not functioning properly.

Another method used to arrive at daily maximum limits was to derive a variability factor $V = (Z + 3s)/Z$ which was then multiplied by the annual average effluent concentration. The resultant number was the proposed daily maximum concentration. This variability factor may also be calculated by plotting the data on probit paper or using a computer program and finding the 50th and 99th percentile concentration. The variability factor V = 99th percentile concentration/50th percentile concentration.

Monthly or 30-day effluent limits may be set as $Z + 2s$ or by determining variability factors on monthly data.

Performance-based effluent limits may be derived using the formulas in Appendix E of the TSD (EPA 1991) and the observed data for the long-term average (LTA).

EXAMPLE OF PERFORMANCE-BASED LIMITS

A permit writer proposes to issue a permit with water quality-based effluent limits for BOD and wants to derive performance-based limits as interim limits for a compliance schedule. The data base consists of 169 effluent values collected once per week. The summary statistics (calculated in Excel™) are presented below.

UNTRANSFORMED		**LOGNORMAL(base e) TRANSFORMED**	
Mean	32.9941	Mean	3.2783
Standard Error	2.00885	Standard Error	0.0492
Median	26	Median	3.2581
Mode	22	Mode	3.091
Standard Deviation	26.115	Standard Deviation	0.6396
Sample Variance	681.994	Sample Variance	0.4091
Kurtosis	7.27301	Kurtosis	0.5068
Skewness	2.51836	Skewness	0.2898
Range	147	Range	3.2387
Minimum	6	Minimum	1.7918
Maximum	153	Maximum	5.0304
Sum	5576	Sum	554.03
Count	169	Count	169
Confidence Level (95.0%)	3.96584	Confidence Level (95.0%)	0.0971
95th percentile	98	95th percentile	
99th percentile	141	99th percentile	

Federal regulations require effluent limits be expressed as a maximum daily limit (MDL) and an average monthly limit (AML)(except municipal limits for conventional pollutants). The method for determining effluent limits from demonstrated performance is found in Appendix E of the TSD. The formulas have been incorporated into PermitCalc.

$$MAXIMUM\ DAILY\ LIMIT(X_{.99}) = \exp\left[\mu_y + 2.326\sigma_y\right]$$

where

μ_y = *mean of* log*transformed data* =3.2783

σ_y =stan*dard deviation of* log*transformed data*=0.6396

Maximum Daily Limit (MDL) =exp(3.2783 + (2.326)(0.6396)) = 117.

The AVERAGE MONTHLY LIMIT (AML) depends on the number of samples that will be required per month for compliance monitoring. The following method is appropriate for 10 or fewer samples/month (Technical Support Document, Appendix E, Table E-2).

$$AVERAGE\ MONTHLY\ LIMIT(X_{.95}) = \exp\left(\mu_n + 1.645\sigma_n\right)$$

where

μ_y=mean of lognormal transformed data=3.2783

σ_y^2=variance of lognormal transformed data=0.4091

$$E(X) = \exp\left(\mu_y + 0.5\sigma_y^2\right) = \exp(3.2783 + 0.5(0.4091)) = 32.5524$$

$$V(X) = \exp\left(2\mu_y + \sigma_y^2\right)\left[\exp\left(\sigma_y^2\right) - 1\right] =$$

$$\exp(2 \cdot 3.2783 + 0.4091)[\exp(0.4091) - 1] = \exp(6.9657)[.505] = 535.126$$

$$\sigma_n^2 = \ln\left\{\frac{V(X)}{\left(n\left[E(X)\right]^2\right)} + 1\right\} = \ln\left\{\frac{535.126}{4(32.5524)^2} + 1\right\} =$$

$$\ln(1.1262) = 0.1188$$

$$\sigma_n = 0.3447$$

$$\mu_n = \ln\left(E(X)\right) - 0.5\sigma_n^2 = \ln(32.5524) - 0.5 \cdot 0.1188 = 3.4235$$

$$AML = \exp(3.4235 + 1.645 \cdot 0.3447) = 54.08$$

The average monthly limit (AML) when there are more than 10 samples per month for compliance is calculated as follows:

$$AML(X_{.95}) = (X_n) + 1.645\left[V(X_n)\right]^{1/2}$$

where

μ_y = mean of lognormal transformed data = 3.2783

σ_y^2 = variance of lognormal transformed data = 0.4091

n = number of samples/month = 12

$$E(X_n) = E(X) = \exp\left(\mu_y + 0.5\sigma^2_y\right) = \exp(3.2783 + 0.5(0.4091)) = 32.55$$

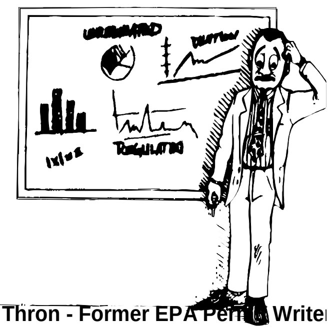
$$V(X_n) = V(X)/n = \exp\left(2\mu_y + \sigma_y^2\right)\left[\exp\left(\sigma_y^2\right) - 1\right]/12 = 535.83/12 = 44.653$$

$$AML(X_{.95}) = 32.55 + 1.645(44.653)^{1/2} = 43.5$$

Effluent limits using these formulas can be calculated using PermitCalc.

In this example for effluent limits for BOD for a municipality the effluent limits would be as average monthly limits and average weekly limits instead of a daily maximum. The weekly average limit is the appropriate average monthly limit (44 or 54) times 1.5.

2. Case-by-Case Derivation of Technology-Based Effluent Limits



Hap Thron - Former EPA Permit Writer Expert

Technology-based effluent limits may be derived on an individual facility basis which is also called case-by-case or BPJ. Case-by-case limits may be developed under federal authority (40 CFR 125.3) or they may be developed under authority of the state law RCW 90.48 (AKART).

Case-by-case derivation of effluent limits may be on a facility basis and cover all pollutants or may be on an individual pollutant basis.

Case-by-case development of effluent limits for an individual facility follows the same process as EPA used for developing effluent guidelines for categories of dischargers. The permit writer can review any development document to reinforce the process described in this Part. Case-by-case development of effluent limits is a 2-part determination. The first part is an engineering determination and the second part is an economic determination.

Case-by-case derivation of effluent limits is necessary in the following circumstances:

- The facility being permitted has an effluent guideline but the industrial processes have changed to the extent that the process and the pollutants produced are no longer accurately described in the development document.
- The facility type does not have federal effluent guidelines. Some of the kind of facilities in Washington State that do not have effluent guidelines are hazardous waste treaters, some equipment manufacturers, waste oil reclaimers, industrial laundries, barrel reclaimers, transportation facilities, some mining operations, water treatment plants, petroleum industry (other than refineries), chitin manufacturers, and some metallurgical manufacturers.
- The facility being permitted has an effluent guideline that accurately describes the manufacturing processes but has a pollutant or pollutants in the effluent that were not described in the development document.

The authority to develop and impose case-by-case or BPJ limits is given in the Clean Water Act Section 402(a)(1). This section authorizes the EPA administrator to issue permits containing "such conditions as the Administrator determines are necessary to carry out the provisions of the Act".

The process of deriving case-by-case (BPJ) effluent limits is not described in federal regulations but the factors which must be considered are given in Section 304(b) of the CWA and 40 CFR 125.3(c)(2) and 40 CFR 125.3(d).

The general factors to be considered for BPJ permit limits are:

- The appropriate technology for the category or class of point sources of which the applicant is a member, based upon all available information; ***and***

- Any unique factors relating to the applicant.

The specific considerations are:

1. For BPT Requirements (Conventional Pollutants)

- The total cost of application of technology in relation to the effluent reduction benefits to be achieved from such application;
- The age of equipment and facilities involved;
- The process employed;
- The engineering aspects of the application of various types of control techniques;
- Process changes; ***and***
- Non-water quality environmental impact (including energy requirements).

2. For BCT Requirements (Conventional Pollutants)

- The reasonableness of the relationship between the costs of attaining a reduction in effluent and the effluent reduction benefits derived;
- The comparison of the cost and level of reduction of such pollutants from the discharge from publicly owned treatment works to the cost and level of reduction of such pollutants from a class or category of industrial sources;
- The age of equipment and facilities involved;
- The process employed;
- The engineering aspects of the application of various types of control techniques;
- Process changes; ***and***
- Non-water quality environmental impact (including energy requirements).

3. For BAT Requirements (Toxic Pollutants)

- The age of equipment and facilities involved;
- The process employed;
- The engineering aspects of the application of various types of control techniques;
- Process changes;
- The cost of achieving such effluent reduction; ***and***
- Non-water quality environmental impact (including energy requirements).

The BAT factors have been briefly defined in EPA guidance as:

- *Age Of Equipment And Facilities* - Age of the plant including manufacturing lines, sewer lines and wastewater treatment system.

- *Process Employed* - The manufacturing process(es) used, and/or the wastewater treatment process employed.

- *Engineering Aspects Of The Application Of Various Types Of Control Techniques* - The design, construction, cost, performance, reliability, etc., of the wastewater treatment processes.

- *Cost Of Achieving The Effluent Reduction* - The capital and operating cost of attaining a specified effluent quality.
- *Non-Water Quality Environmental Impacts* - The trade-offs associated with achieving a specified effluent quality including energy requirement; air pollution; hazardous waste generation; solid waste; etc.

There is no other federal guidance on case-by-case development of effluent limits. The EPA permit writers training course makes several points on case-by-case limits.

- These are best done with a team approach involving at least an engineer and an economist.
- Defensibility depends on a reasonable process and documentation of that process.

The permit writer has several useful tools for defining the appropriate treatment technology. These include engineering reports, the treatability manual, the abstracts of industrial permits, and a computerized literature review.

The permitting process for new facilities in Washington State includes a requirement of dischargers to produce an engineering report in conformance with Chapter 173-240 WAC. This regulation (173-240-130 (q)) requires, "a statement, expressing sound engineering justification through the use of pilot plant data, results from other similar installations, and/or scientific evidence from the literature, that the effluent from the proposed facility will meet applicable permit effluent limitations and/or pretreatment standards."

This may seem like a catch-22 situation for those industries not covered by effluent guidelines. The permit writer can't tell the industry what the permit limits will be until an engineering analysis is completed and the applicant can't make a statement as required until those limits are known. In these cases the permit writer should explicitly instruct the applicant to review all possible treatment technologies, quantify the expected concentration of pollutants from each identified treatment, detail the cost of each identified treatment and list the other environmental factors associated with each treatment method. This data in the engineering report will form the technical basis for the permit writer's BPJ determination of effluent limits.

Another useful tool for determining the appropriate treatment technology or verifying an engineering report is the Treatability Manual (EPA-600/2-82-001). The Treatability Manual is in five volumes. The individual volumes are:

- Volume I - Treatability Data
- Volume II - Industrial Descriptions
- Volume III -Technology for Control/Removal of Pollutants
- Volume IV - Cost Estimating
- Volume V - Summary

Volume I provides physical data for 202 chemical compounds, their occurrence patterns, and methods of treatment and/or removal (with references to Volume III). Volume II is a summary of industrial descriptions from the development of effluent guidelines and describes only those industries for which there are guidelines. It describes manufacturing processes and the pollutants they produce. Volume III describes treatment technologies and their performance when treating industrial wastewater. The technologies include those which are widely used in treating industrial wastewater and those which are being used on a limited basis but have potential application in the removal of toxic pollutants from wastewater. The manual does not specify final effluent concentrations because those would be dependent upon individual wastewater characteristics and other factors.

The permit writer may request a computer search of the literature for any pollutants or process and treatment methods from the Ecology library. The primary journals included in the search which include new treatment process data are the Journal of the Water Pollution Control Federation (now called Water Environment and Technology), the Sanitary Engineering Division of the ASCE, and the Purdue Industrial Waste Conference.

Those permit writers who may need further technical assistance in developing BPJ permit limits may request it from the Water Quality Program Development Services Section. Although problems unique to a region will most likely be solved by that region, some, because of their complexity, political impact, etc. will be viewed as high enough state priority to require the Program Development Services Section involvement.

The second major part of BPJ permitting is the task of determining the cost of the proposed treatment method. The cost is then subjected to a test for reasonableness. Reasonable is an economic test. The reasonable test for BCT is defined by federal regulation and the reasonable test for BAT is defined by Federal guidelines. These economic tests are reviewed in Section 3.12 *Economic Tests Define Reasonable*.

3. All Known, Available, and Reasonable Methods of Treatment (AKART)

This part discusses the phrase, "all known, available, and reasonable methods of treatment" or AKART, which occurs in state water quality law and regulation. This part clarifies the meaning of AKART as used by Ecology in the process of permitting wastewater discharges. Specifically, this part has sections which review law, regulation, PCHB decisions and individual permit instances in which AKART has been used or defined. Subsequent sections discuss engineering analysis and other tests for AKART. This part does not specify in detail the process of engineering analysis because it is assumed that any engineering analysis will be conducted by a qualified engineer.

3.1 A Summary of AKART

- AKART is a statement of legislative intent directed toward the goal of clean water.

- AKART has been interpreted as a technology-based approach to limiting pollutants from wastewater discharges which requires an engineering judgment and an economic judgment. Because AKART encompasses a complex process of engineering and economic decision-making there can be no simple definition.

- AKART allows the state to be more stringent than federal effluent guidelines but actually parallels parts of the CWA.
- AKART has been defined in state regulation for some categories of dischargers.
- A determination of AKART may be the same process as case-by-case permitting as given in 40 CFR 125.3 if a proposed permittee has no effluent guidelines.
- Production increases greater than 10% should be treated as new source for defining effluent limitations for those dischargers with new source performance standards.
- The discharge of pollutants already captured does not meet the intent of AKART.
- AKART may be equivalent to the federal effluent guidelines or may be more stringent.
- AKART means that effluent limits may be derived in consideration of the treatment performance of a similar facility.
- AKART may be a requirement to control pollutants at the source.
- AKART may be zero discharge.

An industrial/commercial indirect discharger should not be required to treat for BOD and solids discharged to a POTW as long as the POTW has the capacity to treat the waste.

The general requirements of an engineering report are specified in WAC 173-240. The actual analysis must be done by an engineer who is trained and experienced in wastewater treatment. Other scientists may assist in determining whether the report meets the AKART criteria. Case-by-case decisions on technology-based effluent limits for existing facilities must be reviewed and approved by an engineer.

Ecology has adopted EPA's BCT and BAT economic tests for AKART analysis.

The BCT economic reasonableness tests imply that the minimum treatment for conventional pollutants on a BPJ basis is secondary treatment with 85% removal of BOD and solids. A candidate treatment technology would be advanced secondary treatment. A new industry producing conventional pollutants similar in nature and strength to municipal wastewater, but not covered by effluent guidelines, would be required at a minimum to treat with secondary treatment as BPT. A candidate BCT treatment would be advanced secondary treatment.

3.2 AKART as Given in Law

In the regulatory scheme of things legislative bodies express their intent through law. Laws are generally not explicit as to how they should be implemented. Therefore, regulations are promulgated to clarify the implementation of the law. In some cases regulatory authorities must also provide guidance as an additional tool to implement the regulations.

AKART has not been explicitly defined in law. AKART has been defined in certain regulations and has been ruled upon by the Pollution Control Hearings Board (PCHB). The following discussion reviews the law and regulation in which the phrase AKART is used.

The phrase AKART is found in three statutes dealing with water pollution and water resources in Washington. The context of these statutes in which the phrase AKART occurs gives some indication of the legislative intent.

The introduction to this manual reviewed some of the legislative history of Chapter 90.48 RCW, Water Pollution Control. Section 010 of 90.48 states, "It is declared to be the public policy of the state of Washington to maintain the highest possible standards to insure the purity of all waters of the state consistent with public health and public enjoyment thereof, the propagation and protection of wild life, birds, game, fish and other aquatic life, and the industrial development of the state, and to that end require the use of **all known available and reasonable methods by industries and others to prevent and control the pollution of the waters of the state of Washington.**" AKART in this section of the law relates to industries and others preventing pollution so as not to affect other water uses and intrinsic values.

Chapter 90.48 RCW, section 520 states, "In order to improve water quality by controlling toxicants in wastewater, the department of ecology shall in issuing and renewing state and federal wastewater discharge permits review the applicant's operations and incorporate permit conditions which require **all known, available, and reasonable methods to control toxicants in the applicant's wastewater."** This section ties AKART to the control of toxics, improvement of water quality, and the issuance of wastewater discharge permits.

In the Pollution Disclosure Act of 1971, Chapter 90.52 RCW, section 040 states "Except as provided in RCW 90.54.020(3)(b), in the administration of the provisions of Chapter 90.48 RCW, the director of the department of ecology shall, regardless of the quality of the water of the state to which wastes are discharged or proposed for discharge, and regardless of the minimum water quality standards established by the director for said waters, **require wastes to be provided with all known, available, and reasonable methods of treatment prior to their discharge or entry into waters of the state**." This statute introduces the concept that AKART is required regardless of the quality of the receiving water.

In the Water Resources Act of 1971, Chapter 90.54 RCW, section 020 (3)(b) states, "Waters of the state shall be of high quality. **Regardless of the quality of the waters of the state, all wastes and other materials and substances proposed for entry into said waters shall be provided with all known, available, and reasonable methods of treatment prior to entry. Notwithstanding that standards of quality established for the waters of the state would not be violated, wastes and other materials and substances shall not be allowed to enter such waters which will reduce the existing quality thereof, except in those situations where it is clear that overriding considerations of the public interest will be served.**" This section of 90.54 continues on with technology-based treatment exemptions for wastewater discharges from municipal water treatment plants on the Chehalis, Columbia, Cowlitz, Lewis, and Skagit Rivers. This law explicitly states that AKART is required even if it results in more stringent treatment than required to meet water quality standards. This is the basic philosophical approach found in the Clean Water Act. Chapter 90.54 also contains the caveat not found in other statutes of an exemption for, "overriding consideration of the public interest."

3.3 AKART As Given In Regulation

The phrase AKART is also found in the regulations that implement the laws reviewed above. In these regulations the phrase may be defined, simply repeated or may be changed to indicate implementation process. In some cases the context of the regulation also indicates implementation.

The state's surface water quality standards, Chapter 173-201A, define AKART as, "represent(ing) the most current methodology that can be reasonably required for preventing, controlling, or abating the pollutants associated with a discharge." These water quality standards also require dischargers to achieve AKART before receiving a mixing zone and require AKART as a condition for exemption to the antidegradation condition.

The state wastewater discharge permit program is implemented by Chapter 173-216 WAC, State Waste Discharge Permit Program. WAC 173-216-020(1) states, "It shall be the policy of the department in carrying out the requirements of this chapter, to maintain the highest possible standards to ensure the purity of all waters of the state and to require the use of **all known, available and reasonable methods to prevent and control the discharge of wastes into the waters of the state**."

WAC 173-216-050(3): "These exemptions" (to the requirement to obtain a state discharge permit) "shall not relieve any discharger from the requirement to apply **all known, available, and reasonable methods to prevent and control waste discharges to the waters of the state**,"...

WAC 173-216-110(1): "Any permit issued by the department shall specify conditions necessary to prevent and control waste discharges into the waters of the state, including the following, whenever applicable:

(a) **All known, available, and reasonable methods of prevention, control, and treatment**:"...

This regulation reiterates the phrase as found in law. The regulation notes that a discharger may be exempted from getting a permit but they are not exempt from AKART.

The state's surface water discharge permit program is implemented through Chapter 173-220 WAC, National Pollutant Discharge Elimination System Permit Program. This regulation refers to the statutes covered above and the technology-based processes of the CWA.

WAC 173-220-130(1): "Any permit issued by the department shall apply and insure compliance with all of the following, whenever applicable:

> (a) All known, available and reasonable methods of treatment required under RCW 90.52.040, 90.54.020(3)(b), and 90.48.520; including effluent limitations established under sections 301, 302, 306, and 307 of the FWPCA."

The state dangerous waste regulations, Chapter 173-303 WAC, which allow a (dangerous waste) permit by rule. That permit by rule is conditioned upon meeting AKART. WAC 173-303-802 (5)(a): "The owner or operator of a totally enclosed treatment facility or an elementary neutralization or wastewater treatment unit that treats dangerous wastes shall have a permit by rule, except as provided in (b) of this section, if he:

> (i) Has a NPDES permit, state waste discharge permit, pretreatment permit (or written discharge authorization from the local sewerage authority) and the permit or authorization provides for the use of **all known, available, and reasonable methods of prevention, control, and treatment of pollution pursuant to Chapter 90.48 RCW, prior to discharge;**"...

The underground injection control program, Chapter 173-218 WAC sets forth the procedures and practices applicable to the injection of fluids through wells. This regulation specifies in 173-218-100 that: (1) Any permit issued by the department shall specify conditions necessary to prevent and control injection of fluids into waters of the state, including the following, whenever applicable: (a) **All known, available, and reasonable methods of prevention, control, and treatment**;.

Other state standards are the ground water standards, Chapter 173-200, and Sediment Management Standards Chapter 173-204 WAC. These two regulations also use the phrase AKART.

The Water Quality Standards for Ground Waters of the State of Washington, Chapter 173-200 WAC, implement Chapters 90.48 RCW and 90.54 RCW.

WAC 173-200-030 Antidegradation policy.
WAC 173-200-030(2)(c): "Whenever ground waters are of a higher quality than the criteria assigned for said waters, the existing water quality shall be protected, and contaminants that will reduce the existing quality thereof shall not be allowed to enter such waters, except in those instances where it can be demonstrated to the department's satisfaction that:
(i) An overriding consideration of the public interest will be served; and
(ii) All contaminants proposed for entry into said ground waters shall be provided with **all known, available, and reasonable methods of prevention, control, and treatment prior to entry**."

WAC 173-200-050 Enforcement limit.
WAC 173-200-050(3): "All enforcement limits shall, at a minimum, be based on **all known, available, and reasonable methods of prevention, control, and treatment**."

WAC 173-200-050(3)(b)(iv): "When naturally nonpotable ground water exceeds a secondary contaminant criterion, an enforcement limit for a secondary contaminant may exceed a criterion when it can be demonstrated to the department's satisfaction that:"..."(D) **All known, available, and reasonable methods of prevention, control, and treatment will not result in concentrations less than the secondary contaminant criteria**."

The Sediment Management Standards, Chapter 173-204 WAC expand the phrase to include best management practices.

WAC 173-204-120(c): "Whenever surface sediments are of a higher quality (i.e., lower chemical concentrations or adverse biological response) than the criteria assigned to said sediments, the existing surface sediment quality shall be protected and waste and other materials and substances shall not be allowed to contaminate such sediments or reduce the existing sediment quality thereof, except in those instances where:"..."(ii) all wastes and other materials and substances proposed for discharge that may contaminate such sediments are provided with **all known, available and reasonable methods of prevention, control, and treatment and/or best management practices**;"

WAC 173-204-400(2): "Permits and other authorizations of wastewater, stormwater, and nonpoint source discharges to surface waters of the state of Washington under authority of Chapter 90.48 RCW shall be conditioned so that the discharge receives **all known, available and reasonable methods of prevention, control and treatment, and best management practices prior to discharge**, as required by Chapters 90.48, 90.52, and 90.54 RCW. The department shall provide consistent guidance on the collection, analysis, and evaluation of wastewater, receiving-water, and sediment samples to meet the intent of this section using consideration of the pertinent sections of the *Department of Ecology Permit Writer's Manual*, as amended, and other guidance approved by the department."

WAC 173-204-410(3): "Except as identified in subsection (6)(d) of this section, any person may apply for a sediment impact zone under the following conditions:
(a) The person's discharge is provided with **all known, available and reasonable methods of prevention, control, and treatment, and meets best management practices as stipulated by the department**;"...

WAC 173-204-410(6)(c): "Any person with a new or existing permitted stormwater or nonpoint source discharge, which fully uses **all known, available and reasonable methods of prevention, control, and treatment, and best management practices as stipulated by the department** at the time of the person's application for a sediment impact zone, shall be required to meet the standards of WAC 173-204-400 through 173-204-420;"...

It is apparent from the language in both law and regulation that AKART is meant to be a technology-based requirement conditioned by a judgment of reasonableness. In this respect it shares the same characteristics of case-by-case or BPJ determinations specified in 40 CFR 125.3. This is discussed in more detail later.

3.4 AKART as State Treatment Standards

AKART has been defined explicitly as effluent limitations in some Ecology regulations for some categories of dischargers and some pollutants.

For domestic wastewater facilities the discharge standards are given in Chapter 173-221 WAC, Discharge Standards and Effluent Limitations for Domestic Wastewater Facilities

WAC 173-221-010(1): "The purpose of this chapter is to implement RCW 43.21A-010, 90.48.010, and 90.52.040 by setting discharge standards which represent "all known, available, and reasonable methods of prevention, control, and treatment for domestic wastewater facilities which discharge to waters of the state."

WAC 173-221 then defines treatment standards (effluent limits) for domestic wastewater treatment plants for the parameters of BOD, TSS, pH, and fecal coliform. This regulation was preceded by a PCHB decision regarding municipalities discharging to marine waters, which is discussed below.

Treatment standards are also defined in Chapter 173-221A WAC, Wastewater Discharge Standards and Effluent Limitations.

WAC 173-221A-010: "This chapter implements Chapters 43.12A, 90.48, 90.52, and 90.54 RCW by setting minimum discharge standards which represent "known, available, and reasonable methods" of prevention, control, and treatment for industrial wastewater facilities that discharge to waters of the state."

This regulation currently defines treatment technology, treatment standards, and best management practices only for upland fin-fish facilities.

3.5 AKART as Defined by the Pollution Control Hearings Board (PCHB) and Other Courts

The PCHB has confirmed some of the individual permit determinations which were based on AKART. The board looks to these past decisions as guidance for future decisions. Discussed below are decisions made on marine discharging municipalities, New Source Performance Standards (NSPS) for production increases and the discharge of captured pollutants.

3.5.1. Marine Discharging Municipalities

The Clean Water Act Section 301(h) allows marine-discharging municipalities to obtain a variance from the requirement of secondary treatment. The variance is conditional upon 7 factors primarily dealing with water quality and upon concurrence of the state in which the discharge is located. In anticipation of several Washington municipalities applying for marine waivers, Ecology requested a formal AG opinion to the question, "Under state law may a municipality discharge wastes from its sewerage system into Puget Sound, or other marine waters, without providing secondary treatment?" The response (AGO 1983 No. 23) reviewed the law as given previously in this section and then continued,

> "Such statutory directions to the Department of Ecology, however, clearly do bring into play the expertise of the department as administrator of the state's water pollution control system. Accord, *Weyerhaeuser v. Southwest Air Pollution Control Authority*, 91 Wn.2d 77, 586 p.2d 1163 (1978). The precise level of treatment required by those general standards involves, primarily, engineering determinations; i.e., as to what treatment methods are "known," what treatment methods are "available," and what treatment methods are "reasonable" with respect to the particular installation in light of the factual circumstances surrounding it.[19] To make those determinations a review must be conducted by the department of existing engineering technologies in order to enable it to decide which methods of treatment--including but not limited to "secondary treatment" as above defined--are suitable with respect to the waste situation involved in the particular case.
> *Cf., Weyerhaeuser, supra*.[20]

19. The use of the encompassing word "all" indicates to us that the existing "state of the art" or "best available" treatment technologies are required to be used.
Cf., Weyerhaeuser v. Southwest Air Pollution Control Authority, supra.

20. These determinations by the Department of Ecology are, of course, to be made in light of the foundation policy that "waters of the state" shall be of high quality and be maintained to the "highest possible standards to insure the purity of all waters of the state" consistent with various environmental and economic objectives. RCW 90.54.020(3)(b) and RCW 90.48.010.

Ecology denied the marine waivers on the basis that secondary treatment constituted all known, available and reasonable treatment for municipal dischargers. Ecology determined reasonableness for each of the municipalities on 3 factors: (1) planning status, (2) environmental or siting constraints, and (3) economics. The economics factor was an analysis of resulting rate structure after meeting secondary treatment and a comparison to rates in other municipalities in the state and nation. The PCHB concurred with Ecology that secondary treatment for marine discharging municipal treatment plants was AKART. The decision for Bellingham v. Ecology (PCHB No. 84-211) contains a good discussion on technology-based treatment.

Footnote 20 above also mentions environmental objectives as a consideration of AKART. Environmental considerations are also a requirement given in federal regulations for case-by-case determinations. Unfortunately, there is no federal guidance on the process of making these environmental considerations. The environmental considerations required for BPT and BCT determinations were a consideration of the environmental effects of the pollutants in question.

3.5.2. New Source Performance Standards for Production Increases

Federal effluent guidelines allow a permit writer to grant an increase in pollutant discharge for production increases because the guidelines are production-based. The new source performance standards in federal regulations are more stringent than standards for existing source because new facilities can take advantage of new treatment methods and equipment and incorporate these into the design of the facility. In 1985 the Industrial Section issued a permit to Weyerhaeuser, Longview pulp mill complex which includes R-W Paper and NORPAC. The permit writer used new source performance standards to derive effluent limits for the 150 tons per day production increase at NORPAC and the 100 tons per day at R-W Paper and used AKART as the basis. Ecology argued that given the cost and planning required for anything except a marginal increase in production, a facility should also be planning and investing in its waste treatment to accommodate production increases. In this case the company did not have to make any capital investment to meet the new effluent limitations. The appellant Weyerhaeuser argued that the AKART standard was too uncertain. The PCHB found that the limits were "more stringent than federally required, but 'reasonable' as a matter of state law." As a general policy, wasteload increases greater than 10% at facilities with applicable effluent guidelines should be considered as new source loading when defining effluent limitations.

3.5.3. Discharge of Captured Pollutants

In the early 1980's, Ecology discovered that an ITT Rayonier pulp mill was discharging clarifier solids to come up to its permitted effluent limit for TSS. When Ecology reissued the permit, it contained a specific prohibition against discharge of sludge. The facility appealed this provision (PCHB No. 85-218), arguing that as long as they were meeting their technology-based effluent limits based on the federal effluent guidelines Ecology could not prohibit the discharge of sludge especially since Ecology could not prove water quality degradation. The mill also argued that the cost to deal with all their solids was excessive. Ecology argued that the discharge of pollutants already captured did not meet the intent of AKART. The PCHB ruled for Ecology.

3.5.4. Source Control of Pollutants

Ecology issued a permit in 1998 to Shell Oil (Tesoro) that contained numeric effluent limits based on the current EPA effluent guidelines and narrative effluent limits for source control (pollution prevention). The narrative limits were based on authority of 90.48 as AKART. The PCHB (98-50) and the Court of Appeals (No. 44762-9-1) affirmed the narrative limits. The Court of Appeals stated, "The Tesoro permit's conditions, which directly address the refinery's pollution control methods, may in fact better satisfy AKART than numeric limits alone…"

3.6 Direct Definitions of AKART

Some legal rulings contain text that clarifies the definitions of AKART. In the footnote number 19 of the marine discharge section above, for example, the Attorney General's office has defined "all" as indicating that the existing "state of the art" or "best available" treatment technologies are required to be used.

In PCHB 85-218 (ITT Rayonier v. Ecology), also discussed above, the board pointed to a decision by the Southwest Washington Air Pollution Control Authority (SWAPCA) for a definition of the terms "known" and "available":

> " ...SWAPCA may not require an applicant to develop new technology to advance the art of emission control. The "advance" must be "known" in the sense that it has been tested and found to control emissions effectively and efficiently. Under this test SWAPCA may not insist that an emission source be utilized as a proving ground for as yet untried control technology. An applicant must, however, incorporate into its proposal those control systems previously developed and presently available. 99 Wn.2nd at 81,82."

The issue of reasonableness was addressed in PCHB 84-211 (Bellingham v. Ecology) dealing with the marine waivers. The results of this case are discussed in the following section 3.12.

3.7 AKART Defined In Individual Permits

In individual permitting situations AKART may be equivalent or more stringent than the federal effluent guidelines. A permit manager may examine a development document and available treatment technologies for a particular category of discharger and make a determination that the federal effluent limitations are AKART. This becomes more difficult as the effluent guidelines become dated and the manufacturing processes change. In some cases the manufacturing processes change to such an extent that they no longer fit those described in the development documents. As described in an earlier section, those effluent guidelines less than 5 years old will always be AKART for the pollutants described in the development document. For effluent guidelines between 5 and 10 years old, the permit manager should compare production processes, pollutants generated and treatment efficiencies at the facility with those in the development document and in the treatability data base. For effluent guidelines older than 10 years, the permit writer should do the previous analysis and review unit processes design if time allows.

In some cases Ecology permit writers have determined that a category of discharger is capable of better performance than specified under effluent guidelines. An example is continuously-monitored pH. Under federal regulations, if a pH limitation in a permit is technology-based and is continuously monitored, then a discharger may receive an exclusion from the permit limits for a period of 1 hour per excursion and a maximum monthly excursion period of 7 hours and 26 minutes (40 CFR 401.17). The federal regulations place no bounds on magnitude of the excursions. Ecology has issued permits which place outside limits on these excursions of 5.0-10.0 units for petroleum refineries and 4.0-9.5 units for pulp mills. The justification for these excursion limits was that water quality standards may be violated at extreme pH ranges, that extreme ranges would be a violation of the state's dangerous waste laws, and that the facilities were capable of achieving a narrower range (AKART). This determination was appealed but a settlement was reached on the issue.

An AKART determination may take into consideration the treatment performance at a similar manufacturing facility. In this situation the permit writer must assess the costs to the facility to achieve the increased treatment efficiency. Some of the factors to be analyzed are:

- Are the production processes equivalent?
- Does this facility have some site specific constraints that would prohibit the increased treatment efficiency?
- And are the facilities of comparable age?

3.8 AKART versus Case-by-Case

In the cases above where proposed effluent limits are more stringent than those promulgated in the federal effluent guidelines, the effluent limits are based on the authority of RCW 90.48 (AKART). Federal regulations are not explicit as to whether or not case-by-case determinations should be made in every permitting circumstance, whereas, the language in 90.48 clearly indicates that all discharges are to be treated with all known, available and reasonable methods. Technology-based limitations based on AKART may have a compliance schedule placed in the permit instead of in a compliance order.

In the case of a facility ***without effluent guidelines***, a permit writer must make concurrent decisions on case-by-case under federal regulations (40 CFR 125.3) for BCT (conventional pollutants), BAT (toxics/nonconventional pollutants) and AKART. This process is covered in the previous section of this manual. In this situation because the permit writer will be using the same cost tests for economic achievability, case-by-case and AKART determinations are equivalent. In this situation the compliance schedule must be put in a companion enforcement order.

3.9 Zero Discharge

The permit writer may determine that for some permits AKART is zero discharge. Although there is no explicit statement in RCW 90.48 equivalent to the "zero discharge" goal of the Clean Water Act, both of these laws have a technology-based principle which, when followed to the logical conclusion lead to zero discharge, when achievable and reasonable.

3.10 AKART for Pretreatment

The pretreatment program parallels the surface discharge program. Municipal treatment plants are designed to treat domestic sewage. The uses to be protected at the treatment plant are biological functioning of the biomass and uses of the biosolids (sludge). Local limits are designed in part to protect these uses and are equivalent to water quality-based limits for surface discharges to prevent violations of the water quality standards. The categorical (pretreatment) effluent limitations are equivalent to the technology-based effluent limitations in federal regulations for surface dischargers.

All indirect dischargers must be examined for AKART in the permitting process because there is no exemption in law for indirect dischargers. Determining AKART for indirect dischargers is the same process as described previously. If the discharger is a categorical discharger the permit writer must determine the applicability of the effluent guidelines. A permit writer may derive limits that are more stringent than the effluent guidelines on the basis of AKART. If the discharger is not a categorical discharger the permit writer must do an engineering and economic analysis to determine appropriate technology-based effluent limits on a case-by-case basis.

Since POTWs are designed to treat BOD and solids, an industrial/commercial discharger should not be required to treat for BOD and solids if the municipality has the capacity to treat the waste.

3.11 Engineering Analysis for All Known and Available

The general requirements for the engineering analysis for all known and available are specified in WAC 173-240 as requirements of an engineering report. The process of engineering analysis is not given in Chapter 173-240 WAC. However, one of the requirements of this regulation is that the engineering report be prepared under the supervision of a licensed engineer unless the requirement is waived by Ecology. The review and analysis of this report by Ecology must also be done by an engineer who is trained and experienced in wastewater treatment. Scientists in the permit unit may contribute to the determinations in an engineering report but an engineer must make the judgment on the question of whether the treatment system proposed meets the AKART criteria. Case-by-case decisions on technology-based effluent limits for existing facilities must also be reviewed and approved by an engineer.

One point made earlier is important to review here. The PCHB in its citation of the SWAPCA decision indicated that Ecology cannot require Permittees to develop new treatment technology. That does not mean that treatment methods must be demonstrated for each kind of discharger. For example, if a discharger has a process not described in the effluent guidelines or elsewhere and which produces the pollutant BOD, and if the BOD concentration and degradation rates are similar to domestic wastewater, then biological treatment process and secondary treatment efficiencies are applicable to that discharger.

3.12 Economic Tests Define Reasonable

The section describes how to conduct the economic evaluation for deriving effluent limits by case-by-case or by AKART.

Performing the economic reasonableness tests requires estimates of the costs of the proposed treatment technologies; estimates of pollutant removal levels; and profit, cost and revenue data. The permittee is responsible for providing any data needed by the permit writer to make a decision. For new dischargers the cost and pollutant removal estimates for the proposed treatment technologies should be included in the engineering report submitted under WAC 173-240. This section covers the information permit writers need from dischargers before deciding on economic reasonableness.

Permit writers can use this section and the other reference documents to carry out economic reasonableness tests for BPJ permits.

As mentioned earlier, Ecology has adopted EPA's economic reasonableness tests. Ecology may develop its own tests in the future. There are 3 federal economic reasonableness tests corresponding to 3 levels of treatment: (1) BPT (2) BCT, and (3) BAT. The New Source and Pretreatment tests are identical to the BAT test.

For indirect dischargers, both AKART and federal pretreatment regulations define the effluent limits. The economic factors in setting pretreatment effluent limits are discussed later in this section.

For dischargers to ground water, AKART alone defines the effluent limits. No Federal law or regulation defines treatment standards for ground water dischargers.

BPT Economic Reasonableness Test

BPT was the first level of treatment identified in the CWA and is applicable only to conventional pollutants. BPT costs are also used in the economic achievability tests for BCT and BAT levels of treatment. BPT treatment for conventional pollutants is used as the base cost for BAT treatment for toxics and nonconventional pollutants because treatment for conventional pollutants is effective in varying degrees for removing toxic pollutants. The BPT economic reasonableness test is authorized by section 304(b)(1)(B) of the CWA. Among the factors that the permit writer must consider in setting BPT effluent limits is:

> "...the total cost of application of technology in relation to the effluent reduction benefits to be achieved from such application..." (40 CFR 125.3(d)(1).

The BPT economic reasonableness test is intended to be a cost-benefit test and benefits are measured in terms of amounts of pollutants removed.

EPA writes that:

> "The cost-benefit inquiry for BPT is a limited balancing, committed to EPA's discretion, which does not require the Agency to quantify benefits in monetary terms....In balancing

> costs in relation to effluent reduction benefits, EPA considers the volume and nature of existing discharges, the volume and nature of discharges expected after application of BPT, the general environmental effects of the pollutants, and the cost and economic impact of the required pollution control level." (47 FR 23263).

Thus, there is no single, precisely-defined BPT economic reasonableness test. The economic factors considered in determining BPT can vary from industry to industry.

According to an EPA economist, in setting BPT effluent limitations, EPA weighed the cost per pound of pollutants removed by the treatment technology more heavily than the effect of the annual cost of the treatment technology on the profitability of the plant (although some weight is given to the effect on profitability). The cost per pound of pollutants removed is intended to be a cost-benefit measure. By considering cost per pound, total cost in relation to pollution reduction is considered.

The intent of the BPT cost-benefit requirement is to avoid requiring wastewater treatment "where the additional degree of effluent reduction is wholly out of proportion to the costs of achieving such marginal level of reduction..." Costs cannot be wholly disproportionate to benefits.

For at least a few industries EPA used the "inflection" or "knee of the curve" method as the economic reasonableness test for BPT effluent limits. For each industry, "cost-effectiveness" diagrams were constructed which graphed the total cost of various treatment technologies against the percentage of pollutants removed by each technology. These graphs show that the marginal cost per percentage of pollutants removed rises as the total percentage of the pollutants removed rises. The BPT effluent limitations "were set at the point where the costs per percent (of) pollutant reduction took a sharp break upward toward higher costs per percent of pollutant removed". The cost per percent of pollutant reduction is called the marginal cost of pollutant removal.

However, the "knee of the curve" test is not ***the*** BPT economic reasonableness test. The U.S. Fifth Circuit Court of Appeals rejected the argument that the CWA ***required*** the use of the "knee of the curve" cost test in setting BPT effluent limits. The court wrote that:

> "The CWA contains no specific statutory language establishing a BPT "knee of the curve" test or any other quantitative cost-benefit ratio test for BPT.... The courts of appeal have consistently held that Congress intended Section 304(b) to give the EPA broad discretion in considering the cost of pollution abatement in relation to its benefits and to preclude the EPA from giving the cost of compliance primary importance."

Section 304(b) of the CWA requires EPA to establish BPT effluent limits. The CWA does not require that the knee of the curve test be used. The knee of the curve test can be used in combination with other tests. EPA does have to consider costs in relation to benefits in some manner.

For each development document, an accompanying economic analysis is written. The economic analysis estimates the impact of the proposed effluent limits (BPT, BCT, BAT, NSPS, etc.) on the affected industry. The economic analysis includes estimates of the regulation's impact on prices, production, employment, profits, and the industry's ability to finance expansion. The ability of the industry to pass costs on to consumers through price increases is also considered. The economic analysis is one of the determinants of the effluent limits (for an example, see 47 FR 23269).

For example, in setting BPT effluent limits, the development documents often make estimates of the impact of the cost of the BPT technology on product prices. The size of the price impact is one determinant of the BPT technology. Technologies with low price impacts are more economically achievable.

In conclusion, there is no single, precisely-defined BPT economic reasonableness test.

BCT Economic Reasonableness Test

Best Conventional Technology (BCT) effluent limits only apply to the 5 conventional pollutants: BOD, TSS, pH, fecal coliform, and oil and grease.

BCT ***always*** provides control of conventional pollutants at least as stringent as that provided by BPT. BCT effluent limits cannot be less stringent that BPT limits. If no BCT treatment technology exists or if it is economically unreasonable, then BCT is set equal to BPT.

The BCT economic reasonableness test is the only federal or state test that is precisely defined in regulations.

The BCT economic reasonableness test is described in 40 CFR 125.3(d)(2)(i) and (ii). In writing case-by-case or BPJ permits for BCT technology, among the factors that the permit writer must consider are:

1. "The reasonableness of the relationship between the costs of attaining a reduction in effluent and the effluent reduction benefits derived.
2. The comparison of the cost and level of reduction of such pollutants from the discharge from publicly owned treatment works (POTW) to the cost and level of reduction of such pollutants from a class or category of industrial sources." Section 304(b)(4)(B) Clean Water Act.

The details of the BCT economic reasonableness test were published in 51 FR 24973-86 (July 9, 1986). This includes the BCT economic reasonableness test methodology.

The BCT economic reasonableness test considers whether it is "cost-reasonable" for an industry to control conventional pollutants to a level more stringent than BPT effluent limitations. The test compares a permit holder's cost of removing conventional pollutants beyond BPT to a POTW's cost of removing conventional pollutants beyond secondary treatment. The test is a cost-benefit test because it compares costs and benefits (benefits are measured by the amount of pollutants removed).

The BCT economic reasonableness tests imply that the minimum treatment for conventional pollutants on a BPJ basis is secondary treatment with 85% removal of BOD and solids. A candidate treatment technology would be advanced secondary treatment. A new industry producing conventional pollutants but not covered by effluent guidelines would be required at a minimum to provide secondary treatment as BPT. A candidate BCT treatment would be advanced secondary treatment.

Conducting the BCT Test

The following BCT test was promulgated as regulation to define a cost test. EPA subsequently used the test to examine those industries that already had promulgated BPT effluent limits. This test requires that BPT technology and costs to have previously been calculated.

Conducting the BCT test as promulgated requires performing ***two*** tests:

1. POTW cost-comparison test.
2. Industrial cost-effectiveness test.

Both of these tests are intended to be cost-reasonableness tests. They implement 40 CFR 125.3(d)(2)(i) and (ii) and section 304(b)(4)(B) of the Clean Water Act. The tests are shown as flow charts in Figures 14, 15 and in Tables 2 and 3.

The proposed BCT technology must pass ***both*** tests for it to be economically reasonable. If it passes one test but fails the other, then it is not economically reasonable.

Performing the two BCT tests requires the calculation of two marginal costs:

1. The annual marginal cost of the existing or proposed BPT treatment technology (MBPT).
2. The annual marginal cost of the proposed BCT treatment technology (MBCT).

The marginal costs are in annual dollars per pound of BOD and TSS removed units (51 FR 24975).

To calculate these two marginal costs requires two annual total cost estimates:

1. The annual total cost of the existing or proposed BPT treatment technology (TBPT).
2. The annual total cost of ***upgrading*** the BPT technology to the proposed BCT treatment technology (TBCT).

The two total costs are ***annual*** costs.

In addition, the two annual pollutant removal amounts are estimated:

1. The amount of BOD and TSS removed annually by the BPT treatment technology in pounds (PBPT).
2. The ***additional*** amount of BOD and TSS removed annually by ***upgrading*** the BPT technology to the proposed BCT technology in pounds (PBCT).

To calculate marginal costs, the annual pounds of BOD and TSS removed by the BPT and BCT treatment technologies must be estimated. Annual amounts of BOD and TSS removed by the

BPT and BCT treatment technologies are measured in pounds per year units. The pounds of BOD and TSS are added together.

In general, only the amounts of BOD and TSS removed by the various treatment technologies are used in calculating annual amounts of pollutants removed. The amounts of the other three conventional pollutants (oil and grease, pH, and fecal coliform) removed should not be included. They should not be included because when EPA calculated the cost benchmarks it only used the amounts of BOD and TSS removed. The chief reason that EPA did not include fecal coliform and pH in the calculation is that these two pollutants cannot be measured in pounds.

However, EPA says that the pounds of oil and grease removed may also be included in the calculation of annual amounts pollutants removed when appropriate "in the context of the industry and technology" (51 FR 24973).

EPA calculated total annual amounts of BOD and TSS removed using the following method using actual data or the monthly maximum effluent limit.

BCT TWO PART ECONOMIC TEST

CALCULATE ANNUAL TOTAL COST OF EXISTING OR PROPOSED BPT TREATMENT TECHNOLOGY (TBPT)

CALCULATE ANNUAL TOTAL COST OF PROPOSED BCT TREATMENT (TBCT)

CALCULATE POUNDS OF BOD AND TSS REMOVED ANNUALLY BY BPT (PBPT)

CALCULATE ADDITIONAL BOD AND TSS REMOVED BY PROPOSED BCT TREATMENT (PBCT)

CALCULATE BPT MARGINAL COST (MBPT) AS TBPT/PBPT

CALCULATE BCT MARGINAL COST (MBCT) AS TBCT/PBCT

CONDUCT POTW TEST AND CONDUCT INDUSTRY TEST IF NECESSARY

Figure 11. The BCT Cost Test

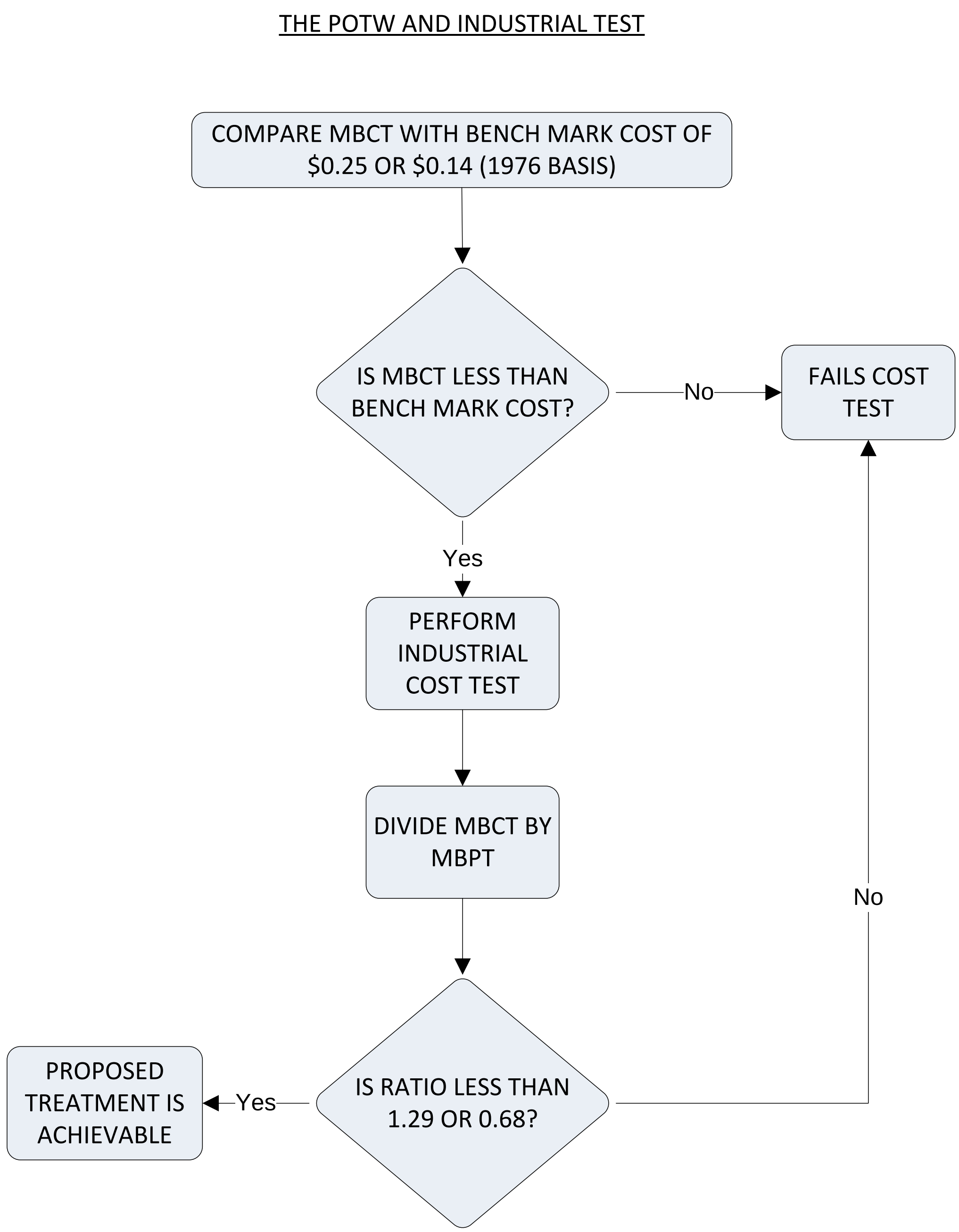


Figure 12. The POTW and Industrial Cost Tests for BCT

Treatment processes for which long-term pollutant removal data is available (long-term means at least 12 months), actual long-term pollutant removal data (or data on pollutant concentrations in the effluent of the various treatment processes) should be used to calculate the amount of BOD and TSS removed annually.

For treatment processes for which long-term pollutant removal data is unavailable, the maximum 30 day BPT effluent limits for BOD and TSS effluent limits should be used to calculate the amount of BOD and TSS removed annually.

For both types of processes (those with and those without long-term data) pollutant loadings of the raw wastewater should be estimated from actual data. (For more information on how to calculate amounts of pollutants removed by treatment processes, see 51 FR 24983 and 51 FR 24985-6.)

Marginal Costs

The marginal costs are in annual dollars per pound of BOD and TSS removed units.

To calculate the marginal cost of BPT treatment: divide the BPT annual costs by the BPT annual weight in pounds of conventional pollutants removed.

To calculate the marginal cost of BCT treatment, compute the following ratio:

1. Numerator: The annual total cost of upgrading the BPT technology to the proposed BCT technology.
2. Denominator: The additional amount of BOD and TSS removed annually by upgrading the BPT technology to the proposed BCT technology.

The POTW Cost-Comparison Test

The POTW cost-comparison test is the first part of the cost-reasonableness test. It compares the industry's cost of removing additional pounds of conventional pollutants (beyond BPT) to a POTW's cost of removing additional pounds of conventional pollutants (beyond secondary treatment).

The POTW benchmarks were calculated in 1986. They are expressed in 1976 prices. These benchmarks must be updated to the year in which the proposed BCT technology cost estimate is made. If old benchmarks were used, the benchmarks would be too low (because construction and operation costs are constantly rising) and too many proposed BCT treatment technologies would be rejected as economically not achievable.

EPA published a table that updated the benchmarks through 1985 (51 FR 24985). EPA has not formally updated the benchmarks past 1985. However, it can give help in updating them (cost indices, etc.).

Table 2. The POTW Cost-Comparison Test

POTW COST-COMPARISON TEST
<u>TO PERFORM THE POTW COST-COMPARISON TEST, COMPARE THE FOLLOWING TWO MARGINAL COSTS:</u> 1. The permit holder's annual marginal cost per pound of pollutant removed when upgrading its treatment process from BPT to the proposed BCT treatment technology. 2. An average-size POTW's annual marginal cost per pound of pollutant removed when upgrading from secondary treatment to advanced secondary treatment. Secondary treatment is defined as 30 mg/L of BOD and TSS. Advanced secondary treatment is defined as 20 mg/L of BOD and TSS. Use the following figures for the POTW's annual marginal cost (51 FR 24985-6): A. $.25 (in 1976 dollars) when the proposed BCT treatment process has long-term pollutant removal data (here, *long term* means at least 12 months). This figure is referred to as the "first tier POTW benchmark." B. $.14 (in 1976 dollars) when the proposed BCT treatment process does not have long-term pollutant removal data. This figure is referred to as the "second tier POTW benchmark."
If the permit holder's marginal cost exceeds the appropriate POTW marginal cost benchmark, then the proposed BCT treatment process is <u>not</u> economically reasonable. If the permit holder's marginal cost is less than or equal to the appropriate POTW marginal cost threshold, then the proposed BCT treatment process <u>is</u> economically reasonable.

The Industrial Cost-Effectiveness Test

The industrial cost-effectiveness test is intended to be a test of the proposed BCT technology's cost-effectiveness. It compares the industry's costs of attaining a reduction in pollution with the pollution reduction benefits derived. See the following Table 3 for the test.

The POTW benchmarks were calculated in 1986. They are expressed in 1976 prices. They do not have to be updated to the year in which the proposed BCT technology's cost estimate is made. EPA (47 FR 49199) stated that the benchmarks for the industrial cost-effectiveness test would not be indexed for cost changes over time because any such changes would be small. The ratios are the ratios of the marginal cost of upgrading a secondary STP to advanced secondary to the marginal cost of building a secondary STP. It is unlikely that ratio will change much over time because the cost indices for secondary and advanced secondary STPs should be nearly identical.

The proposed BCT technology must pass ***both*** tests for it to be economically reasonable. If it passes one test but fails the other, then it is ***not*** economically reasonable.

If the proposed technology fails one or both tests, then BCT is set equal to BPT.

Table 3. The Industrial Cost-Effectiveness Test

INDUSTRIAL COST-EFFECTIVENESS TEST
TO PERFORM THE INDUSTRIAL COST-EFFECTIVENESS TEST, COMPARE THE FOLLOWING 2 RATIOS OF MARGINAL COSTS: 1. The permit holder's ratio of marginal costs. This ratio is intended to be a measure of the candidate BCT treatment's cost-effectiveness. It is the ratio of the following 2 marginal costs: A. Numerator: The permit holder's marginal cost per pound of additional pollutants removed when upgrading its treatment process from BPT to the proposed BCT treatment process. B. Denominator: The permit holder's marginal cost per pound of pollutant removed when upgrading its treatment process from no treatment (raw waste) to BPT. 2. A POTW benchmark ratio of marginal costs. This ratio is referred to as the "industry cost benchmark." This is the ratio of the following two marginal costs: A. Numerator: The marginal cost per pound of pollutant removed when a POTW upgrades from secondary treatment to advanced secondary treatment. B. Denominator: The marginal cost per pound of pollutant removed when a POTW upgrades from no treatment (raw sewage) to secondary treatment. Use the following figures for the POTW benchmark ratio (51 FR 24985-6): A. 1.29 (calculated using 1976 dollars) when the proposed BCT treatment process has long-term pollutant removal data (here, *long term* means at least 12 months). B. 0.68 (calculated using 1976 dollars) when the proposed BCT treatment process does not have long-term pollutant removal data.
If the permit holder's ratio exceeds the POTW benchmark ratio, then the proposed BCT treatment process is **not** economically reasonable. If the permit holder's ratio is less than or equal to the POTW benchmark ratio, then the proposed BCT treatment process **is** economically reasonable.

BAT Economic Reasonableness Test

BAT is Best Available Technology Economically Achievable and is applicable to toxics and non-conventional pollutants.

In setting BPJ effluent limits for BAT treatment technologies, 40 CFR 125.3(d)(3)(v) states that:

> "the cost of achieving such effluent reduction" must be considered. This regulation repeats a portion of section 304(b)(2) of the Clean Water Act, which defines BAT. Even though the CWA does not list pollution reduction benefits among the factors that must be considered in determining BAT, they are considered by EPA when determining BAT. Therefore, the relationship between the cost of BAT and the pollution reduction achieved by the installation of BAT is also considered. An EPA permit writing expert has defined the cost of achieving the effluent reduction as the capital and operating cost of attaining a specified effluent quality.

The CWA does not require a comparison of costs and benefits. EPA writes:

> "The statutory assessment of BAT "considers" cost, but does not require a balancing of costs against pollution reduction benefits...In developing the BAT limitations, however, EPA has given substantial weight to the reasonableness of costs. The Agency has considered the volume and nature of discharges, the volume and nature of discharges expected after application of BAT, the general environmental effects of the pollutants, and the costs and economic impact of the required pollution control levels" (47 FR 23263).

Costs and benefits do not have to be compared. However, EPA does consider the cost of the pollutant reduction achieved by BAT technology in setting BAT effluent limits. Thus, it does compare costs and benefits (as measured by pollutant reduction) in determining BAT. However, economic achievability is given more weight.

With regard to the BAT economic achievability test, the U.S. Fifth Circuit Court of Appeals wrote:

> "Both Congress and the Supreme Court have made clear that in setting BAT, the *EPA is not required to compare the costs against the benefits of pollution reduction* in the same manner as the EPA is required to do in setting BPT standards". (page 250, Chemical Manufacturers Association vs. USEPA)

The court also wrote that section 301(b)(2)(A), which defines BAT, differs from section 301(b)(1)(A), which defines BPT, in that it does ***not*** state that costs shall be considered in relation to effluent reduction. No cost-benefit test is required by the CWA (page 250, Chemical Manufacturers Association vs. USEPA). In setting BAT effluent limits, EPA must only consider their "economic achievability."

BAT Economic Achievability Tests

The BAT economic achievability tests are described in Federal ***guidelines*** - not in Federal or State ***regulations***. EPA's *Guidance Manual for Estimating the Economic Effects of Pollution Control Costs* describes these tests. EPA emphasizes that this manual is not regulation or policy. Therefore, Ecology must determine the specific methods that it will use to evaluate economic achievability and to justify those methods. Ecology could use methods other than the federal tests if it has legitimate reasons for using them.

EPA's *Guidance Manual* defines a treatment technology to be economically achievable if its use would not cause the plant to shut down. That is, the technology is economically achievable if its annual cost is less than the plant's annual profits.

EPA's *Guidance Manual* uses a 3-stage approach to determining economic achievability:
1. First, perform a ***firm-level*** test.
2. If the control technology passes the firm-level test, but the permit holder protests that the technology is not economically achievable, then perform a ***plant-level*** test.
3. If the firm-level test is inconclusive, then a ***plant closure*** analysis must be conducted.

The BAT economic achievability test is shown in Figure 13.

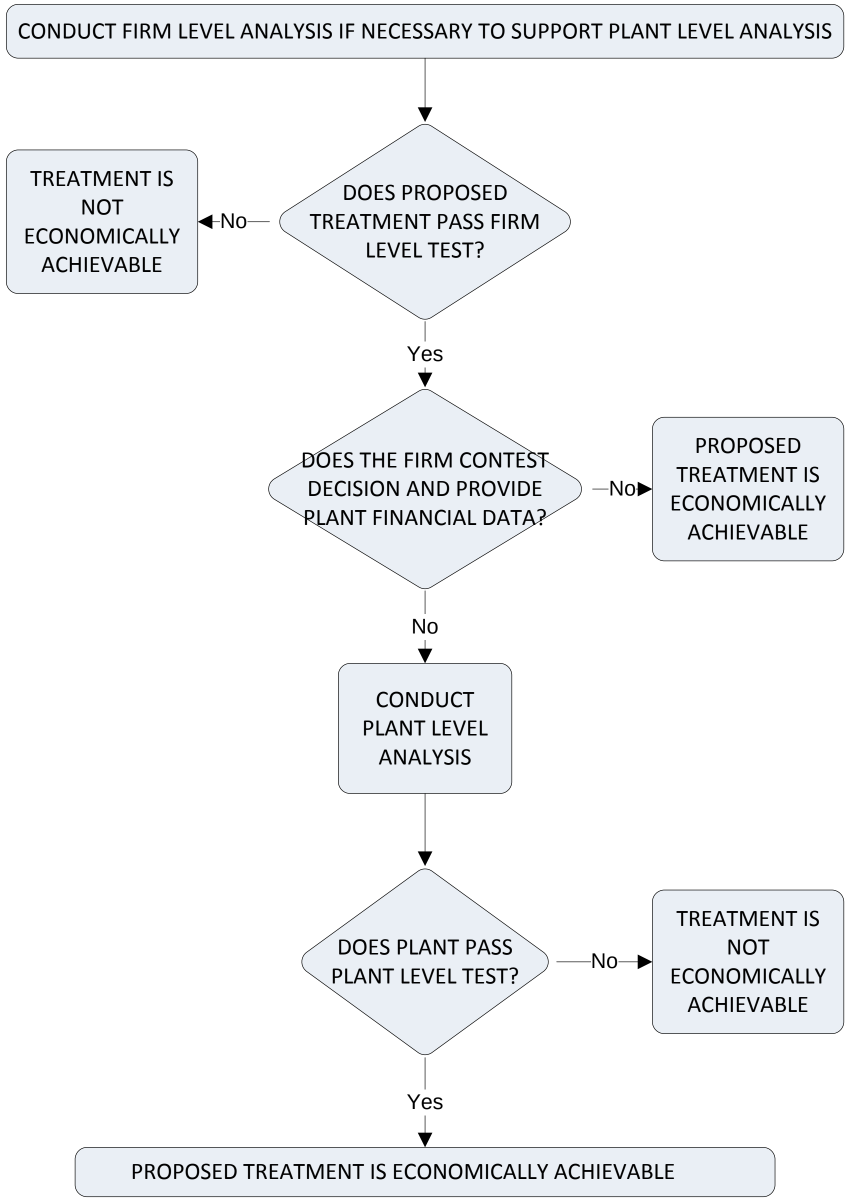


Figure 13. Sequence of Analysis for Determining Economic Achievability for BAT

The plant-level test makes the most sense economically. It is more precise than the firm-level test. However, plant-level tests are difficult to do because plant-level data is limited and confidential. Therefore, the *Guidance Manual* recommends doing the firm-level test first because, in some cases, it is possible to conduct it with publicly-available data on the firm's balance sheet, income statement, and stock prices.

However, in most cases it is either impossible or a waste of time to perform the firm-level test for two reasons:

1. For most permit holders, the firm-level test is difficult to do because few of them are publicly held corporations. Therefore, no publicly available balance sheet or stock market data exists. In many cases, because the firm is so small, the firm will equal the plant.
2. Any permit holder with any business sense will demand that the plant-level economic achievability test be performed in any case, because he/she, as a profit-maximizer, is interested in the profitability of the plant. A profit-maximizing firm owner has no interest in subsidizing the wastewater treatment costs of one plant with profits earned by the remainder of his/her firm.

The primary justification for conducting the firm-level test is that the data needed to perform the test is publicly available from sources such as *Moody's Industrial Manual* and from stock prices. However, very few Washington permit holders (especially small- and medium-sized companies) are publicly owned. Thus, few have stock that is publicly traded. Few permit holders are listed in Moody's and similar publications. There is no other publicly available data. Therefore, for these firms, permit holders must provide the data needed to conduct firm-level tests.

In cases where the firm is identical to the plant, a plant-level test is the same as a firm-level test, therefore, call it a plant-level test.

Even when there is publicly available data, a firm-level test will usually yield a meaningless answer that will be immediately disputed by the permit holder. There is little point in estimating the impact of the annual cost of a proposed BAT treatment system for a Weyerhaeuser plant on the total worldwide profits of the Weyerhaeuser Co. It is obvious that the impact will be tiny. It is also obvious that Weyerhaeuser will immediately point out that it is concerned with the profitability of each of its facilities and is not interested in subsidizing one plant with profits from its other plants. Therefore, it will want a plant-level test to be conducted.

Generally the firm-level test should not be conducted except in the situation discussed below where it is used to compliment the plant-level test.

Firm-Level Test

The firm-level test examines whether the firm as a whole can afford the treatment technology. It is performed using publicly available balance sheet and stock market data.

There are 7 different firm-level tests. They all estimate the impact of the cost of pollution control equipment on a financial ratio. Among the tests are: the current ratio, which is the ratio of current assets to current liabilities; Beaver's ratio, which is the ratio of cash flow to total debt;

the debt/equity ratio; and the market-to-book ratio.

The *Guidance Manual* suggests that if the firm-level test shows that the proposed BAT treatment technology is not economically achievable for the firm, then it is not economically achievable for the plant. This is not always true because the firm-level test may give misleading results. It is possible that the plant is making large profits, while the firm as a whole has low profits. Losses in some of the firm's plants offset profits in others. In such a situation, the firm-level test would indicate that the proposed BAT technology is economically unreasonable, when, in fact it was reasonable.

If the firm-level test shows that the proposed BAT treatment technology is economically achievable, the owner may contest this determination. The owner may contend that the BAT technology will make the plant unprofitable to operate. If the determination is contested, the owner must provide plant-level data for the plant-level test.

In some cases (especially when the permit holder has only one plant), the firm-level tests can be used to supplement the plant-level test. They can provide information that the plant-level test does not. In most cases the data needed to perform the firm-level tests will have to be provided by the permit holder. Because there are several firm-level tests and because performing them is complicated, instructions for conducting them are not included here. See the *Guidance Manual* for instructions.

As explained earlier, in most cases the firm-level test is meaningless and will probably be disputed by the permit holder. In addition, for many firms, balance sheet and stock price data which is required to perform the firm-level test is not publicly available. Therefore, the firm-level test should only be performed to compliment the plant-level test.

Plant-Level Test

There are three plant-level tests. All the plant-level tests ask the same question: would the plant's earnings before taxes be greater than zero if it installed the proposed BAT technology? That is, would the plant be driven out of business by the cost of the BAT technology?

The three plant-level tests are:

1. Earnings test
2. Gross margin test
3. Revenue test

According to EPA, only 1 of the plant-level tests needs to be done because the three tests are essentially the same, differing only in the amount of data that they require the firm to provide. The three tests require data from the plant's income statement and estimation of the annual cost of the proposed BAT treatment technology.

It is important to note that all three of the BAT plant-level economic achievability tests are conservative. They assume that the permit holder cannot pass ***any*** portion of the cost of the BAT treatment equipment on to its customers. The cost is assumed to come completely out of its profits. The tests assume that the cost of the pollution control equipment is an additional cost but that revenue is constant. Generally, this assumption is incorrect for many of the industries that hold permits because the permit holder will be able to pass along a portion or all of the cost, thus lowering the impact of the cost of the treatment equipment on its profits. The more that water pollution control regulations are consistent throughout the U.S., the easier it is for the permit holder to pass the costs on. Therefore, this economic achievability test is biased in favor of the permit holder.

The permit holders are responsible for providing the cost, earnings, and revenue data needed to perform the economic achievability test. If they refuse to supply the data, then it should be assumed that the treatment technology is economically achievable.

Plant Closure Analysis

If the plant-level tests do not provide conclusive answers, then a detailed plant closure analysis must be conducted. This is a much more detailed and therefore, more valid and expensive--examination of the impact of the cost of the treatment technology on the plant's economic viability. It is a job for a consultant.

The EPA *Guidance Manual* states:

> The plant-level tests are intended and designed as screening tests rather than rigorous and definitive evaluations of a plant's ability to afford pollution control costs. If the test results indicate that pollution controls would impose severe economic impacts, then a more detailed plant closure analysis would be necessary. This would entail working closely with the plant and corporate accountants to gather information on a variety of costs, revenues, and accounting procedures. Information on salvage values of equipment as well as projections of future economic conditions may be desirable or required.

Data Requirements for Plant-Level Test

If the owner does not think that a treatment technology proposed by Ecology is economically reasonable and wants a plant-level test conducted, ***he/she must provide the data needed to conduct the economic achievability tests***.

The permit holders are responsible for providing all the data needed to perform the economic achievability tests. They must supply two types of data:

1. Cost estimate for upgrading the treatment technology from BPT to the proposed BAT technology.
2. Data from its income statement.

Pollution Control Equipment Cost Estimate

All 3 BAT plant-level economic achievability tests require estimates of the annual cost of the proposed BAT treatment technology. This cost is the cost of ***upgrading*** from BPT to BAT treatment. For the BAT test, the ***total*** annual cost of upgrading from BPT or proposed BPT to the proposed BAT treatment technology is used. Marginal costs per unit of pollutant removed are not used in the BAT tests.

Ecology may propose a BAT treatment process based on the fact that a competitor of the permittee had a similar process. If the permittee disputes this type of comparison they must submit data to show why they are substantially different from their competitor.

The plant-level tests use ***before-tax*** annual costs.

Income Statement Data

The permit holder must provide plant-level income statement data—revenue, costs, and earnings—for the most recent three years (the EPA *Guidance Manual* only uses data from the most recent year's income statement). If it does not collect this data at the plant level, it must do the best job it reasonably can in constructing accurate income statements for the plant.

The permit holder must provide the following income statement data:

1. Revenue.

2. Cost of Goods Sold.
   A. Cost of materials.
   B. Direct labor costs.
   C. Production overhead costs (indirect labor, rent, energy, etc.).
   D. Extraordinary costs should not be included.

3. Corporate Overhead Costs Assigned to the Plant
   A. Selling, general, and administrative expense.
   B. Interest expense.
   C Depreciation on common property.
   D. Etc.

The permit holder must supply documentation to verify the data. For example, state excise tax returns, federal income tax returns, tax schedules, etc.

For plants that are owned by companies with several facilities, income tax returns and schedules will usually lump together the revenue, cost, and earnings data for all the facilities. In such cases, income tax forms will be worthless for verifying plant-level revenue and cost data. Ecology will then have to rely on accounting records. Such records might be biased by the permit holder. There is little Ecology can do about this, short of auditing the firm.

There are several problems that will be faced in obtaining accurate plant-level data:

- Plant-level data is usually confidential.
- Sometimes firms do not collect plant-level revenue and cost data. Many companies do not keep revenue data at the plant level. Instead, they maintain some cost records at the plant level but record revenues at the division or firm level.
- Corporate overhead costs are not usually allocated to individual plants. And when they are, biases may exist in the allocation method.
- Non-standard accounting procedures used internally by the firm can make it difficult to verify cost and revenue data.

- Firms may bias the plant's costs and revenues. It is essentially impossible to audit the cost and revenue data for accuracy.
- Transfer prices for inputs purchased by the plant from other parts of the firm can be biased upward in order to increase costs.
- Transfer prices for goods sold by the plant to other parts of the firm may be biased downward in order to reduce revenue.

The BAT plant-level economic achievability tests are performed using the following tests which are calculated using income statement data:

- Earnings before taxes test (EBT) = revenues minus the costs of goods sold and corporate overhead
- Gross margin test = revenues minus costs of goods sold
- Revenue test

Performing the Plant-Level Tests

The earnings test is the most accurate plant-level BAT test. Therefore, if the data is available, it is the test that should be performed. The earnings test asks the question: would the plant's earnings before taxes be greater than zero if it installed the proposed BAT technology?

The earnings test analyzes a plant's earnings before taxes (EBT) and determines if the EBT would be positive after installation of pollution control equipment.

The earnings test requires data that may not normally be collected at the plant level. Therefore, its application may be limited. The gross margin test and the revenue test require less data and, therefore, can be used in more situations.

Table 4. The BAT Earnings Test

EARNINGS TEST
TO PERFORM THIS TEST CALCULATE: Earnings before taxes minus the annual cost of proposed BAT technology
• If this number is greater than zero, the proposed BAT treatment technology is economically achievable. • If this number is less than zero, the proposed BAT technology is not economically achievable. • If this number is equal to zero (or near zero), then the test is inconclusive. A plant closure analysis must be carried out.

If the earnings test is inconclusive, the other two plant-level tests will ***not*** help to determine whether or not the proposed technology is economically achievable. All three tests are identical except that the gross margin and revenue test use less accurate data than the earnings test uses. Tests performed using less accurate data cannot help provide a conclusive answer when the test using the most accurate data (the earnings test) does not provide a conclusive answer.

Gross Margin Test

According to the EPA *Guidance Manual*, if the earnings test cannot be performed because cost data that allocates corporate overhead costs to individual plants is not available, then either the gross margin test or the revenue test should be performed. There is no need to perform both. As explained below the two tests are equivalent except for the data requirements.

Gross margin is equal to revenue minus the cost of goods sold. It is a measure of the plant's profit before deducting corporate overhead costs. The gross margin test avoids the problem of accurately allocating corporate overhead to the plant. This test is a less accurate test of economic achievability than the earnings test because an estimate of the plant's corporate overhead is used instead of actual data.

The gross margin test assumes that the firm's EBT-to-gross margin ratio is equal to its industry's EBT-to-gross margin ratio. The test uses the firm's gross margin and the industry's EBT-to-gross margin ratio to estimate the firm's EBT (multiply the firm's gross margin by the industry's EBT/gross margin to yield the estimate of the firm's EBT). It then compares the cost of the BAT technology to the firm's estimated EBT. So, the gross margin test is an earnings test that uses estimated earnings rather than actual earnings.

Table 5. The Gross Margin Test for BAT

GROSS MARGIN TEST
TO PERFORM THE GROSS MARGIN TEST CALCULATE: 1. Ratio of the annual cost of the proposed BAT technology to the firm's gross margin. 2. Ratio of the industry's average EBT to the industry's average gross margin. The industry average EBT and gross margin are obtained from Robert Morris Associates' *Annual Statement Studies*. They are available for 4-digit SIC codes.
• If the first ratio is less than the second ratio, then the proposed BAT treatment technology is economically achievable. • If the first ratio is greater than the second ratio, then the proposed BAT treatment technology is not economically achievable. • If the first ratio is equal (or approximately equal) to the second ratio, then the test is inconclusive. A plant closure analysis must be carried out.

If the gross margin test is inconclusive, the revenue test will ***not*** help to determine whether or not the proposed technology is economically achievable. Both tests are essentially the same except that the revenue test uses less accurate data than the gross margin test does. A test performed using less accurate data cannot help provide a conclusive answer when the test using the more accurate data (the gross margin test) does not provide a conclusive answer. However, if not enough data is available for the BAT earnings test or the gross margin test, then the revenue test can be used.

Revenue Test

The EPA *Guidance Manual* suggests that if the earnings test cannot be performed because accurate cost data for the plant is not available, then the revenue test should be performed. This test has easy-to-meet data requirements.

The revenue test completely avoids the problem of collecting accurate cost data for the plant. It does not require any data on production or overhead costs. It only uses the plant's revenue. The disadvantage of this is that the revenue test is a less accurate test of economic achievability than either the earnings test or the gross margin test.

The revenue test assumes that the firm's EBT-to-revenue ratio is equal to its industry's EBT-to-revenue ratio. The test uses the firm's revenue and the industry's EBT-to-revenue ratio to estimate the firm's EBT (multiply the firm's revenue by the industry's EBT/revenue to yield the estimate of the firm's EBT). It then compares the cost of the BAT technology to the firm's estimated EBT. So, the revenue test is an earnings test that uses estimated earnings rather than actual earnings.

Table 6. The Revenue Test for BAT

REVENUE TEST
TO PERFORM THE REVENUE TEST CALCULATE: 1. Ratio of the annual cost of the proposed BAT technology to the firm's revenue. 2. Ratio of the industry's average EBT to the industry's average revenue. The industry average EBT and revenue are obtained from Robert Morris Associates' *Annual Statement Studies*. They are available for 4-digit SIC codes.
• If the first ratio is less than the second ratio, then the proposed BAT treatment technology is economically achievable. • If the first ratio is greater than the second ratio, then the proposed BAT treatment technology is not economically achievable. • If the first ratio is equal (or approximately equal) to the second ratio, then the test is inconclusive. A plant closure analysis must be carried out.

NSPS Economic Reasonableness Test

In setting New Source Performance Standards (NSPS), section 306(b)(1)(B) of the CWA requires that EPA "take into consideration the cost of achieving such effluent reduction." This language is identical to that which specifies how costs are to be considered in defining BAT.

In setting NSPS effluent limits for toxic and conventional pollutants discharged by chemical manufacturers, EPA used the BAT economic test. The U.S. Fifth Circuit Court of Appeals agreed with EPA that use of the BAT test in setting NSPS effluent limits was required by the CWA (page 262, Chemical Manufacturers Association vs. USEPA).

Therefore, BAT economic achievability analysis is also applicable to NSPS.
The cost of installing a given level of treatment in a new plant (NSPS) should be less than the cost of installing it in an existing plant (BCT and BAT). Therefore, the economic reasonableness test for NSPS should be easier to pass than the test for BPT and BAT.

Pretreatment Economic Reasonableness Test

In setting Pretreatment Standards for Existing Sources (PSES) and Pretreatment Standards for New Sources (PSNS), EPA stated:

> "The legislative history of the 1977 Act (i.e., the CWA) indicates that pretreatment standards are to be technology-based and *analogous to the best available technology* for removal of toxic pollutants" (47 FR 23264).

That is, PSES and PSNS are analogous to BAT.

However, in setting PSES and PSNS effluent limits, EPA also considered:
The cost of application of technology in relation to the effluent reduction and other benefits achieved from such application (47 FR 23264).

This criterion is similar to that used in setting BPT effluent limits. It is a cost-benefit test.

The U.S. Fifth Circuit Court of Appeals wrote that the CWA requires that pretreatment standards be "based on BAT or more stringent criteria" (page 196, Chemical Manufacturers Association vs. USEPA). The court also wrote that the PSES pretreatment standards are:

> ..."technology-based and are *analogous to the BAT effluent-limitation guidelines* for the removal of toxic pollutants--that is, they are intended to represent the best available technology that is *economically achievable* by indirect dischargers" (page 244, Chemical Manufacturers Association vs. USEPA).

In addition, the court wrote that the PSES standards are *equivalent* to BAT standards and, therefore, are to be set in accordance with section 304(b)(2)(B) of the CWA, which lists the factors that must be considered in determining BAT (page 249, Chemical Manufacturers Association vs. USEPA).

Therefore, the BAT economic achievability test is applicable for pretreatment effluent limits.

The cost of installing a given level of treatment in a new plant (PSNS) should be less than the cost of installing it in an existing plant (PSES). Therefore, the economic reasonableness test for PSNS should be easier to pass than the test for PSES.

Economic Reasonableness Tests for Sewage Treatment Plants Requesting Marine Waivers

In denying the municipal sewage treatment plants' (POTWs) applications for marine waivers discussed earlier, Ecology used the following criteria to determine "reasonable methods of treatment" for AKART for municipal POTWs' discharges to marine waters:

- Status of planning needed to proceed with the proposed method of treatment.
- Environmental or siting constraints.
- Economic factors.

The PCHB accepted Ecology's use of these 3 criteria to determine reasonableness. The PCHB also wrote:

> "The economic aspect of the reasonableness criterion of the State Standard is, we conclude, defined by two propositions: (1) whether secondary treatment for the source would involve significantly greater costs than for others obliged to obtain the same levels of treatment, and (2) whether secondary treatment is within the economic ability of the source to meet the costs of treatment."

EPA's refusal to consider the second of these propositions in industrial variances was upheld in *National Crushed Stone Association, supra*. But, underlying this conclusion was the realization that a single plant unable to come up to industry-wide standards can simply cease operations. This is a luxury municipal sewage treatment facilities do not enjoy. The sewage must go someplace. Therefore, in interpreting the state law requirement for reasonableness as to municipalities, we think it is appropriate to include "ability to pay" factor. *Cf. Weyerhaeuser v. Southwest Air Pollution Control Authority*, 91 Wn.2nd 77, 586 P.2d 1163 (1978)."

Here the PCHB is defining a test for economic reasonableness.

The first proposition (1) applies to both industrial and municipal permit holders. A proposed treatment technology is economically reasonable if its cost is "similar" to the cost to other dischargers with the same level of treatment (the other dischargers may or may not be in the same industry). One measure of cost is cost per pound of pollutants removed. Another measure--which is applicable to STPs--is cost per user.

"Similar" is not precisely defined. It does not mean identical. Costs can be either above or below other dischargers' costs. If they are below, then they are definitely reasonable. And even if they are above other dischargers' costs they can still be reasonable as long as they are not too far above.

The second of the PCHB's propositions (2) considers whether the cost of the treatment technology is within the permit holder's ability to pay. For an industrial discharger, the impact of the cost of the treatment technology on the discharger's profitability is examined. Impact on profitability may be considered in BAT analysis, but not in BCT or BPT analysis. The PCHB held that only the first proposition is relevant in determining economic reasonableness for industrial dischargers when the AKART level is the same as the BCT level. For municipalities, ability to pay is measured by the impact of the treatment technology's cost on user rates.

In setting AKART effluent limits, pollution reduction benefits (as measured by amounts of pollution reduction) are also to be considered. Greater amounts of pollution reduction make a given level of cost more reasonable.

Water Quality Financial Assistance

Ecology takes economic factors into account when dealing with municipal POTWs in the Centennial Clean Water Fund (CCWF) and the State Revolving Fund (SRF). Ecology's Water Quality Financial Assistance Program (WQFAP) administers both these funds.
The CCWF makes grants and loans to public bodies for water pollution control activities and

facilities. Economic achievability or ability to pay is one of the determinants of the size of loan or grant that a municipality may receive.

Among the rating criteria for allocating CCWF grants and loans to marine dischargers (this includes POTWs, CSOs, and stormwater dischargers) is the monthly residential user charge that would result from construction of the project without any state assistance (see Chapter IV of WQFAP's *Centennial Clean Water Fund: Program Guidelines*).

In addition, under the CCWF, public bodies may receive "supplemental financial hardship assistance" when project costs cause user charges to exceed 1.5% of the municipality's median household income. In some cases, other information--for example, unemployment rates--may be used to establish financial hardship. Chapter IV of the *Centennial Clean Water Fund: Program Guidelines* contains more detailed information on how economic factors determine loan and grant amounts.

The impact of project costs on rate payers is also a rating criterion for making loans from the State Revolving Fund. If project costs without financial assistance would cause a municipality's user charges to exceed 1.5% of its median household income, WQFAP will try to award sufficient funding to bring the user charge down to 1.5%.

EPA Affordability Guidelines. EPA's Construction Grants Program had several affordability guidelines for municipal sewer user charges. They ranged from 1.0% of median household income for low-income communities to 1.75% of median household income for high income communities. The guidelines were used to determine whether a project was a "high cost" project. The guidelines are the source of the 1.5% threshold used by WQFAP.

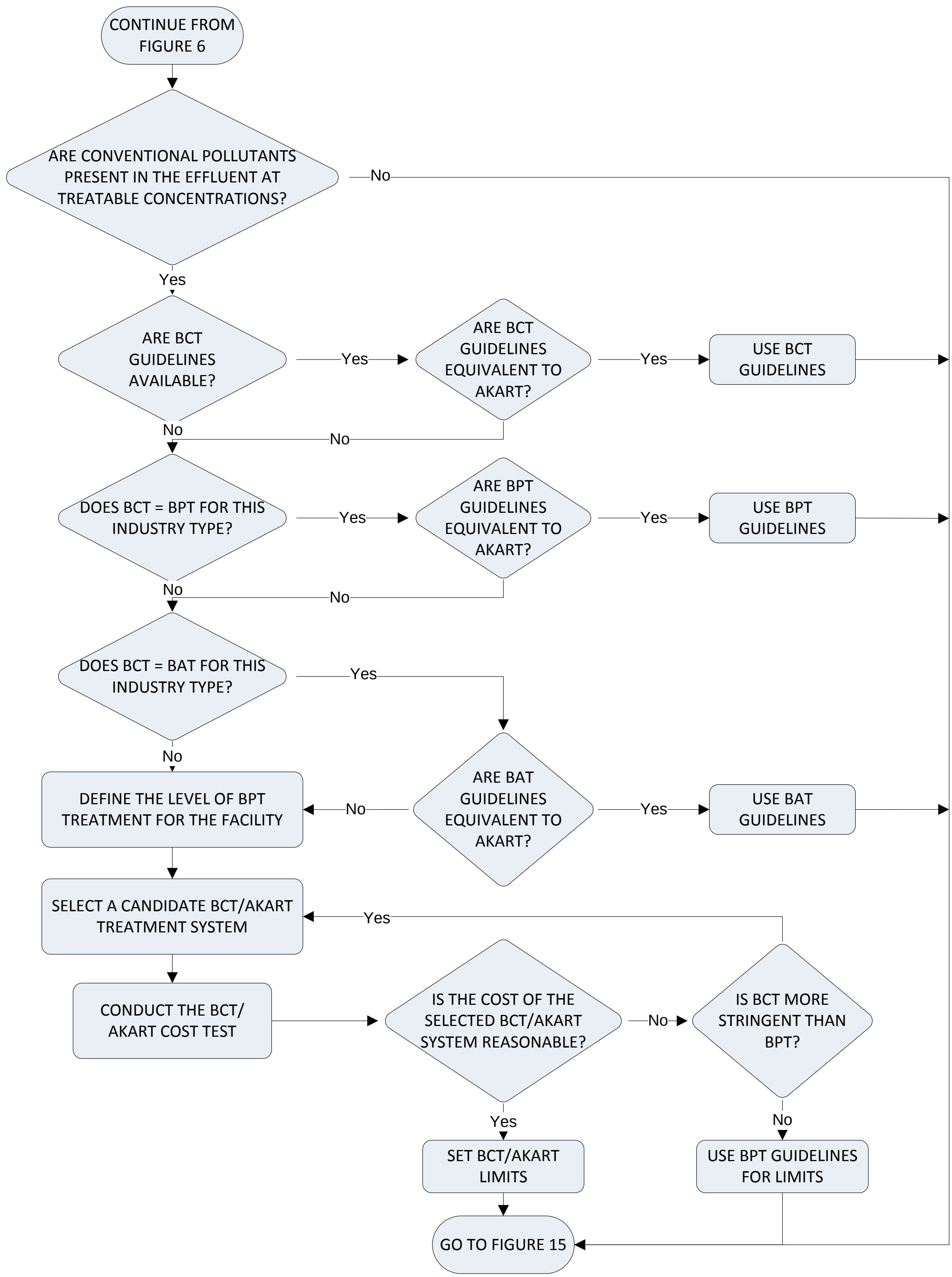


Figure 14. Deriving BCT Limits for Conventional Pollutants

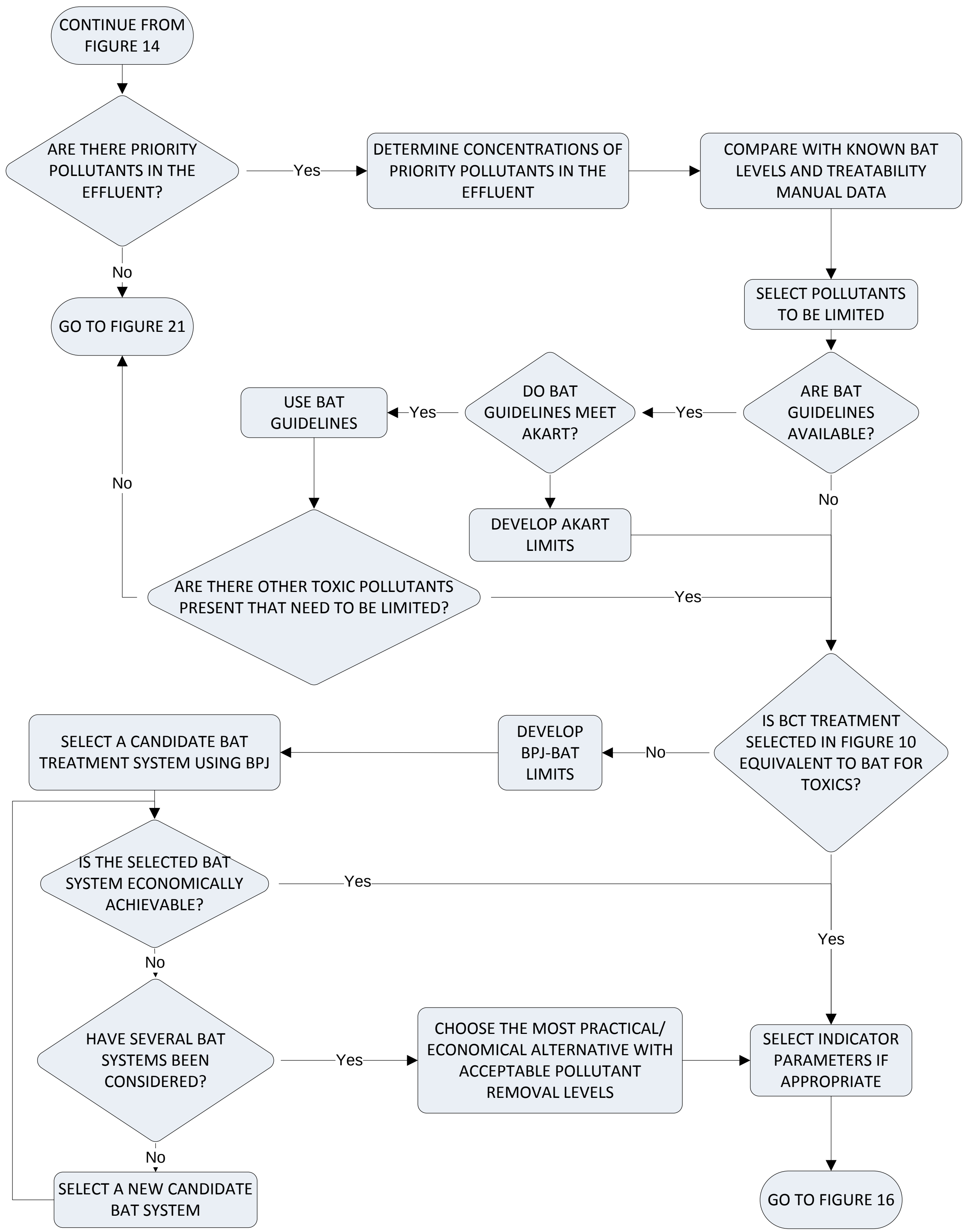


Figure 15. Deriving BAT Limits for Toxic Pollutants

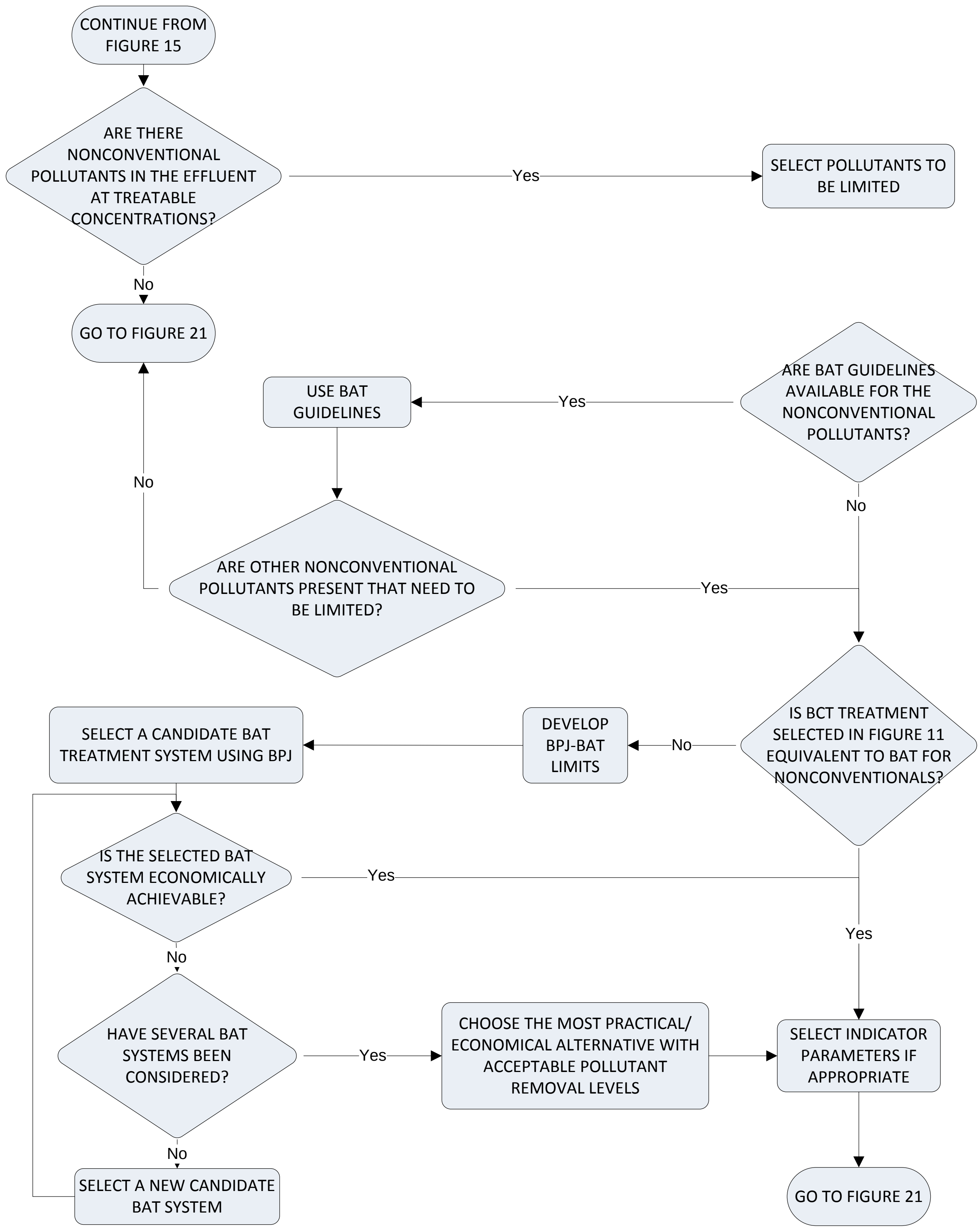


Figure 16. Deriving BAT Limits for Nonconventional Pollutants

4. Adjustment of Effluent Limits for Autocorrelation

This section discusses the process of adjustment to the monthly average effluent limit in cases where the effluent data is not independent. It is based on two technical memoranda from Jeanette L. Kranacs, Mathematical Statistician, and Henry Kahn, Chief, Statistical Analysis Section of the Engineering and Analysis Division, USEPA. (March 20, 1996, June 25, 1996). Background material is presented in Gilbert (1987) and Box and Jenkins (1976). The example in Appendix B is from a request to the Ecology Industrial Section.

4.1 Applicability

This adjustment is applicable only to water quality-based effluent limits and case-by-case technology-based effluent limits. It is not applicable to effluent limits derived from effluent guidelines. It is applicable only to the average monthly limitation.

4.2 Process

The permit writer may evaluate effluent data for autocorrelation in the course of developing effluent limits or a permittee may request an adjustment of an effluent limitation. The PDS Section will provide assistance in evaluating autocorrelation.

4.3 Background

The Technical Support Document for Water Quality-based Toxics Control (EPA 505/2-90-001, Appendix E) discusses the problem of correlated effluent data when deriving effluent limits and presents techniques for adjusting monthly average effluent limitations based upon an analysis of autocorrelation.

4.4 What is Autocorrelation and Why Does it Result in an Increase in Effluent Limits

When calculating statistics such as mean and variance from a data set there is a presumption of normal distribution and independence. If the data are not normally distributed they can be transformed to approximate a normal distribution so that statistics may be derived using techniques based on normal theory. If the data are not independent (i.e., each value is correlated to the value preceding and following) then the calculated mean will be lower than the true mean of the sample distribution.

In wastewater treatment processes with hydraulic detention times of several days, the daily sample values are usually correlated. If sample values are correlated then a correction process must be used to derive the correct mean. Monthly average effluent limits developed on a case-by-case basis (water quality or technology based) are dependent on the mean so that an adjustment to the mean results in a different monthly average effluent limitation. Correction for autocorrelation results in a smaller effective sample size, a numerically higher mean and corresponding higher monthly effluent limitation.

When EPA develops effluent guidelines they conduct an analysis for autocorrelation and adjust the effluent limitations accordingly.

4.5 Accurate Estimates of Autocorrelation

If x_1. x_2, ..., x_n denotes a series of equally spaced measurements, Box and Jenkins (1976) indicate that the most satisfactory method of estimating the *l*th lag autocorrelation, ρ_l is

$$\rho_l = \frac{\sum_{t=1}^{n-l}(x_t - \overline{x})(x_{t+1} - \overline{x})}{\sum_{t=1}^{n}(x_t - \overline{x})^2}$$

In practice, at least n=50 measurements are needed to obtain accurate estimates of the ρ_l for lags l = 1, 2, ..., K, where K should not exceed n/4 (Gilbert 1987). Therefore, a 30 day lag requires a data base (n) of 30 x 4 = 120. Because it's difficult to predict what the maximum lag will be before data collection and because a 30 day autocorrelation may be allowed, the permit writer should specify a data requirement of 120 data points collected over a year. These should be collected as daily samples for a month and the 4 months should be seasonally representative. This will allow for an analysis of seasonally effected autocorrelation.

Most of the time we would expect significant autocorrelation to occur in biological treatment plants rather than physical/chemical treatment because of the longer hydraulic residence time. The significant autocorrelation should be within the range of one to three times the hydraulic residence time. Autocorrelation that occurs at lag periods longer than three times the hydraulic residence time should be suspect and may simply be a characteristic of the data set. Gilbert (1987) cautions that the analysis for autocorrelation assumes that the underlying process being measured does not cycle, does not have long-term trends, does not make sudden jumps in magnitude or change its autocorrelation coefficient over time. If the significant autocorrelation factors are not continuous (i.e., one day, two days, three days, and up to the maximum significant lag) the facility must provide some engineering explanation of why the autocorrelation is discontinuous, otherwise Ecology will not approve it. Discontinuous autocorrelation lags indicates some periodicity (cycling) that is process related.

4.6 Monitoring Frequency

The collection of data to assess autocorrelation and the autocorrelation coefficient allows the permit writer to derive a monitoring frequency which is characteristic of the discharge. The procedure is illustrated in the example in Appendix B. The number of measurements, n, required to estimate the mean μ by the sample mean X with the prescribed accuracy, d, and 100(1-α)% confidence is:

$$n = D\left(1 + 2\sum_{l=1}^{n-1} \rho_l\right)$$

where ρ_l includes only the significant autocorrelations

and

$$D = \left(\frac{z_{1-\frac{\alpha}{2}}\sigma}{d}\right)^2$$

with σ^2 estimated by

$s^2 = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2$ and $z_{\left(1-\frac{\alpha}{2}\right)} = \left(1-\frac{\alpha}{2}\right)$ percentile of the standard normal distribution.

5. Intake Credits for TBELs

Federal rule at 40 CFR 122.45(g) allows for adjustment of technology-based effluent limits to reflect credit for pollutants in the discharger's intake water. Upon request of the discharger, permit writers may consider use of intake credits for the quantity of pollutants in the intake water where (1) the applicable effluent guidelines specify that the guidelines are to be applied on a net basis; or (2) the pollution control technology would, if properly installed and operated, meet applicable effluent guidelines without the pollutants in the intake waters.

The following requirements are included in § 122.45(g) regarding intake credits:

- Credit for conventional pollutants, such as BOD5 or TSS, are only authorized where the constituents resulting in the effluent BOD5 and the TSS are similar between the intake water and the discharge.
- Credit is authorized only up to the extent necessary to meet the applicable limitation or standard, with a maximum value equal to the influent concentration.
- Intake water must be taken from the same body of water into which the discharge is made.
- Net credits do not apply to the discharge of raw water clarifier sludge generated during the treatment of intake water.

Using intake credits to adjust effluent limits will require additional analysis during permit development and additional permit requirements (e.g. intake monitoring). Permit writers evaluating the use of intake credits for technology-based limits should consult Chapter 13. Permit writers evaluating the use of intake credits for water quality-based effluent limits for the protection of human health should consult Chapter 7, Section 7.

Chapter 5. Municipal Effluent Limitations and Other Requirements

1. Introduction

The largest category of discharger which has technology-based effluent limits is the municipal treatment plants. This chapter discusses the technology-based effluent limits for municipal plants and some other requirements for municipalities such as biosolids, and CSO control.

The Department of Ecology has quantitative discharge standards for domestic wastewater facilities (i.e., municipal sewage treatment plants) which discharge to surface waters. The standards are codified in Chapter 173-221 WAC. Prior to this rule, Washington state generally used federal standards as published first on August 17, 1973 [38 FR 22298] and codified in 40 CFR Part 133. The regulation was extensively revised in 1984, and amended again in 1985 and 1989. See Table 7 for a history of the federal rule.

In 1984, when the federal government amended its secondary treatment requirements, individual states had the option of applying those regulations or establishing more stringent requirements. Ecology decided to establish an ad hoc committee to study the options and make recommendations.

After hearing committee recommendations, Ecology adopted a state regulation defining secondary treatment requirements.

This section explains how to determine technology-based permit limits for conventional pollutants (BOD5, TSS, pH, fecal coliform) discharged by domestic wastewater treatment facilities. When reviewing a permit application or renewal, the permit writer must first determine the proper technology-based limits. Then the writer must decide if these limits are stringent enough to ensure that water quality standards are not violated in the receiving water. If they are not, then water quality-based limits must be developed. Guidance for making that decision is provided in Chapter 6.

Domestic Wastewater treatment facilities are also subject to other permitting requirements such as whole effluent toxicity testing and monitoring of receiving water and sediments. Please refer to other chapters for these topics.

Table 7. Secondary Treatment Regulation - 40 CFR 133

Date (Federal Register)	Applicability	Action	Parameter	Limit	Citation
August 17, 1973 (38 FR 22298)	All secondary facilities	initial definition	BOD_5	30 mg/L, 30-day avg 45 mg/L, 7-day avg 85% removal, 30 day avg	133.102(a)
			SS	30 mg/L, 30-day avg, 45 mg/L, 7-day avg 85% removal, 7-day avg	133.102(b)
			FC	200/100 ML, 30-day avg 400/100 ML, 7-day avg	133.102(c)
			pH	6.0 to 9.0	133.102(d)
	Secondary facilities with combined sewers, during wet weather	revise limits	BOD_5 SS	% removal discretionary % removal discretionary	133.103(a) 133.103(a)
	Secondary facilities with industrial wastes	revise limits	BOD_5	Proportional adjustment of 30-day and 7-day concentration and load limits, but not % removal	133.103(b)
			SS	Proportional adjustment of 30-day and 7-day concentration and load limits, but not % removal	133.103(b)
July 26, 1976 (41 FR 30788)	All secondary facilities	delete	FC	--	
		revise definition	pH	--	
October 7, 1977 (42 FR 54665)	WSP less than 2 mgd	revise limit	SS	State-determined, EPA-adopted	133.103(c)
September 20, 1984 (49 FR 36986)	TF, WSP	revise limits	BOD_5	45 mg/L, 30-day avg 65 mg/L, 7-day avg	133.105(a)(1)&(2)
			SS	45/mg/L, 30-day avg 65 mg/L, 7-day avg	133.105(b)(1)&(2)
September 20, 1984 (49 FR 36986)		allow ASR's	BOD_5	State-determined EPA-approved	133.105(d)

Date (Federal Register)	Applicability	Action	Parameter	Limit	Citation
			SS	State-determined EPA-approved	133.105(d)
	All WSP	remove 2 mgd cap	SS	State-determined, EPA-adopted	133.103(c)
	All secondary facilities	allow use of CBOD5 for BOD5	$CBOD_5$	25 mg/L, 30-day avg 40 mg/L, 7-day avg 85% removal, 30-day avg	133.102(a)(4)
June 3, 1985 (50 FR 23382)	TF, WSP	revise limits	BOD_5 SS	65% removal, 30-day avg 65% removal, 30-day avg	133.105(a)(3) 133.105(b)(3)
	Secondary facilities with separate sewers, less concentrated influent during wet or dry weather	revise limits	BOD_5 SS	% removal discretionary % removal discretionary	133.103(d) 133.103(d)
January 27, 1989 54 FR 4224)	Secondary facilities with combined sewers, less concentrated influent during dry weather	revise limits	BOD_5 SS	% removal discretionary % removal discretionary	133.103(e) 133.103(e)

Before writing domestic wastewater permits, a permit writer should be familiar with WAC 173-221 Sections 10-50.

2. Technology-Based Wastewater Discharge Standards

TASK OUTLINE FOR STANDARD TECHNOLOGY-BASED PERMIT LIMITS

(Following the rules in WAC 173-221-040.)

1. Unless a facility qualifies for an alternative discharge standard or effluent limitation, listed in Section 050, its discharge must meet the following standards.

Pollutant Parameter	Average Concentration		Average Daily Load Limits	
	30-day	7-day	7-day	30-day
Biological Oxygen Demand (BOD_5)	30 mg/L	45 mg/L	NA*	lbs/day (see Step 3)
Total Suspended Solids (TSS)	30 mg/L	45 mg/L	NA	lbs/day (see Step 3)
Fecal Coliform (geometric means)	200 organisms/ 100 ml	400 organisms/ 100 ml	NA	NA
pH	NA	NA	6.0-9.0 standard units	NA

* Not applicable.

2. In addition, the 30-day average percent removal for BOD_5 and TSS shall not be less than 85%.

3. Determine the maximum allowable 30-day (monthly) average pounds per day of BOD_5 and TSS as follows:

Influent

Refer to the Ecology-approved plans and specifications. They should include a table which specifies the design, maximum month influent BOD_5 and TSS loadings. Include those in the permit. If no record exists, consider requiring an engineering report to determine the design capacity of the plant. Alternatively, use the historical capacity listed in previous permits or set a capacity based on the historical discharge monitoring reports (DMRs).

Effluent

Specify the lower number obtained by one of these two methods:

a) Multiply 30 mg/L by 8.34 and by the design flow as expressed in million gallons per day (mgd) for the maximum flow month in the design year. The result is in lbs/day.

b) Multiply the Ecology approved, design maximum month influent loading (lbs/day) by 0.15 (fifteen/hundredths).

Method (b) results in a lower number when, for example, the influent BOD_5 is below 200 mg/L or $CBOD_5$ is used in place of BOD_5.

Permit writers may apply the less stringent method if the following factors apply:

- The facility designed its treatment facility based on weak influent strength (<200 mg/L TSS or BOD as noted in the engineering report).
- The actual influent concentrations are higher than the influent concentrations assumed in the design report (i.e., infiltration and inflow is not excessive).
- The facility consistently treats and achieves greater that 85% removal.

The permit writer must explain, in the fact sheet, the reason for the use of the less stringent method.

Refer to the most recent engineering report and plans and specifications which Ecology has approved for the maximum month design flow and loading. For permit compliance, remember that the permittee must still achieve 85% removal of every monthly average influent concentration and every monthly influent mass loading. Therefore a permittee may discharge less than the maximum allowable 30-day average lbs/day and still violate its permit.

4. Determine the 7-day (weekly) average load limits by multiplying the 30-day limits by 1.5. The result is expressed in lbs/day.

5. Finally, Permittees can qualify for pH effluent limits outside the allowable range of 6.0-9.0, if they can meet all three conditions listed in Subsection 040(3).

6. Determine whether the technology-based limits derived above (including pH) will cause water quality standards violations in the receiving water (Chapter 6).

Note: Federal and state regulations refer to 30-day and 7-day average limits, not monthly and weekly average limits. For ease of permit writing and compliance monitoring, permits are typically written in terms of monthly and weekly averages.

3. Alternative Wastewater Discharge Standards

The secondary treatment regulation (WAC 173-221-050) allows alternative effluent limitations in five cases:

- Trickling filters
- Waste stabilization ponds
- Facilities with combined sewers
- Weak influent sewage
- $CBOD_5$ in lieu of BOD_5

The state rule also includes alternative discharge standards for the above, but adds additional restrictions in each case. The next page describes conditions a municipality must meet to qualify for any alternative limit. Following that are background and explanations for each alternative discharge standard and a task outline for determining the appropriate alternative effluent limitation. The permit writer should be familiar with the background section before using the corresponding task outline.

3.1 Conditions for Receiving Alternative Effluent Limitations

3.1.1 Discussion of Section 050(5)

In order to qualify for any of the alternative effluent limitations of WAC 173-221-050(1-4), a municipality must prove compliance with the six conditions in 050(5). Therefore, those conditions, *a*, *b*, and *d* are explicitly required by federal regulation. Condition *a* requires that the alternative limit not cause a water quality violation. For condition *b*, note that the phrase "effluent concentrations consistently achievable through proper operation and maintenance" is defined in Section 030 (Definition #11). For condition *d*, check the design criteria sheet of the facility's plans and specifications.

Ecology has added condition *c* to the list. This prevents issuing alternative limits to a facility which cannot achieve 30/30 mg/L BOD5/TSS because of interference by industrial wastewater. EPA did not intend alternative limits for such cases. The federal industrial pretreatment regulation, 40 CFR Part 403, allows states to require a pretreatment program for any size facility if industrial wastewater interferes with attaining permit effluent limitations.

Condition *e* requires the permittee to analyze whether alternative limits should be seasonal rather than year-round. Here are two examples.

- Facilities may have less concentrated influent wastewater only during certain winter months. Any reduced percent removal limit should be applied only to those months.
- Some ponds may have difficulty meeting the 30 mg/L BOD_5 limit during certain months (e.g., winter time when biological activity is slow). If a review of the historical record shows a consistent pattern, consider alternative limits just for those months.

Finally, condition *f* requires a municipality to meet all other permit requirements and conditions.

3.2 Trickling Filters

3.2.1 Discussion of Section 050(1)

The trickling filters which were constructed and/or expanded prior to November 1984 can qualify for alternative effluent limitations. In this case, the effluent limitations for BOD and TSS are set on a case-by-case basis, according to past performance. However, effluent limitations must not exceed 45 mg/L BOD_5 and 45 mg/L TSS on a 30-day average.

Rule 050(1) is more restrictive than the federal rule in two ways.

First, it applies only to trickling filters which meet definition #23 in Section 030. The definition excludes trickling filters which have a supplemental biological treatment system, other than waste stabilization ponds, for the principal wastewater stream.

In recent years, engineers have developed various ways of combining trickling filters with suspended growth; i.e., activated sludge systems. These systems have proven to be cost effective and reliable. When designed properly, they are capable of achieving 30/30 mg/L BOD_5/TSS effluent and better. Ecology requires that such systems achieve those limits. Note that trickling filter/waste stabilization pond combinations (built before November 1984) can qualify for alternative effluent limitations allowed under Section 030. Any trickling filter may still qualify for alternative limits as allowed under Section 050(3), (4), and (6). These systems will still have periodic problems with algae in the effluent. The algae are reported as suspended solids.

Secondly, the rule does not allow alternative limits for trickling filters constructed and/or expanded after November 1984. That is the effective date of the 1984 federal secondary treatment rule revisions. Recent advances in trickling filter design and technology have made these systems more efficient pollutant removers. Synthetic media, and proper hydraulic and organic loading designs are examples of these advances. New trickling filters are capable of achieving 30/30 mg/L BOD_5/TSS and thus should not be eligible for alternative discharge standards. This position is consistent with the EPA Science Advisory Board.

The November 1984 cutoff date is appropriate because it coincided with the effective date of EPA's regulations. When Ecology was proposing its secondary treatment rule, no municipalities in the state had expanded or constructed trickling filters since November 1984.

Most of the existing trickling filters in the state were built between 1930 and 1960. Some of these qualify for alternative effluent limitations because they are not consistently achieving 30/30 mg/L BOD_5/TSS and 85% removal. However, most are achieving those limits the majority of the time and Ecology expects them to continue to do so. When these facilities need replacing because of population growth or age, the new systems should meet the 30/30 and 85% standards. The permit writer must use judgment when deciding whether a rehabilitation project at such a facility is sufficiently extensive that 30/30 and 85% should apply.

One reason for requiring new trickling filters to achieve 30/30 is the recent concern about toxicants in effluents. In general, the amount of toxicant removal by a conventional secondary treatment plant is proportional to its removal of conventional (BOD, TSS) pollutants. Trickling filters designed for 30/30 will be better suited to deal with toxicity-based limits.

3.2.2 Task Outline for Determining Trickling Filter BOD_5/TSS Effluent Limits

1. Does the facility meet definition #23 of Section 030?

    Yes - Go to 2

    No - Use Section 040. Sections 050(3), 050(4), and (6) may also apply if requested by the applicant.

2. Was the facility constructed or did it have its most recent significant rehabilitation before

November 1984?

Yes - Go to 3.

No - Use Section 040. Sections 050(3), (4), and (6) may also apply if requested by the applicant.

3. Determine BOD5 and TSS "effluent concentrations consistently achievable.." per definition #11 of Section 030, then find the percent removal value.

Procedure:

Examine at least the last few years of discharge monitoring reports for average monthly effluent concentrations and percent removals. Do not use effluent data for months during which the facility had equipment failure, operator error, overloading, or other extenuating circumstances. Review the permit file for any information which may indicate that certain data are inaccurate. Do not use those data. Class I and II inspection reports, Roving Operator Trainer reports, and memos of conversations are examples of information sources.

Determine the effluent concentration and percent removal that have been achieved 95% of the time. The following table indicates which data points represent the 95th percentile values.

Number of Acceptable Monthly Average Values	95th Percentile Values	
	Percent Removal	Concentration
24-35	2nd lowest value	2nd highest value
36-59	3rd lowest value	3rd highest value
above 60	4th lowest value	4th highest value

4a. Is the 95th percentile value for TSS or BOD_5 less than 45 mg/L?

Yes - Propose the 95th percentile value as the monthly effluent limit. Proceed to 4b.

No - Propose 45 mg/L as the limit. Proceed to 4b.

4b. Is the 95th percentile value for percent removal greater than 65%?

Yes - Use the percent removal value as the monthly effluent limit. Proceed to 5.

No - Use 65% as the monthly effluent limit. Proceed to 5.

Note: You can have different percent removal limits for BOD_5 and TSS.

5. Does the facility meet all six requirements of Section 050(5)? (See above.)

Yes - Use the limits obtained in 4. Proceed to 6.

No - Use Section 040 or Section 050(6)(a).

6. Determine maximum monthly average weight per day of BOD_5 and TSS effluent loading by:
   a) Multiplying the facility's approved design year maximum month flow as expressed in million gallons per day by the concentrations determined in Step 4, and by 8.34; or,
   b) Multiplying the Ecology approved, design maximum month influent loading by the quantity (1 minus the % removal limit (from Step 4b and expressed as a decimal)). The result is expressed in lbs/day. Use the lower number (Step 6a or 6b) as the effluent limit. Proceed to Step 7.

7. Determine the effluent weekly average concentration and loading limits by multiplying the monthly values by 1.5. However, the maximum acceptable weekly concentration limits are 65/65 mg/L BOD_5/TSS.

8. Determine whether the technology-based limits derived above will cause water quality standard violations in the receiving water. If they will, see Chapter 6 on water quality-based effluent limits.

3.3 Waste Stabilization Ponds

3.3.1 Discussion of Section 050(2)

Waste stabilization ponds which have design capacity below 2 million gallons per day (mgd) or have received the Department of Ecology's approval for a greater design capacity, prior to the effective date of the regulation (11/12/87), can qualify for alternative limits. Permit writers should determine effluent limitations for individual waste stabilization ponds on a case-by-case basis according to past performance. However, effluent limitations shall not be set higher than 45 mg/L BOD_5 and 75 mg/L TSS on a 30-day average, and 65 mg/L BOD_5 and 112 mg/L TSS on a 7-day average.

The EPA secondary treatment regulation applies to all ponds. It does not include design capacity restrictions. Ecology added four conditions:

- In 1977, EPA published a regulation (see Table 7) which allowed ponds under 2 million gallons per day (mgd) capacity to exceed the 30 mg/L TSS requirement. By that regulation, EPA established the TSS requirement for such ponds on a state-by-state basis. For each state, EPA made the TSS limit a concentration which 90% of the ponds in that state were achieving. In 1977, a survey of lagoon effluent quality set that concentration limit at 75 mg/L.

  EPA figured that ponds under 2 mgd probably served towns of under 10,000 population. Such towns, they reasoned, should not be required to operate and maintain a treatment system more complex than a simple pond system. However, those ponds could not always achieve 30 mg/L TSS. Rather than requiring each small town which had a pond treatment system to change to a different system, EPA allowed higher TSS limits for ponds.

  Ecology agrees with this approach, and will continue to allow small municipalities the option of constructing and keeping ponds as their treatment system. Forcing these communities to more complex systems would be counterproductive. Such systems would require more intensive operation and maintenance (highly qualified operators working longer hours). In the short run, lack of qualified operators and funds would result in poor operation, maintenance, and poor effluent quality. Ultimately it would mean a financial burden which EPA and Ecology contend is not necessary or reasonable.

- EPA used similar arguments for justifying alternative BOD_5 limits for ponds. Ecology concurs, and will continue to *require engineers to design ponds using state of the art techniques to achieve 30 mg/L* BOD_5. However, if despite proper design a pond under 2 mgd design capacity does not achieve 30 mg/L BOD_5, the permit writer can change the effluent limits for that facility. The permit writer should require the facility to achieve that which it has proven it can achieve. No permit should have an average monthly discharge effluent limit above 45 mg/l BOD_5.

- EPA now allows these higher effluent limits for all ponds regardless of size. They have done so because the Clean Water Act legislative history does not necessarily indicate that Congress intended to limit alternative standards to small communities.

  Ecology is not constrained by the federal congressional record. Municipalities over 10,000 population should have the ability and the financial wherewithal to construct and operate a facility which can achieve 30/30 mg/L BOD_5/TSS. Therefore, any new ponds with design capacity equal to or greater than 2 mgd must meet those limits.

  In addition, if a municipality with a pond system expands such that it exceeds the 2 mgd ceiling, it must treat that portion of the flow over 2 mgd to the 30/30 mg/L BOD_5/TSS standard. However, if a municipality expands its total treatment capacity above 2 mgd by replacing the old pond system with a new pond system, it must treat all of the flow to the 30/30 mg/L BOD_5/TSS. These various permitting situations are described in steps 1 to 9 of the next section (*3.3.2, Task outline for determining waste stabilization ponds* BOD_5*/TSS effluent limits*).

- Municipalities which have Ecology-approved pond systems of greater than 2 mgd design capacity can also qualify for alternative effluent limitations. Again, Ecology wants to allow those municipalities which have invested in a pond treatment system to continue to use that investment. However, the provisions of state law which require all known available and reasonable technology (AKART) dictate that more complex treatment systems capable of achieving 30/30 mg/L BOD_5/TSS are reasonable for larger municipalities. Therefore, any flows exceeding the pond system design capacity approved prior to December 12, 1987, must be treated to meet the 30/30 mg/L BOD_5/TSS standard.

3.3.2 Task Outline for Determining Waste Stabilization Pond BOD_5/TSS Effluent Limits

Permitting Situation	Start at this Step
New Pond under 2 mgd	Step 1
Existing Pond under 2 mgd:	
renewal application for same capacity	Step 3
renewal application for greater capacity < 2 mgd	Step 1
renewal application for greater capacity $\geq$ 2 mgd	Step 8
Pond $\geq$ 2 mgd, capacity approval by Ecology after 12/87	Step 2
Existing Pond $\geq$ 2 mgd, renewal application for capacity $\geq$ 2 mgd	Step 9

1. The first 5-year permit limits shall be 30 mg/L BOD_5 and the TSS concentration which Ecology is using to satisfy definition #25. Until notified otherwise, use 75 mg/L TSS for the 30-day average, and 112 mg/L TSS for the 7-day average. The applicant should submit a design based on achieving 30 mg/L BOD_5 and minimizing TSS. The design review should use the *Criteria for Sewage Works Design* and nationally recognized design manuals as standards for proper design.

   Percent removal limits for BOD_5 or $CBOD_5$ shall be 85% unless Section 050(3) and/or (4) apply. No percent removal applies to TSS.

2. Use Section 040 for this and all renewal permits. Section 050(3), (4), and (6) may also apply if requested by the applicant.

3. Determine BOD_5 and TSS "effluent concentrations consistently achievable..." per definition #11 of Section 030.

Procedure:

Examine at least the last 2 years of discharge monitoring reports for average monthly effluent and percent removals. Do not use effluent data for months during which the facility had equipment failure, operator error, overloading, or other extenuating circumstances. Review the permit file for any information which may indicate that certain data are inaccurate. Do not use those data. Examples of information sources are Class I and II inspection reports, Roving Operator Trainer reports, and memos of conversations.

Determine the effluent concentration and percent removal that have been achieved 95% of the time. The table below indicates which data points represent the 95th percentile values.

Number of Acceptable Monthly Average Values	95th Percentile Values	
	Percent Removal	Concentration
24-35	2nd lowest value	2nd highest value
36-59	3rd lowest value	3rd highest value
above 60	4th lowest value	4th highest value

Alternatively, place the values in Excel and use the Data Analysis to calculate the 95th percentile.

4a. Is the BOD_5 value less than 45 mg/L?

Yes - Propose that value as the monthly effluent limit and proceed to Step 4b.

No - Propose 45 mg/L as the limit and proceed to Step 4b.

4b. Is the TSS value less than 75 mg/L?

Yes - Propose it as the monthly effluent limit and proceed to Step 4c.

No - Propose 75 mg/L as the limit and proceed to Step 4(c).

4c. Is the percent BOD_5 removal determined in Step 5, greater than 65%?

Yes - Propose it as the monthly limit.

No - Propose 65%.

5. Does the facility meet all six requirements of Section 050(5)? (See review of that section.)

Yes - Use the limits obtained above in Step 4. Proceed to Step 6.

No - Use Section 040, or Section 050(6)(a) if requested by applicant.

Note: One of the conditions of Section 050(5) is the identification of effluent concentrations consistently achievable through proper operation and maintenance. The permit writer should have already checked the permit file, as explained in Step 3 above, for indications of inaccurate data. The permit writer should also check whether the facility is being operated in accordance with the Operation and Maintenance Manual.

For pond systems, the writer should particularly note whether the manual includes any recommendation for frequency of sludge removal from the ponds, or whether it indicates an acceptable sludge depth. Prior to considering any alternative limits, the permit writer should require the applicant to verify the extent of sludge accumulation. Significant accumulations can be the reason for declining performance.

If the Operation and Maintenance Manual is silent on sludge accumulation and dredging, the permit writer will have to use judgment in deciding when dredging of the pond is necessary. If the existing pond system has extensive accumulations in one or more ponds which are likely affecting the quality of the effluent, require dredging as soon as possible. Review the long-term effluent quality records to note if a gradual decrease (corresponding to the sludge accumulation) in treatment efficiency has occurred. If so, give the pond system higher effluent limits (based on the last few years of data) for the time period up to the dredging, and lower limits (based on pond performance years when sludge accumulations were low) for the remaining time of the 5-year permit. Permit limits at the next renewal should be based on pond performance after dredging.

Finally, the permit writer should include periodic sludge depth monitoring in the pond system as a condition of the permit. Such a condition is included in the recommended monitoring schedule for lagoons.

6. Determine maximum monthly average (lbs/day) of BOD_5 and TSS effluent loading limits by:

    (a) Multiplying the facility's approved design year maximum month flow (as expressed in million gallons per day) by the concentrations determined in 4 above, and by 8.34; or,

    (b) for BOD_5 only, multiplying the Ecology approved, design maximum month influent loading by the quantity (1 minus the % removal limit [expressed as a decimal] determined in 4(c) above). The result is expressed in lbs/day. For BOD_5, use the lower number obtained by method a or b.

7. Determine the weekly average concentration and loading limits by multiplying the monthly values by 1.5. However, the weekly average BOD_5 concentration limits should not exceed 65 mg/L; and the weekly average TSS concentration limits should not exceed 112 mg/L.

8. Case I: If all the flow is treated by the ponds, use Section 040. Sections 050(3), (4), and (6) may also apply, if requested by the applicant.

    Case II: The applicant plans to use its existing ponds for its previously approved flow capacity. In this case, follow the instructions in Steps 3 through 7 to determine the permit limits. The remaining flow must be treated in a separate facility which meets the requirements of Section 040. Section 050(3), (4), and (6) may also apply if requested by the applicant.

    Case III: The applicant plans to expand the existing pond capacity up to 2 mgd and take higher flows to a separate facility. Design the pond for 30 mg/L BOD_5. The first 5-year permit limits should be a 30-day average of 30 mg/L BOD5, 75 mg/L TSS; and a 7-day average of 45 mg/L BOD_5, 112 mg/L TSS for the pond. The separate facility shall have permit limits required under Section 040. Section 050(3), (4), or (6) may also apply if requested by the applicant. The pond may qualify for alternative effluent limitations in subsequent permits.

9. This step applies only to the following pond systems:
    - Everett
    - Longview
    - Montesano
    - Marysville

The applicant may propose a system(s) which meets limits under Case A or Case B.

Case A: If the proposal is to use the existing ponds within the previously approved design capacity, use the procedure outlined in Steps 3 through 7 above. Any additional flow over the previously approved capacity must be treated in a separate facility whose effluent limits shall be based upon Section 040. Section 050(3), (4), and (6) may also apply if requested by the applicant.

Case B: If the proposal is to expand the design capacity of the pond system, use Section 040. Section 050(3), (4), and (6) may also apply if requested by the applicant.

10. Determine whether the technology-based limits derived above will cause water quality standard violations in the receiving water. If they will, see Chapter 6 on water quality-based effluent limits.

3.4 Facilities with Combined Sewers

3.4.1 Discussion of Section 050(3)

Facilities which receive flow from combined sewers during wet weather can qualify for alternative monthly percent removal limits. During such wet weather conditions, the facility may be excused from achieving any predetermined percent removal requirement or may have a percent removal limit which is lower than otherwise allowed.

During rainfall events, sewage treatment facilities which serve combined sewers can receive widely fluctuating influent flow rates and influent pollutant concentrations. These fluctuations are due to the intrusion of stormwater to the sewer system. In some situations the influent concentrations are so dilute that achieving 85% or any other predetermined percent removal per Section 050(1) or (2) is not possible. The fluctuations can also cause inaccurate computation of the 85% removal requirement. In many cases, the wide fluctuations prevent the establishment of a minimum (below 85%) percent removal requirement which the treatment system would be expected to achieve regardless of any flow situation.

This section of the regulation differs from EPA's rule because we define "wet weather" (See definition #30 in WAC 173-221-030). We want the option to restrict application of this waiver to the time period immediately surrounding rainfall events.

In all cases first verify whether the applicant has a significant combined sewer area in its collection system. Refer to the definition of combined sewers (See definition #5). Verify that the sewers were originally designed to serve a stormwater and sanitary sewage function; and that the combined sewer area is allowed by local ordinance. The following is an inclusive list of those which to have combined sewer systems as of December 1988. Please contact the Program Development Services Section if any municipalities request to be added to this list:

Seattle	Bellingham	Bremerton
METRO	Snohomish	Olympia
Everett	Port Angeles	Anacortes
Spokane	Mt. Vernon	

Note that municipalities should not build, nor should Ecology approve, any new combined sewers. All new construction must have separate sanitary and storm sewers. New building construction in a combined sewer area can place stormwater into the combined system. However, all municipalities with combined sewers must comply with Chapter 173-245 WAC for reducing combined sewer overflows. Any new storm drainage from new construction must not delay achievement of compliance with Chapter 173-245 WAC. The municipality should have an Ecology approved CSO plan with a schedule for CSO control compliance.

For communities with secondary treatment, review the DMRs to see if a minimum percent removal requirement for wet weather months is identifiable. For municipalities still at primary treatment, consider no percent removal requirement for the traditional wet weather months until secondary treatment is on line for at least a couple years. This should give sufficient data to identify plant capabilities.

A municipality may choose to comply with Chapter 173-245 WAC regarding CSO control by transporting and treating high wet weather flows at the central domestic wastewater treatment plant. For these situations in particular, the permit writer can grant relief from the monthly percent removal requirement. However, federal rules do not allow relief from the monthly and weekly concentration limits. If any municipality wishes to control their CSOs in this way, but is concerned about meeting their monthly concentration limits, please consult the Program Development Services Section about making inquiries to EPA.

3.4.2 CSO Treatment Facilities (173-245-090) (1) (a) (ii))

If the municipality has chosen at-site treatment facilities (e.g., primary treatment and disinfection) for CSO control, the permit writer can choose to permit the facility under the same permit as that for the secondary treatment plant, or write a separate permit. In either case, the permit should include numerical limits for the discharge, flow capacity limits for the facility, and reporting requirements.

The numerical limits must at a minimum address the definition of "primary treatment" given in WAC 173-245-020; i.e., settleable solids not exceeding 0.3 ml/l/hr and not less than 50% removal of total suspended solids. The permit writer has some discretion in how to write the numerical permit limits. They can apply and be enforced on a yearly, monthly, or per event basis. That which is reasonable to achieve should be required. Refer to Chapter 13-2.4 for monitoring guidance.

The permit should also note that "the total treated and untreated annual discharge from an at-site treatment plant shall not increase above the baseline annual" level (WAC 173-245-090)(1)(a)(ii).

3.4.3 Task Outline for Determining Percent Removal Limits for Combined Sewer Systems

1. The applicant may request the alternative limit and submit supporting documentation for that request. The permit writer is not obliged to initiate any adjustment without a request.

2. Determine whether the applicant meets the requirements of Section 050(5) (discussed earlier in this chapter).

   Yes - Proceed to 3.

   No - Use Section 040, or Section 050(6)(a) if requested by the applicant.

3. Determine whether the facility is capable of 85% removal on a monthly basis in spite of the combined sewage flow.

   Yes - Use 85%. Go to 6.

   No - Go to 4.

4. If 85% removal is not reasonable, determine whether a lower percent removal is consistently achievable.

   Yes - Use the lower, consistent percent removal as the limit. Go to 5.

   No - Delete the percent removal requirement during wet weather conditions. Go to 5.

5. Include a condition which lists the specific months for which a lower or no percent removal limit applies. For example, delete the requirement for November through April, the rainiest months.

   Word the condition such that the percent removal requirement does apply for any month which does not receive significant rainfall or snow melt, (e.g., a dry December).

   Also state that this condition does not relieve the permittee from operating the treatment facility as efficiently as possible. Cross reference the standard condition that requires this.

6. Determine whether the percent removal limit determined above will be sufficient to prevent water quality standard violations in the receiving water. If not, determine what percent removal will achieve the standards. Chapter 6 on water quality-based effluent limits may be helpful.

3.4.4. Definition of a CSO Event

RCW 90.48.480 requires “the **greatest reasonable reduction** of combined sewer overflows at the earliest possible date”. Chapter 173-245 WAC defines the **greatest reasonable reduction** as “the control of each CSO such that an average of one untreated discharge may occur per year”.

The process of CSO control is given in the Criteria for Sewage Works Design (Ecology 98-37 WQ); however, that document does not define storm (event), overflow event or averaging period. A definition of event is necessary for large communities with numerous overflow sites and frequent overflows to design facilities for collection and treatment.

- A CSO event may be defined as the overflow or multiple overflows of a CSO outfall occurring within a 24 hour period (option 1 below).
- A CSO event may be defined by a 24 hour minimum inter-event time for a CSO outfall (option 5 below).
- One rainfall storm event causes only one CSO event.
- The averaging period may be one year or the five year permit term.

Defining Some Terms

Combined Sewer Overflow (CSO) – an event during which excess combined sewage flow caused by inflow is discharged from a combined sewer, rather than conveyed to the sewage treatment plant because either the capacity of the treatment plant or the combined sewer is exceeded.

Inter-Event Time (IET) – The dry period or time steps between storm or CSO events.

Minimum Inter-Event Time (MIET) – The amount of dry time or non-overflow time required to indicate a storm event or CSO event is independent (CV $\approx$ 1).

Storm Duration – The time from the first wet time step at the beginning of the storm event to the last wet time step ending the event.

Storm Event – A period of rainfall separated from other wet time steps by a dry period equal to or greater than the minimum precipitation inter-event time.

Storm Inter-Arrival Time – The time from the beginning of one storm event to the beginning of the next storm event. (Equal to one storm duration and one inter-event time).

Threshold Rainfall – The amount of rainfall necessary to cause runoff. In the Portland Oregon area this varies from 0.05 to 0.1 inch, depending on length of the storm.

Wet Time Steps – A time increment in a precipitation record in which a measurable amount of precipitation occurs. The measurable amount may be defined as threshold rainfall.

Options Considered for Defining Event

1. *Any overflow or multiple overflows in a specific interval of time (e.g., 24 hours) is considered an event.*

   This is the simplest option and may be appropriate for small CSO communities with few overflows and that are close to compliance with the one per year requirement. This option may be applicable where the engineering analysis is relatively straight forward and the solution may be as simple as additional storage or I and I correction. The advantage of this option is that it does not require analysis of regional precipitation, CSO system response to storm events and derivation of a design storm.

   This option doesn't provide the statistical tools to predict the return period (probability) of a storm event of a certain magnitude.

The current regulatory practice for larger sewer systems required to design to a certain return period is to link the definition of overflow event to the definition of storm event. Linking overflow events to storm events provides engineers with a mechanism for determining return periods of storm events and subsequent design of control structures. The following options 2 through 5 (based on Nicholson and Adderley, 1994) are contingent upon linking the definition of a CSO event to the definition of a storm event.

2. *Sewer System-Based Definition*

   Under this definition, a storm event is considered to end when the sewer system has processed or discharged the wet weather flows.

   It is difficult to justify use of this definition for facilities planning because the system performance will change as controls are put in place. Systems with storage or systems affected by rain-induced infiltration also cause difficulties with using this system because the overflow may continue long past the end of the precipitation. This problem is discussed in more detail later.

3. *Best Professional Judgment IET*

   This definition relies heavily on the expertise, local knowledge, and preferences of the individual(s) developing the event definition. Typical values recommended for various projects include 1 hour, 3 hours, 6 hours, 12 hours, 24 hours, and 48 hours of dry time between storms (precipitation IET) or outfall discharges (CSO IET).

4. *Duration-Volume Design Criteria*

   An event is considered over when a specific amount of time has elapsed (6 hours to 3 days) since the rainfall stopped, or when a certain depth or volume of rainfall has occurred (0.5 inch to 3 inches).

   The problem with this definition is that design storms based on return periods developed from this storm definition may be misleading. A 10-year, 24-hour design storm may generate a 100-year CSO or a 1-year CSO depending on the soil moisture conditions and available storage in the system at the time the design storm occurred.

5. *Statistical Independence*

   This definition is used when the probabilistic return frequency of events is important to the design, operation, or evaluation of the system. A frequency analysis has as its underlying assumption that the events (storms, CSO flows) are independent of one another; i.e., there is no joint probability linking one event to any other event. Such a definition helps prevent facilities from being undersized. The drawback of this definition is that the methods required to determine the statistical independence are somewhat difficult to use. This method has been used for the City of Portland (Nicholson and Adderley 1994) and for the EPA national model (Woodward-Clyde Consultants 1989). This method has also been examined for use in Seattle (Lukas and Merrill, 1996) and Spokane (Mau, 1999). The method is based on a paper by Restrepo-Posada and Eagleson (1982).

Additional desirable criteria considered for selecting the most appropriate storm/CSO event definition are:

1. Incorporates the local hydrology patterns.
2. Provides results that are appropriate for use in frequency analysis.
3. Is objective and defensible.
4. Provides results that are reasonable and useful.

Why Not Use The EPA National Definition Of Storm Event?

An analysis of 40 years of rainfall data from 138 gages across the U.S. was conducted by Woodward-Clyde (1989). This analysis defined precipitation inter-event times required to define independent storm events. The IET for the Eastern US was six hours, 20 hours for the mid-country, and 300 hours for the arid southwest. This analysis did not specify an IET for the Pacific Northwest. Woodward-Clyde (1989) recommended that a uniform 6-hour minimum IET be used nationwide to assure a common basis throughout the country. Nicholson and Adderly (1994) say that a 6-hour IET may be used for the design of small-scale stormwater facilities but should not be used for design of large-scale CSO control facilities in the Pacific Northwest.

Precipitation events in the Pacific Northwest have different characteristics than events in other parts of the country. Rainfall in the Pacific Northwest is characterized by long-duration, low-intensity storms and it may be difficult to identify individual storms. Several analysts have demonstrated a 6-hour IET is not applicable for defining a storm event in the Pacific Northwest.

Defining CSO Event by Defining Storm Event (Option 5 Statistical Independence)

The process as described in the paper by Restrepo-Posado and Eagleson (1982) utilizes long-term precipitation data, typically hourly records. The following description of the process is taken from Nicholson and Adderley (1994).

In rainfall frequency analysis, the return period of a storm of a given volume or peak intensity is based on the assumption that the volume or peak intensity of each storm is independent. A sufficient condition that assures independence between peak storm volumes and peak intensities is when the inter-event times (dry times) between storms is independent as well. Establishing independence between storm events is done by assuming the rainfall data represent continuous time (t) divided into a sequence (i = 1 to n) of discrete subintervals of duration (Δt, 1 hour if hourly record). The variable X_i (i = 1 to n) is defined as depth of rainfall occurring in each interval i. At each time interval, a test is made to determine if rain occurred ($X_i > 0$) or no rain occurred ($X_i = 0$). Then a second variable that characterizes the occurrence of rain or event function, Y_i, is defined as:

$Y_i = 1$ for $X_i > 0$
$Y_i = 0$ for $X_i = 0$

If the storm events as represented by Y_i are independent of each other, then the series will fit a Poisson distribution, $P_x = e^{-\lambda} \frac{\lambda^x}{x!}$, and the dry periods between the events (the precipitation inter-event times) are exponentially distributed. One of the characteristics of a Poisson distribution is that the mean (m) and the standard deviation (s) are the same, and the coefficient of variation (CV = s/m) equals one. The test for independent storm events is conducted by calculating the coefficient of variation (CV) of the IETs and comparing it to one.

This simplified method is applicable up to the point where overlapping begins to occur. Overlapping means that the storm as modeled actually contains several storms grouped into one large event. Overlapping is prevented by keeping the ratio of the storm duration and the storm inter-arrival rate (time from the beginning of one storm to the beginning of the next storm) much less than 1.0:

(Storm Duration) / (Storm Duration + Inter-Event Time) << 1.0

An additional requirement is that the method must be applied to data that are homogenous or belong to the same seasonal weather patterns. The data must be analyzed by months and grouped into seasons with similar patterns.

The authors of this procedure noted that it was empirical and inexact but useful in many design situations. The statistical independence technique for defining event resulted in a precipitation MIET for the Portland area of 18 hours for winter and 48 hours for summer. A combined precipitation MIET of 24 hours was recommended (Nicholson and Adderley, 1994) for the Portland area.

An analysis of rainfall from the SeaTac Airport resulted in a precipitation MIET of 15 hours for winter and 36 hours for summer. A combined precipitation MIET of 18 hours was recommended (Lukas and Merrill, 1996).

An analysis of the Spokane rainfall record showed independent events at a MIET of 24 hours (Mau, 1999).

The basic assumption of this procedure is that the definition of an independent storm event also defines a CSO event and that only one CSO event will occur during one storm event. Therefore, if the rainfall event is defined, then a CSO event is also defined. During a storm event, the rainfall intensity will vary over the duration of the storm. At certain times in the storm when the rain falls at an intense rate, CSO discharges may occur. A discharge may occur at the beginning of the storm, stop, and then begin again at the end of the storm. The assumption that a rainfall event defines a CSO event means that these intermittent flows are considered one CSO event.

Defining Event by Overflows

The simplest method to define a CSO using the statistical-based procedure is to define a CSO by equating the CSO IET to the precipitation MIET so that any CSO's that were separated by a period longer than the precipitation MIET would be deemed separate events (one storm event can only cause one CSO event). CSO communities would measure compliance by measuring the beginning and ending of each CSO.

Lucas and Merrill (1996) point out a potential problem with this approach as illustrated in the following figure of actual precipitation record and resulting computer simulated overflows at the Martin Luther King Way (MLK) CSO.

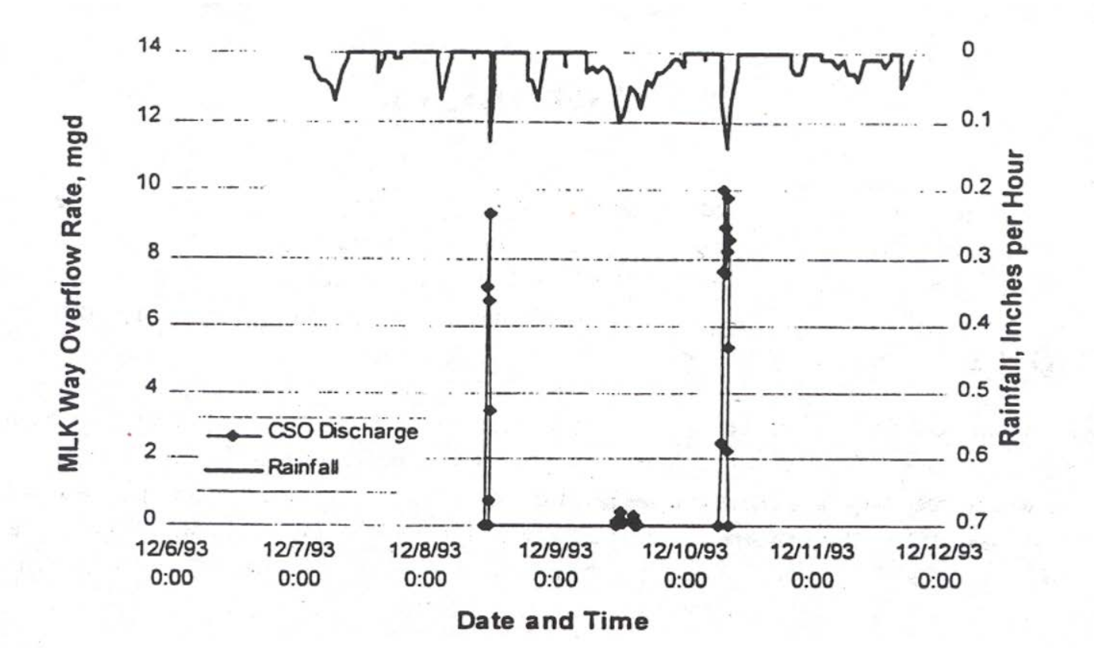


Figure 17. An Illustration from Lucas and Merrill (1996) Comparing Rainfall and CSO Inter-Event Periods

This figure shows a series of precipitation events that have been classed as one event based on an 18-hour precipitation MIET. The three CSO overflows are separated by more than 18 hours and would be classified as three overflow events if we simply used the precipitation MIET as the CSO MIET. Lucas and Merrill (1996) propose an alternative in which they use the simulation model to predict the number of overflows for the MLK overflow for the period of the precipitation record (Table 8). The CSO IET is analyzed for varying periodicity (3 hours, 6 hours, etc.) and the resulting number of overflows. For the SeaTac precipitation data, an 18-hour precipitation MIET caused a simulated 3805 precipitation events (81.8/year) for the 46.5 period of record. Of these 3805 precipitation events, 802 (17.3/year) caused simulated overflow events. The analysis of the CSO IETs showed that a 40-hour (interpolated) CSO IET caused an equivalent number (802) overflow events for the period of record. They recommend, for the MLK overflow, the use of 48-hour CSO MIET for administrative convenience. A 48-hour CSO MIET results in an average of 17 CSO events/year at MLK. This CSO process and the inter-event number were based on the assumptions that the Carkeek CSO permit had defined Ecology's future processes for CSO's. Specifically, that future CSO permits would be written to require reporting of CSO discharge without regard to the causative rainfall and Ecology would require reporting of CSO discharges on a calendar day basis.

Table 8. Inter-Event Analysis Results – Martin Luther King Way CSO and SeaTac

Airport Rainfall (from Lukas and Merrill, 1996).

Minimum inter-event, hr.	MLK Overflow		SeaTac Rainfall				Rainfall Events Causing Overflow (Simulated)	
	No. of Events in 46.5 year record	Events per year	No. of Events in 46.5 year record	Events per year	Summer inter-event C.V.	Winter inter-event C.V.	No. of Events in 46.5 year record	Events per year
3	1196	25.72	9458	203.40	1.87	1.63	1048	22.54
6	1103	23.72	6668	143.40	1.57	1.32	961	20.67
9	1047	22.52	5448	117.16	1.42	1.17	900	19.35
12	999	21.48	4706	101.20	1.33	1.07	862	18.54
15	967	20.8	4202	90.37	1.26	1.00	836	17.98
18	943	20.28	3805	81.83	1.21	0.94	802	17.25
24	884	19.01	3216	69.16	1.12	0.85	742	15.96
30	849	18.26	2744	59.01	1.06	0.78	687	14.77
33	831	17.87	2555	54.95	1.02	0.75	660	14.19
36	821	17.66	2409	51.81	1.00	0.73	639	13.74
48	771	16.58	1904	40.95	0.92	0.63	571	12.28
60	725	15.59	1533	32.97	0.84	0.57	497	10.69
72	679	14.60	1311	28.19	0.79	0.52	450	9.68
84	633	13.61	1138	24.47	0.75	0.49	408	8.77
96	600	12.90	999	21.48	0.72	0.46	379	8.15
120	559	12.02	751	16.15	0.65	0.41	314	6.75
144	527	11.33	589	12.67	0.59	0.39	270	5.81
168	485	10.43	475	10.22	0.55	0.38	224	4.82

Note that the precipitation IET of 18 hours contains 17 storm events/year but a predicted 20 CSO events/year. While this analysis may be valid for counting the number of overflows now, this analysis is not applicable to other systems and does not predict the probability of this problem when overflows approach the required one per year. Ecology believes this difference between events will become negligible as CSO frequency approaches one per year and therefore no adjustment on a policy basis is necessary for overflows into the inter-event period.

Definition of Event

For smaller communities with few overflow points and infrequent overflows a CSO event may be counted as any 24-hour period when a CSO discharge or multiple discharges occur. This prevents having to do a regional precipitation analysis and modeling of the CSO system to derive a design storm.

For large communities with numerous overflow points and frequent overflows, a CSO event is defined as a 24-hour minimum inter-event time for a CSO outfall.

Averaging Period and Compliance Options

(Reserved)

3.5 Facilities with Less Concentrated Influent Wastewater

3.5.1 Discussion of Section 050(4)

The facilities which receive less concentrated influent wastewater than normally received by domestic wastewater facilities can qualify for alternative limits. The influent wastewater must have a BOD5 concentration less than 167 mg/L. In such cases, the facility may apply for a lower percent removal requirement than the 85% from Section 040 or the minimum 65% for trickling filters and waste stabilization ponds (BOD_5 only).

The 85% removal requirement was originally established to achieve 2 basic objectives:

1. To encourage municipalities to remove high quantities of infiltration and inflow (I/I) from their sanitary sewer systems, and

2. To prevent intentional dilution of influent wastewater. However, in facilities with dilute influent which is not attributable to high quantities of I/I or intentional dilution, the percent removal requirement will result in forcing "advanced treatment". Advanced treatment generally refers to additional treatment processes (e.g., filtration, chemical addition, or 2-stage biological treatment) which achieve significantly greater pollutant removals than secondary treatment processes alone. Ecology concurs with EPA, that it is not reasonable or cost effective to require advanced treatment in these cases.

However, the EPA regulation does not accomplish objective (1) above. Despite establishing three conditions (see 40 CFR 133.103(d) and WAC 173-221-050(4)(b)(i-iii)) to qualify, a municipality could still qualify despite grossly high levels of I/I. The federal regulation would allow such a municipality to claim that it is more effective to transport and treat such flows--at a reduced percent removal--than to correct. This could result in increasing total weight of pollutants discharged and neglecting adequate sewer system maintenance. To prevent this situation, Ecology has added a fourth condition (See 050(4)(b)(iv)). That condition requires a municipality to submit a program aimed at controlling I/I. Ecology has approval authority over the program. The permit writer should incorporate the program into the conditions of the NPDES permit.

3.5.2 Task Outline for Determining Lower Percent Removal Limits for Less Concentrated Influent Wastewater

1. The permittee must request and submit supporting documentation for the permit writer's review. The documentation should include I/I analyses, and sewer system surveys, performed to meet federal requirements (as referred to in 2.c. below). The daily historical rainfall record and historical daily sewage flows should be provided with these studies.

2. Determine whether the permittee qualifies under Section 050(4)(b).

a. Does the facility meet its effluent concentration limits and the mass loading limits based on those effluent concentration limits for BOD_5 (or $CBOD_5$) and TSS as established in Section 040 and 050(1) and (2)?

Yes. Proceed to b.

No. Does not qualify. The permit should include the requirements of Section 040 or section 050(1) or (2). If the permittee cannot immediately comply, issue an administrative order requiring submission of a plan and schedule to achieve compliance (e.g., build more capacity).

b. Have the average influent concentrations of BOD_5 and TSS generally been below 167 mg/L in the months for which the permittee has requested lower percent removal limits? (Review at least a few years worth of data.)

Yes. Proceed to c.

No. Does not qualify. Section 040, or Section 050(1) or (2) applies.

c. Is the less concentrated influent the result of "excessive" I/I?

The permit applicant must use the EPA pamphlet document "I/I Analysis and Project Certification" for proposing what is "excessive" I/I. When computing the costs of transporting and treating the sewage, include the present cost (capital and operation and maintenance) of whatever technology would be necessary to achieve the limits allowed by Section 040, or Section 050(1), or (2), whichever is applicable. Any overflow of sewage is deemed excessive I/I.

If the answer to c. is Yes, the applicant does not qualify for a lower percent removal limit. Issue a permit with the standard percent removal requirement (Section 040 or Section 050(1) or (2)), and propose a sewer rehabilitation program and schedule as a condition of the permit or within an administrative order. You will probably need additional guidance for determining reasonable rehabilitation schedules. The minimum goal of the rehabilitation program would be to eliminate "excessive" I/I.

When the "excessive" I/I is eliminated, the applicant can get lower percent removal limits in accordance with #4 below, if they agree to further sewer rehabilitation as outlined in #4.

If the answer to c. is No, proceed to Step 3.

3. Does the facility meet all the requirements of Section 050(5)? (See task outline for this earlier in this chapter).

Yes, proceed to Step 4.

No, does not qualify.

4. Propose a lower percent removal effluent limitation which the applicant has demonstrated it can meet 95% of the time. This % removal limit can be less than 65% for certain lagoons and trickling filters. Use DMR data as explained in Step 3 of the task outline for determining trickling filler BOD_5/TSS effluent limits. Make a note in the permit that whenever the monthly influent concentration exceeds 167 mg/L, 85% removal is the permit limit.

5. If the applicant ever exceeds the EPA screening criteria of 120 gallons per capita per day (7-14 day average for sewage plus infiltration) or 275 gallons per day (highest daily flow recorded during a storm event--includes sewage flow plus I/I), propose a sewer rehabilitation program and schedule as conditions of the permit. Alternatively, keep the permit condition worded in general terms and place the specific schedule of activities in an administrative order.

The goal must be to eliminate sufficient I/I quantities such that the influent sewage BOD_5 and TSS concentrations exceed 167 mg/L. Thereafter, the standard percent removal requirements of Sections 040 and 050(1) and (2) would once again apply and should be written into the next permit renewal.

If the permittee rehabilitates the sewer and gets flows below the EPA screening criteria, yet the BOD_5 and TSS concentrations do not exceed 167 mg/L on a monthly average, propose a lower percent removal effluent limitation.

For trickling filters (BOD_5 and TSS) and waste stabilization ponds (BOD_5) which also qualify for percent removal limitations between 85 and 65% under Sections 050(1) and (2), the sewer rehabilitation goal should be to reduce I/I below the EPA screening criteria, or to raise the influent concentrations such that the facility no longer meets 050(4)(b)(ii); i.e., the influent concentrations are above 167 mg/L and therefore Section 040 or Section 050(1) or (2) applies. If during the rehabilitation program, the flows are reduced below the EPA screening criteria, yet the BOD5 and TSS concentrations do not rise above 167 mg/L, propose a lower percent removal limitation based on Section 050(1) or (2).

3.6 Substitution of $CBOD_5$ for BOD_5

3.6.1 Discussion of Section 050(6)

The facility owner/operator can request and the Department can approve substitution of carbonaceous BOD_5 ($CBOD_5$) for the standard BOD_5 limitation. In such cases, the Department may substitute a 25 mg/L CBOD5 limit for a 30 mg/L BOD5 limit.

USEPA has extensively studied the use of a $CBOD_5$ limit in lieu of a BOD_5 limit. They concluded that a 25 mg/L $CBOD_5$ limit is effectively equivalent to a 30 mg/L BOD_5 limit. We agree. A detailed explanation for this substitution is in the preamble to 40 CFR part 133 as published on September 20, 1984.

Using $CBOD_5$, a municipality could discharge more oxygen-demanding nitrogenous material than when using BOD_5. This is likely if a facility can't prevent partial nitrification.

Nitrification is the conversion of organic nitrogen and ammonia-nitrogen (nonoxidized) to nitrate (oxidized). It occurs by chemical action or by certain microorganisms which consume nonoxidized nitrogen getting into the water. These organisms use large amounts of oxygen when consuming organic nitrogen and ammonia-nitrogen (both unoxidized) and converting them to nitrate (oxidized). When this process is underway (partial nitrification), it creates a high BOD. Once nitrification is complete, there is very little oxygen-demanding nitrogenous material left.

Using the BOD_5 test, facilities have to either keep nitrifying microorganisms out (prevent partial nitrification), or wait for them to completely nitrify the water before discharge. Using $CBOD_5$ however, facilities can discharge partially nitrified water, even with its high nitrogenous oxygen-demand.

Notably, unless Ecology identified a problem in receiving water quality, a facility has no obligation to remove nitrogenous oxygen-demanding substances from its wastewater. USEPA's longstanding 30 mg/L BOD_5 effluent limit was not intended to force removal of nitrogenous pollutants. It was intended for carbonaceous pollutants. The newer federal rule and Chapter 173-221 WAC clarify that intent, and eliminate the need for facilities to remove these nitrogenous pollutants. This need exists at some facilities only because the nitrogenous pollutants gave a false indication of poor facility performance.

3.6.2 Task Outline for Determining $CBOD_5$ Limits

1. The permittee must request the change.

2. Is the facility a waste stabilization pond or trickling filter as defined in Section 030, which has requested or received alternative BOD_5 or $CBOD_5$ limits?

   Yes - Go to Step 3.

   No - Issue new permit limits of 25 mg/L $CBOD_5$ for the monthly average; and 40 mg/L for the weekly average. Refer to the explanation (earlier in this chapter) of Section 040 to determine monthly and weekly load limits. Percent removals are based on CBOD in the influent and effluent.

The Average Monthly Mass Effluent Limit (CBOD) =
The maximum monthly design flow (MGD) x Concentration Limit (mg/L) x 8.34 =
_____MGD x 25 mg/L CBOD x 8.34 = lb/day CBOD

The Average Weekly Mass Effluent Limit (CBOD) = 1.5 x Average Monthly Mass Limit

3. Have the permittee submit at least one year's worth of influent and effluent data for CBOD5, BOD5, and ammonia nitrogen.

a. Try to establish a ratio between BOD_5 and $CBOD_5$, (for example, the BOD5/CBOD5 could be 1.2/1) for months with low or moderate nitrification.

b. Determine the "effluent BOD_5 concentration consistently achievable through proper operation and maintenance." See task outlines for Section 050(1) or (2).

c. Determine corresponding $CBOD_5$ concentration for the BOD_5 value determined above by using the ratio established in Step 3a.

d. Is the corresponding monthly average $CBOD_5$ concentration limit less than 40 mg/L?

Yes - Use it as the new $CBOD_5$ limit.

No - Use 40 mg/L as the new $CBOD_5$ limit.

e. Determine the weekly average $CBOD_5$ limit by multiplying the number obtained in d. by 1.5.

f. Refer to the explanation in this chapter for Section 040 for guidance in determining influent and effluent load limits for $CBOD_5$. Remember to use the $CBOD_5$ influent and effluent concentrations determined above.

g. Determine percent removal requirements similarly to the procedures explained earlier for trickling filters and waste stabilization ponds respectively.

NOTE: Whenever effluent $CBOD_5$ limits are given, the permit must also be changed to require influent $CBOD_5$. The 85% removal requirement applies to the $CBOD_5$ effluent as compared to the $CBOD_5$ influent.

When designing biological aeration tanks, it's still appropriate to use BOD_5, and in many cases, nitrification-demand requirements for determining aeration capacity.

4. Defining Compliance with 85% Removal

Compliance with the 85% removal standard of secondary treatment is defined as the 30-day average influent concentration (AIC) minus the 30-day average effluent concentration (AEC) divided by the 30-day influent concentration (AIC):

(AIC - AEC)/ AIC.

This method of calculation is consistent with the regulatory intent of the performance standard as a long-term average performance standard. This method gives a percentage that is a fraction of a percent higher than if calculated as the average of the daily percent removals.

This determination comes from federal regulations, 40 CFR Part 133 (definitions).

40 CFR 133.101(b) 30-day average. The arithmetic mean of pollutant parameter values of samples collected in a period of 30 consecutive days.

40 CFR 133.101(j) percent removal. A percentage expression of the removal efficiency across a treatment plant for a given pollutant parameter, as determined from the 30-day average values of the raw wastewater influent pollutant concentrations to the facility and the 30-day average values of the effluent pollutant concentrations for a given period of time.

40 CFR 133.102 Secondary treatment

- (a) BOD_5
  - (3) The 30-day average percent removal shall not be less than 85%
- (b) SS
  - (3) The 30-day average percent removal shall not be less than 85%

4.1 STEP Systems

Section 2 of this chapter pointed out that federal and state regulations require POTW's to remove 85% of BOD and solids of the influent wastewater. This removal requirement is difficult to assess in a STEP systems which utilize septic tanks as part of the treatment system. This part presents a process for dealing with STEP systems.

4.1.1 Recommendations

A NPDES discharge permit and fact sheet for a POTW with a STEP system should include the following:

1. The permit should contain the appropriate effluent concentration limits and percent removal requirements from WAC 173-221-040 or 050 (1) or (2).
2. The 85% BOD_5 removal requirement in the permit should be footnoted with the following:

   i. The permittee will be presumed to be in compliance with the percent removal requirement in the permit if the permit effluent concentration limit is met and there is no excessive inflow and infiltration (I/I). Infiltration is excessive when the highest 7-14 day average daily dry weather flow is greater than 120 gallons per capita per day. Inflow is excessive when the highest recorded daily flow during a storm event is greater than 275 gallons per capita per day or when hydraulic overloading of the treatment plant occurs.
3. The permit should require monitoring and reporting of the influent BOD_5 and the percent BOD_5 removal accomplished at the central treatment plant.
4. The fact sheet should explain that as long as the permit effluent concentration is met and neither USEPA criteria (120 gallons per capita per day for the highest 7-14 day average, and 275 gallons per capita per day for the highest 24-hour average) are exceeded, the permittee will be presumed to be in compliance with the percent removal requirement in the permit.
5. The fact sheet should also explain that if either EPA criteria are exceeded the permittee

will be required to implement a rehabilitation program to reduce I/I. The program will be agreed upon between Ecology and the permittee and the details (schedule, work plan, financial commitment) will be incorporated into an administrative order.

6. The permit should require annual reporting of the highest 7-14 day average daily dry weather flow rate and the highest 24-hour per capita daily flow rate.
7. The permit should require the permittee to institute or continue an adequate operation and maintenance program for the entire sewage system including the septic tanks in the STEP system.

4.1.2 Background

Septic tanks remove settleable solids and provide a limited amount of digestion of organic matter of domestic wastewater. When used as part of a STEP system, properly operated and maintained septic tanks can achieve some degree of BOD_5 removal and thus reduce wastewater BOD_5 loading to the sewage treatment plant downstream. The reported mean effluent BOD_5 concentrations from domestic septic tanks range from 120 to 240 mg/l (USEPA 1980). Based on limited data, the influent BOD_5 concentration to the central sewage treatment plant of a Western Washington municipality (Montesano) with septic tank effluent pumps discharging to a pressure conveyance system was found to be around 180 mg/l.

For POTWs that receive domestic sewage after treatment in septic tanks (STEP system), the BOD_5 removal in the septic tanks is considered an integral part of the treatment process for BOD_5 removal. Since it is impractical to measure the actual influent BOD_5 to the septic tanks, compliance with the 85 percent BOD_5 removal requirement of the secondary treatment rule may be assumed if the effluent concentration meets 30 mg/l, and if there is no excessive inflow and infiltration (I/I). In this case excessive infiltration is defined as exceedance of the USEPA screening criterion of 120 gallons per capita per day (average daily dry weather flow - highest average daily flow recorded over 7-14 day period of seasonal high ground water); excessive inflow is exceedance of the USEPA criterion of 275 gallons per capita per day (highest daily flow recorded during a storm event for wastewater plus I/I); or any occurrence of treatment plant hydraulic overload. If the USEPA screening criteria for I/I are not exceeded, the presumption is that the raw sewage influent would be at least 200 mg/L if the septic tanks were not present. These screening criteria apply regardless of whether the I/I can be cost-effectively removed (see section 3.5 of this chapter).Therefore, complying with the 30 mg/L effluent BOD5 concentration limit means that the 85% removal requirement is also achieved.

Since the sewage conveyance system is under pressure, ground water intrusion (infiltration) into the public sewer should not be a factor for weak influent. However infiltration can occur through sewers connecting the buildings to the septic tanks and through possible cracks in the tanks. The report required under (6) above should be sufficient to allow the permit writer to make an assessment of excessive infiltration.

5. Operations and Maintenance (O&M) Manual

The NPDES permit special condition "Operation and Maintenance of Municipal Facilities" requires the permittee to keep an approved O&M manual at the treatment plant. The approved O&M manual must be updated as needed and a copy of the updated portions be submitted to the Department for review and approval. Failure to keep an approved and updated O&M manual at the treatment plant is a permit violation and subject to enforcement. The permit writer should talk with his/her supervisor concerning the appropriate enforcement measures needed.

5.1 O&M Requirements for Collection Systems

The collection system (that is the network of sewers and pumps or lift stations) is an integral part of the wastewater treatment works. For the most part these are buried and distant from the treatment facilities, so that small leaks often go unnoticed for long periods. Leaks of untreated sewage constitute a discharge of wastewater which is not allowed under the terms of the permit.

Small leaks, especially if numerous or under pressure, can result in significant impacts on the environment. Leaks can adversely impact the treatment plant if they result in excessively dilute sewage (infiltration or inflow). For these reasons, maintenance of the collection system should be considered part of the Operations and Maintenance for the wastewater treatment system, even if they are managed by different departments of the municipality.

If the existing O&M manual for the facility does not include the collection system, the permit will require preparation and implementation of a section on the collection system. If the collection system is included in the O&M Manual for the facility, a periodic review will be required and an update for all modifications of the system (e.g., extensions) required.

Mechanical systems (lift stations and pumps)

- There needs to be a regular schedule for reviewing the performance of mechanical systems which are part of the collection system. This includes schedules for lubrication, testing pump and motor performance, testing the operation of level switches and alarms, call out systems and cleaning any screens, floating material and sediments. If there is excessive corrosion of the interior walls of wet wells, then leak testing may be warranted. Planning for power failures or unanticipated overflows needs to be implemented.

Gravity sewers

- Sewer pipes which operate partly full have low internal pressures (nearly atmospheric), which allows ground water to enter the sewer through leaks whenever the water table is above the level of the sewage and the leak. This is called **infiltration**. The water table typically fluctuates seasonally (high during wet weather or irrigation season) so that leaks which result in infiltration during part of the year may result in exfiltration, leakage of raw sewage out of the sewer, at another time during the year. Excessive infiltration dilutes the sewage, increases the costs of treatment and potentially interferes with the complete treatment of the sewage. **Exfiltration** is a discharge of pollutants to groundwater.

- Testing sewers designed to operate at atmospheric pressure is more difficult than testing piping systems intended for operation under pressure, since there are more openings to close and less strength for resisting leakage without failing. Although pressure testing of individual pipe segments is possible, testing sewers for infiltration (and by implication exfiltration) is usually done by measuring flows or other characters of the sewage such as temperature or conductivity.   Temporal patterns of varying temperature and conductivity might be indicative of infiltration of groundwater into the sewer pipes. If the temperature or conductivity show values closer to groundwater during the low flow period in the early morning, infiltration is suspected and needs to be further characterized as to how much and where the leaks are occurring. Also, smoke testing of sewers can be an effective technique for detecting leaks.

- Sewers may also collect water such as stormwater through holes in the covers for the access points to the sewer, direct connection of downspouts to the sanitary sewer, etc. This results in increased flows associated with storms and can cause some of the same problems as infiltration for treatment. This is referred to as **inflow**. Once **inflow** has been identified, it needs to be characterized for how much and where it enters; the techniques and tools used are often the same as those used for infiltration.

Pressurized sewers:

- These are sewers with pressures significantly greater than atmospheric pressure, in which case leaks will almost always result in exfiltration. Sewers which operate at greater than atmospheric pressure include **force mains** where the pressure is generated by a pump operating against gravity and friction, and **inverted siphons** where the pressure results from gravity acting on the column of water between the invert of the siphon and the free surface in the gravity sewer.

- Pressurized sewers can be tested, if they can be taken out of service, by closing all of the valves, pressurizing the system and measuring the loss of pressure with time.

Leaks can be especially problematic if the collection system contains segments which cross surface water or follow the low lying land along surface water (river, stream, or lake). A regular schedule of inspections and testing of the collection system on those segments in sensitive environments is required.

Once a leak has been determined to be present and its location narrowed down, (for instance between two manholes), confirmation of the type of leak and location can often be done by passing a television camera through the sewer.

6. Maintaining Adequate Capacity

Ecology has observed over the years that it takes municipalities several years to plan and fund expansions of the wastewater treatment plant. Permit writers should note the population growth of a municipality when redrafting their wastewater discharge permit. For those nearing capacity or with rapid population growth, the permit writer should put a requirement in the permit that causes the municipality to submit a report on capacity. The triggers for submitting a report are when the peak flows waste load exceeds 85% of the design criteria for three months in a row or if flows or loads are expected to reach design capacity during the life of the permit. The plan should include a schedule for continuing to maintain capacity. The capacity as outlined in the plan must be sufficient to achieve the effluent limitations and other conditions of this permit. This plan should address any of the following actions or any others necessary to meet the objective of maintaining capacity.

1. Analysis of the present design including the introduction of any process modifications that would establish the ability of the existing facility to achieve the effluent limits and other requirements of this permit at specific levels in excess of the existing design criteria.
2. Reduction or elimination of excessive infiltration and inflow of uncontaminated ground and surface water into the sewer system.
3. Limitation on future sewer extensions or connections or additional waste loads.
4. Modification or expansion of facilities necessary to accommodate increased flow or waste load.
5. Reduction of industrial or commercial flows or waste loads to allow for increasing sanitary flow or waste load.

7. Operator Certification

Anyone operating a wastewater plant in Washington State is required to be a certified operator. Certification requires a combination of training and experience as described below. A higher certification is required to operate higher discharge or more complex treatment plants. The complete requirements for Operator Certification are given in Chapter 173-230 WAC. Table 9 below gives the operator level required for various treatment processes and flow volumes.

Table 9. Treatment Plant Classification Criteria

Treatment type	Design flow MGD	Operator Classification required
Primary	≤1	I
	>1, ≤10	II
	>10, ≤20	III
	>20	IV
Lagoon (Nonaerated)	All	I
Lagoon (Aerated)	≤1	I
	>1	II
Biofiltration	≤1	II
	>1, ≤10	III
	>10	IV
Extended aeration	≤5	II
	>5	III
Activated sludge	≤1	II

Treatment type	Design flow MGD	Operator Classification required
	>1, ≤10	III
	>10	IV
Constructed wetlands	≤1	I
	>1, ≤5	II
	>5	III
Tertiary	≤5	III
	>5	IV
Membrane bioreactor[a] (Operators of these facilities must have an expert on call when needed as determined by the department)	For any size facility discharging to a sensitive water body with effluent limits beyond secondary treatment, Ecology will decide on the certification level on a case-by-case basis using engineering judgment, the complexity of the operation, the record of permit compliance and the risk to humans and the environment.	
	≤1	II
	≤1 Class A reuse	III
	≤1 with chemical addition for nutrient removal	III
	>1, ≤10	III
	>10	IV
	Any size discharge with water quality-based limits with limits more stringent than technology-based secondary treatment	Determined on a case-by case basis using engineering judgment based on the complexity of the operation, the record of compliance, and the risk to humans and the environment.

a. Classification levels have been determined by policy.

Plants may be classified in a group different than indicated in this section if:

1. They have characteristics that make operation less complex or more difficult than other similar plants of the same flow range; or
2. The conditions of flow or the use of the receiving waters require an unusually high degree of plant operational control; or
3. They use an approved method of wastewater treatment that is not included in this section.

8. Loading Calculation for Intermittent Discharges

The following method is recommended for calculating loading for intermittent discharges: Multiply the month’s average daily flow (gpd) *x* average of sampled daily concentrations *x* [0.00000834]. Days with zero flow are included in the average daily flow calculation.

The federal definition (40 CFR Part 122.2 is "*Average monthly discharge limitation* means the highest allowable average of ''daily discharges'' over a calendar month, calculated as the sum of all ''daily discharges'' measured during a calendar month divided by the number of ''daily discharges'' measured during that month.

Ecology notes that if a facility discharges intermittently, this definition does not adequately represent the discharge loading particularly for discharges to land and for TMDL compliance. EPA's definition was intended to apply to technology based limits and continuous discharges. We can direct facilities with intermittent discharges to calculate compliance with limits using a different method specific to the situation.

9. Biosolids (Sludge)

Important Points for Permit Writers

- The Waste 2 Resources Program has the lead for biosolids management, including permitting and regulation. There is a biosolids coordinator in each regional office and at headquarters.

- Treatment plant upgrades are a critical control point for effective biosolids management. When an upgrade or significant change in treatment technology is contemplated, it is essential to be sure the regional biosolids coordinator is in the loop. Rather than attempting to decipher the options for biosolids management available under the regulations, it is often more helpful for operators to ask themselves, "What do we want to do with our biosolids," and then investigate the requirements and feasibility.

- Virtually all sewage treatment facilities (and some others) come under the state biosolids program, including lagoons. Lagoons often neglect biosolids management and find themselves with a very short time frame for decision making on costly projects. The recommended planning horizon for removing biosolids from a lagoon is two years.

- Biosolids are not a solid waste. State law says they are a valuable commodity and directs Ecology to implement a program maximizing beneficial use. The Waste 2 Resources Program generally does not support management options that lead to disposal.

- Ecology does not have delegation of federal program authority. This does not affect state program implementation because we have independent statutory authority, however, Ecology's program must meet federal program requirements. Lack of federal delegation means that treatment works continue to have dual obligation of submitting permit applications and annual reports to both agencies. It also means that EPA can initiate unilateral permitting or enforcement actions, although this has not occurred. In some cases Ecology has delegated certain authorities to local health jurisdictions (LHJs). It can be helpful to know the extent of local delegation agreements.

9.1 The State Program

1992 Legislation directed the Department of Ecology to implement a program maximizing the beneficial use of biosolids, a valuable commodity (Chapter 70.95 J RCW). This Legislation was significant because it was the first in the nation to recognize “biosolids” in statute, it gave authority for program development and implementation to Ecology, and it removed biosolids from regulation as a solid waste, declaring instead the product was a valuable commodity.

Ecology adopted new rules for biosolids management in Chapter 173-308 WAC and issued a statewide general permit for biosolids management in the spring of 1998. New general permits were issued in 2005 and 2010, and a revised rule was adopted in 2007. The Waste 2 Resources Program is the regulatory authority responsible for authorizing and permitting the use of biosolids throughout the state. In some cases delegation agreements are in place with LHJs. Ecology’s biosolids program is intended to meet or exceed federal program requirements of the Clean Water Act, 40 CFR Part 503, and various other federal regulations. There is a program coordinator in the headquarters office and a coordinator in each regional office.

The term *biosolids* was adopted by the state Legislature in 1992 in Chapter 70.95J RCW. Biosolids is municipal sewage sludge that meets the quality standards allowing it to be beneficially used. The standards for quality are defined in Chapter 173-308- WAC. Biosolids which do not meet these standards may not be applied to the land (even under a solid waste permit). Disposal options include incineration and landfill disposal. Chapter 70.95J recognizes biosolids as a valuable commodity and directs Ecology to develop a program to maximize beneficial use. Landfill disposal is discouraged, but may be allowed in some cases on an emergency or short-term basis, or even as a long-term management option.

Ecology does not support incineration but recognizes the importance of incineration to a few communities in the state who have incineration facilities in place. We have encouraged these communities to operate their incinerators as efficiently as they can for as long as they are serviceable. As these units need significant upgrades or replacements, Ecology will advocate strongly for abandonment and a shift to beneficial use.

The state rule includes a permitting program, the key to which is identification of a facility as a Treatment Works Treating Domestic Sewage (TWTDS). TWTDS is a term adopted from federal rules and essentially refers to any treatment facility which changes the quality of biosolids. The vast majority of TWTDS are publicly owned treatment works. Privately owned treatment works qualify only if there is *no* industrial influent component. Other facilities may also meet the definition of TWTDS. Biosolids compost facilities are TWTDS as are facilities which simply combine biosolids from two different sources, because they both change the quality of biosolids they receive. Certain land application sites, called Beneficial Use Facilities, are also TWTDS. Facilities that treat or land apply septage are also TWTDS. Ecology can also use its authority to designate TWTDS and bring facilities under the permit program that would not typically require permitting.

The state biosolids rule is directly enforceable. All facilities and persons subject to the rule must comply with its requirements, regardless of their standing under the permit program. There are several steps to the permitting process which includes SEPA review, public notice, an application process and potentially public hearings. The first step involves submission of a Notice of Intent form at least 6 months before an existing general permit expires. The notice of intent acknowledges the facility’s intention of applying for coverage under the general permit. In the second step of permitting, the facility submits a complete permit application. The permit application must be submitted within 180 days following the issuance of a new general permit. Complete review by Ecology may not occur for some time. In the third step Ecology reviews the application and current practices. Once final conditions have been established, the facility is notified with a letter of final approval; this letter may include additional or more stringent requirements if needed. The facility must then comply with all final plans and any additional or more stringent requirements stipulated in their final approval letter.

9.2 The Federal Program

The Environmental Protection Agency (EPA) has responsibility for implementing biosolids program requirements on Indian lands and in states which have not taken delegation of federal program authorities. EPA does not consider the federal program to be a high priority and in recent years has significantly disinvested from the biosolids program. This has left EPA Regions in a very difficult position to implement federal requirements. In Region 10 the primary focus has been on facilities in Alaska and Idaho which have fewer resources for implementing state programs. EPA has also worked with some facilities on Indian lands and federal facilities. EPA has chosen two approaches to implementing the biosolids program at the federal level. The initial focus was on inclusion of requirements in federal NPDES permits. This effort is continuing at some level in Region 10.

After a time, EPA began using a general permit approach in some regions. EPA's expectations of Washington facilities appear to be fairly reasonable and minimal at this point in time. Facilities with NPDES permits should have complete (and updated) federal biosolids permit applications on file with Region 10. Other Treatment Works Treating Domestic Sewage (mostly state waste discharge permitted treatment works) should have Part 1 of the federal application on file. All major facilities should submit annual reports to EPA. EPA does not have an annual report form and has stressed that content of the report is the critical issue. Washington's form has been determined to be acceptable. Beyond these requirements, EPA has a fundamental expectation of compliance with the rules.

9.3 Delegation

Ecology originally intended to pursue delegation of federal program authority, but staff cannot set aside implementation activities in order to pursue federal delegation without compromising the state program. Consequently, the Waste 2 Resources Program has elected not to pursue delegation until adequate resources are available for the task. Ecology's authority to implement the state program, however, is independent of federal delegation. A lack of federal delegation does not in any way invalidate the state program. The benefits of federal delegation are marginal for Ecology. Delegation would relieve the regulated community of certain duplicative processes, particularly permit applications and annual report submittals. It would also clarify the first line of authority for regulatory decisions. EPA, however, has not played an active role in biosolids management with Washington facilities to date, although they have been helpful to Ecology. Nationwide only a handful of states have received delegation of federal authority.

Ecology may delegate certain responsibilities to LHJs. Typically this delegation will at a minimum include review of applications and site plans and routine inspections. A few LHJs around the state have delegation agreements in place with Ecology.

9.4 Overlap with Wastewater Permits

Generally, Water Quality Program permit writers and managers should consult with the biosolids permit managers in the Waste 2 Resources Program regularly, as there is the potential for significant overlap between permits.

One of the most critical points of overlap with wastewater permits are biosolids sampling and analysis requirements. All TWTDS which apply biosolids or sell or give away biosolids for application must conduct a minimum amount of sampling on an annual basis. The pollutants and monitoring schedules are the same in the federal and state rules, although permit requirements may extend those requirements. Both rules have provisions that require *representative* sampling as well. Many times the minimum specified sampling frequency may be inadequate. This is an area where Ecology's biosolids permit program must fill the gap. While sampling methods are specified in the rules, the specific vehicle directing them is not critical to the biosolids program. For example, samples obtained in support of a pretreatment program may also be acceptable for biosolids program compliance. Water Quality permit managers should check with their counterparts in the Waste 2 Resources Program as monitoring requirements come under review.

Facility upgrades and new construction are areas of critical concern to both programs. Facilities should have a clear vision of future biosolids management practices when contemplating upgrades. For example, the biosolids treatment systems designed to produce Class A biosolids (a measure of pathogen reduction) are different than those which produce a Class B product. Both products are acceptable, but there are markedly different implications for permitting in the biosolids program as well as for end uses. Also, the Waste 2 Resources Program would likely oppose a proposed management system which would depend either on incineration or landfilling of biosolids.

Finally, a delegation agreement between Ecology and a LHJ may be important in terms of Water Quality Program permitting. Permit managers should specifically inquire about current delegation agreements in both the area where the biosolids are generated, and where they are used.

Chapter 6. Water Quality-Based Effluent Limits for Surface Waters

Permit writers must consider the impact of every proposed discharge to surface waters on the quality of the receiving water and specifically consider how the discharge may affect the use of the receiving water. In some cases, this consideration may reveal that permit limits based on a treatment technology are not sufficiently stringent to protect water quality even with a mixing allowance. In these cases, additional permit limits must be developed, or alternative disposal methods or locations must be found. This chapter deals with conducting an analysis of reasonable potential and developing effluent limits for the protection of aquatic life for individual permits. Human health protection is covered in Chapter 7. Appendix E covers the situation where a TMDL has been developed and water quality-based effluent limits are based on a wasteload allocation set by the TMDL.

To evaluate the effect an effluent has on receiving water, a permit manager must use:

- The water quality criteria and standards described below in Section 1,
- The mixing zone criteria described below in Section 2, and
- A method for predicting impact and defining effluent limits for numeric criteria described below in Section 3.

The permit writer should keep in mind that the requirement for imposing effluent limitations for the protection of water quality does not require a demonstration of impact beyond any doubt but only that there is a determination of reasonable potential determined by a rational and scientific process.

Section 4 of this Chapter describes analytical levels for permit application and effluent limits.

Evaluating an effluent's effect on receiving water includes an evaluation of whole effluent toxicity (WET). Section 5 presents Ecology's approach for dealing with whole effluent toxicity.

Additional guidance on determining effluent mixing is presented in Appendix C.

1. Water Quality Criteria and Standards

Water quality criteria are estimated threshold concentrations for specific pollutants which are based on scientific data about adverse effects to aquatic life or human health. These criteria address human health effects, toxicity to aquatic organisms, bioaccumulation potential, or an adverse effect on some other beneficial water use. These criteria may be single numbers, a concentration range, or a narrative statement.

The first water quality criteria developed by direction of the Water Quality Act of 1965 and the Federal Water Pollution Control Act (Clean Water Act) have since been revised several times.

The methods used for deriving the criteria have changed over the years. The different methods that EPA has used are published as appendices to the Gold Book EPA 440/5-86-001. EPA maintains a site dedicated to criteria development: https://www.epa.gov/wqc. The criteria have become increasingly complex as EPA tries to incorporate all the factors which affect toxicity including exposure patterns or characteristics. The Criteria sheet of PermitCalc contains the current criteria.

Many of the numeric criteria for aquatic life protection have the following three components:

- Magnitude or concentration,
- Duration - averaging period for exposure to the chemical in question, and
- Frequency - the number of times that the criteria may be exceeded within a given time frame without permanently affecting the aquatic communities. Three years is used as the period of time for aquatic community reestablishment.

Each of these components is defined for short-term (acute) and long-term (chronic or sub-lethal) effects.

The current EPA aquatic life criteria for zinc, for example, are:

> "freshwater aquatic organisms and their uses should not be affected unacceptably if the 4-day average (duration) concentration of zinc (in µg/L) does not exceed the numerical value given by $(.986)(e^{(0.8473[\ln(\text{hardness})]+0.7614)})$ (concentration) more than once every three years on the average (frequency) and if the 1-hour average (duration) concentration (in µg/L) does not exceed the numerical value given by $(.978)(e^{(0.8473[\ln(\text{hardness})]+0.8604)})$ (concentration) more than once every three years on the average (frequency). For example, at hardness of 50, 100, and 200 mg/L as $CaCO_3$, the 4-day average concentrations of zinc are 58, 105, and 188 µg/L respectively, and the 1-hour average concentrations are 64, 114, and 206 µg/L. If the striped bass is as sensitive as some data indicate, it will not be protected by this criterion... Saltwater aquatic organisms and their uses should not be affected unacceptably if the four-day average concentration of zinc does not exceed 81 µg/L more than once every 3 years on the average and if the 1-hour average concentration does not exceed 90 µg/L more than once every 3 years on the average."(Values are from FR Volume 60, No. 86, May 4, 1995)

The criteria for toxic pollutants, including zinc, have separate development documents which provide a detailed review of the data used to develop the criteria. These documents are available from the Department of Ecology Library, the Environmental Assessment Program, and from the EPA Region 10 library in Seattle. New or revised criteria are published in the Federal Register.

The criteria for toxic pollutants are not static. EPA continues to refine these numbers to incorporate new research data and risk methods.

1.1 The Water Quality Standards Define the Designated Uses and Incorporate Criteria

Water quality standards for Washington's surface waters are codified in Chapter 173-201A WAC, *Water Quality Standards for Surface Waters of the State of Washington*, Amended

November 20, 2006 (Water Quality Standards) and in 40 CFR Part 131 *Water Quality Standards*, Section 131.36, known as the National Toxics Rule. The National Toxics Rule does not apply to those substances which were already included in our Water Quality Standards at the time the Rule was adopted. The Water Quality Standards consist of the following three key parts.

Part I

Part I of the standards contains the purpose and definitions.

Part II

Part II of the standards defines the designated uses of surface waters and the in-stream criteria necessary to protect those designated uses. The four categories of uses are aquatic life, shellfish harvesting, recreational uses, and miscellaneous. Within these categories there are subcategories and the criteria necessary to support those uses. The criteria within a subcategory or classification are numerical values or narrative statements. The conventional and historical parameters are dissolved oxygen, fecal coliform, dissolved gas saturation, temperature, pH, and turbidity. A map application assists Ecology staff in identifying the designated uses on a water body and their associated numeric criteria. The application and instructions are found at: https://fortress.wa.gov/ecy/waterqualityatlas/StartPage.aspx.

Toxic substances are addressed through both narratives statement and numerical criteria. Toxic criteria apply to all uses of waters.

Many of the numerical values of the criteria are dependent on other water quality parameters such as pH, temperature and hardness. Some values have duration periods specified as instantaneous values, 1-hour averages, 24-hour averages or 4-day averages. A summary of duration periods by parameter is available in Appendix C, Table C-2 of this manual.

Silver is given in our standards as an instantaneous value not to be exceeded. Implementation of silver is the same as an acute one hour average exposure.

The chronic aquatic life criterion for mercury is based on accumulation of methylmercury in aquatic organisms. Permit writers should use the chronic criterion for mercury just like all other chronic criteria.

In addition to the specific numerical criteria, the State Water Quality Standards state that the Gold Book may be used as a source of information for determining the toxicity of substances not specifically listed in the standards [(173-201A-240(4) and (5)].

The key narrative criteria of the Water Quality Standards are:

- Toxic, radioactive, or deleterious material concentrations must be below those which have the potential, either singularly or cumulatively, to adversely affect characteristic water uses, cause acute or chronic conditions to the most sensitive biota dependent upon those waters, or adversely affect public health (see WAC 173-201A-240, toxic substances, and 173-201A-250, radioactive substances).

- Aesthetic values must not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch, or taste (see WAC 173-201A-230 for guidance on establishing lake nutrient standards to protect aesthetics).

Part III

Part III of the Water Quality Standards is the antidegradation policy and process. Three levels of protection are described. Tier 1 is a statement of policy that existing and designated uses will be protected. Tier 2 is most applicable to permit writers. Tier 2 is applicable to new dischargers or any discharger increasing pollutant loading which then causes a measurable degradation (concentration exceeding detection levels) of the receiving water (boundary of the chronic zone for those pollutants with near field effects). Measurable degradation is defined in regulation for temperature, dissolved oxygen, bacteria, pH, and turbidity. The increase in pollutant loading must be shown to be necessary and in the overriding public interest. Generally, the tier II analysis should be conducted by the permittee as a companion to an engineering report.

Implementation of antidegradation for general permits requires Ecology to describe in the fact sheet how new stormwater pollutant control technologies will be incorporated into the permit [(WAC 173-201A-320(6)].

The detailed guidance for antidegradation is available in *Water Quality Program Guidance Manual: Supplemental Guidance on Implementing Tier II Antidegradation*, Ecology Publication 11-10-073.

The Water Quality Standards also contain some specific directives for permit managers. These include the requirements that:

- Permits be conditioned such that the discharge will not cause a violation of the standards [WAC 173-201A-510(1)],
- Permits are subject to modification if a permitted discharge is discovered to be causing a violation of the standards [WAC 173-201A-510(1)(b)], and
- No waste discharge is allowed to: the Cedar River (RM 21.6 to headwaters), the Green River (RM 59.1 to headwaters), Mill Creek (RM 25.2 to headwaters), the Sultan River (RM 9.4 to headwaters), the Tolt River (RM 6.9 to the headwaters), the Union river and tributaries (RM 6.9 to the headwaters), and the Wishkah River and tributaries (RM 32.0 to the headwaters) [WAC 173-201A-602]. These river sections are preserved as sources of drinking water.

There are also many other special waterbody-specific special conditions listed in Sections 602 and 612 concerning fecal coliform, temperature and dissolved oxygen.

See Chapter 7 for a discussion of the criteria to protect human health. Permit writers can find a discussion on intake credits as an implementation tool for application of the human health criteria in Chapter 7, Section 7.

1.2 Conversion Factors and Translators for Metal Criteria

In the 1992 revision of the Washington Water Quality Standards, the metals criteria were changed from being expressed as total to expression as dissolved. The conversion was accomplished using the **conversion factors** recommended by EPA at the time. The conversion factors recommended by EPA were ratios observed in laboratory testing. The conversion did not make the criteria more or less stringent but simply expressed them in the form believed to be toxic. These conversion factors become part of the formula for calculating the criteria. The current criteria are given in permit tool PermitCalc.xlsm.

Conversion of the metal criteria to the dissolved form created a problem for permit writers because federal regulation (40 CFR 122.45(c)) requires that effluent limitations for metals be in the form of total. The permit writer then needs a **translator** to conduct a determination of reasonable potential or derive effluent limits. The translator is used to predict the dissolved to total fraction that will occur in the receiving water from the total metal in the effluent.

Ecology permit writers should use one of the following as a translator, in the following order of priority depending on the circumstances:

1. Use the measured fraction of dissolved to total measured in the receiving water during critical condition.
2. If there is no data on the dissolved fraction in the receiving water but there is TSS data on the receiving water use the TSS-dissolved fraction relationship described in Table 10 below for copper and zinc. Use the appropriate fraction for Cd and Pb from Table 10.
3. If there is no receiving water data on ratios or data on TSS, use the appropriate dissolved fraction from Table 10 for cadmium, copper, lead and zinc. For other metals, use the conversion factor as the translator. PermitCalc.xlsm will calculate the appropriate translator (see Appendix C). A facility/receiving water-specific translator may be used if the appropriate experimentation is conducted.

Table 10. Recommended Estimates of the 90th and 95th Percentiles of Ambient Dissolved Fractions (f_d) of Cd, Cu, Pb, and Zn Based on Data from Rivers in Washington

Regressions assume TSS in mg/l. From Pelletier, 1996.

	90th percentile of f_{d*}	95th percentile of f_d
Cd	0.898	0.943
Cu	if seasonal TSS<6.7 mg/L: 1 if seasonal TSS $\geq$ 6.7 mg/L: $1.91*TSS^{-0.341}$ if no TSS data: 0.968	if annual TSS<11.4 mg/L: 1 if annual TSS $\geq$ 11.4 mg/L: $2.29*TSS^{-0.341}$ if no TSS data: 0.996
Pb	0.340	0.466
Zn	if seasonal TSS<4.9 mg/L: 1 if seasonal TSS $\geq$ 4.9 mg/L: $1.44*TSS^{-0.231}$ if no TSS data: 0.965	if annual TSS<12.5 mg/L: 1 if annual TSS $\geq$ 12.5 mg/L: $1.79*TSS^{-0.231}$ if no TSS data: 0.996

*The 90th percentile values are used if the TSS data is from the critical season. The 95th percentile values are used if the data are not stratified by season.

Waste-specific translator

The translators described above assume a near-instantaneous equilibrium of the metal in the receiving water. This may be a valid assumption for metals bound to the light floc discharging from secondary treatment. Other wastewaters, such as from physical chemical treatment may have metals tightly bound in the solids fraction and the conversion to dissolved form occurs slowly. A discharger may be allowed to develop a waste-specific translator if the permit writer agrees. When allowing waste-specific translator development, permit writers should work with the WQ Standards unit for assistance in development of the QAPP and experimental design.

1.3 Site-Specific Water Effect Ratio

Footnote dd to Table 240(3) mentions the use of the water effects ratio to adjust metal criteria on a site-specific basis. This adjustment currently requires an amendment to the Water Quality Standards and therefore can only be granted for exceptional circumstances. Permit writers should contact the Watershed Management Section for more information.

2. The Point of Compliance of the Water Quality Standards

The Water Quality Standards allow the use of mixing zones for discharges that would otherwise exceed the water quality criteria for aquatic life. Mixing zones are areas where the water quality standards may be exceeded but the exceedances are small enough and short enough so as not to interfere with beneficial uses. Mixing zones are a regulatory recognition that the concentrations and effects of most pollutants diminishes rapidly after discharge due to dilution. They are established in a manner which limits the duration of exposure for organisms passing through the effluent plume in order to minimize the risk from each discharge.

The water quality standards for chronic protection must be met at the boundary of this zone and beyond. A smaller zone in which acute criteria may be exceeded can also be authorized. This zone must be small enough to limit exposure times and therefore not cause acute mortalities or interfere with passage of aquatic organisms in the water body.

An intermediate goal in point source pollution control which is consistent with the CWA goal of zero discharge is the elimination of the need for a mixing zone.

The water quality standards do not prohibit a permit writer from granting a mixing zone for a shore discharge, but shore areas are important biological areas. A permit writer should be sure that granting of the mixing zone on a shoreline will not cause biological effects as specified in the regulation. This may require a demonstration on the part of the permittee in some cases.

2.1 General Considerations for Authorizing Mixing Zones

The authorization of a mixing zone (chronic) is subject to some conditions, as given in the Water Quality Standards.

1. The allowable size and location shall be established in discharge permits or orders.

A discharger does not receive a mixing zone unless it is specifically authorized in a permit or order. Any discharger whose effluent exceeds the water quality criteria and has not been authorized a mixing zone is in violation of the water quality standards. For marine waters the permit writer should authorize, as necessary, some distance around the point of discharge and place this in the permit. The fact sheet should discuss the distance, the dilution factor that results from this distance and the method of deriving the dilution factor. A diagram of the mixing zone and a map of location are helpful for the fact sheet reader. For fresh water, the permit writer should authorize some distance or some volume fraction of the receiving water, whichever is more stringent, and discuss the selection in the fact sheet.

2. The discharger shall be required to fully apply AKART prior to being authorized a mixing zone

This is the technology-based limit process described in Chapter 4. In some instances a pollutant may not have been addressed in the derivation of the technology-based limits for a discharger. For example, municipal discharges have technology-based limits for BOD, TSS, fecal coliform and pH in regulation and this has been determined to be AKART (Chapter 173-221 WAC). This regulation does not address ammonia or chlorine and therefore ammonia and chlorine should be addressed on the design basis or on a water quality basis.

3. Consider critical discharge conditions

The receiving water critical condition is generally defined in the Water Quality Standards. Design conditions are discussed in more detail later in this section.

4. Not cause loss of sensitive or important habitat

Generally, permit managers have little data on the physical and biological characteristics of the receiving water and must meet the intent of this section by limiting the size of the mixing zone and conditioning permits to meet water quality standards.

5. Not exceed criteria past the boundary of the mixing zone

The process of deriving effluent limits described later in this chapter will ensure the water quality standards are not exceeded past the mixing zone boundary or flow restriction.

6. The mixing zone size and the pollutant concentrations shall be minimized

Mixing zones are minimized by the design factors given in Table 11.

A mixing zone is typically sized for the pollutant with the largest potential to violate water quality standards. Mixing zones may be authorized and sized for individual pollutants.

7. Maximum size specifications (Chronic)

In rivers and streams the maximum mixing zone boundary is 300 feet downstream plus water depth at critical condition. The dilution factor to use in calculating effluent limits for protection of the chronic criteria is the more restrictive of 1) twenty-five percent (25%) of the flow at critical condition or 2) the center line dilution factor occurring at the downstream boundary of the authorized mixing zone (Figure 18) as determined by use of a hydraulic mixing model.

In estuaries the maximum mixing zone boundary is 200 feet plus water depth at MLLW in any horizontal direction (Figure 19).

In oceanic waters the maximum mixing zone boundary is 300 feet plus water depth at MLLW in any horizontal direction (Figure 20).

8. Zone of acute criteria exceedance

This zone can only be authorized if it will not create a barrier to the migration or translocation of indigenous organisms to a degree that has the potential to cause damage to the ecosystem. If a permit is conditioned such that acute criteria are not exceeded past the boundary of this zone it can be assumed in the absence of information to the contrary that it will not cause a barrier.

In rivers and streams the maximum size of this zone is the more restrictive of the mixing occurring at 10% of the mixing zone distance (centerline) or 2.5% of the flow at critical condition.

In estuaries and oceanic waters the maximum size of this zone is 10% of the mixing zone horizontal distance. There is no vertical limitation on this zone.

2.1.1 Determining Mixing

A mixing zone may be a boundary around a point of discharge and a permit writer must know or be able to estimate the amount of mixing which occurs inside that area to determine the potential for a violation of the water quality standards and to derive effluent limitations if necessary.

The permit writer has three basic options for determining the amount of mixing occurring within a mixing zone:

1. Use a computer hydraulic simulation model to predict the amount of mixing. A permit writer has several models available for use if the input data is available or can be reasonably estimated. These models are discussed in Appendix C of this Manual and Section 4.4 of the TSD. The EA Program must be consulted before using these models unless the permit writer has a strong background in modeling.

2. Require the mixing analysis to be done within the permit. A permit writer may run a model using the best available data for determination of reasonable potential but also require a permittee to do a mixing analysis as a requirement of a regulatory order or as a requirement in the permit.

3. Require the mixing analysis as a part of the permit application. If a permit writer knows that a permit will be done in the next fiscal year, the mixing and other data necessary for making water quality determinations can be requested well in advance. The data that could be requested are mixing data, effluent data and ambient receiving water data. Producing this data may be beneficial to the discharger. For example, the multiplication factor for making a "reasonable potential" determination decreases with increasing number of data points.

Requiring the analysis as an order or permit application will slow the issuance of the permit. Requiring the analysis as a permit condition may mean the permit will have to be modified if the analysis leads to a different conclusion than what the permit conditions are based.

Saltwater discharges are modeled using steady state analysis and hydraulic models. These models require data on discharge depth, effluent flow rates, density of effluent, density gradients in the receiving water, ambient current speed, ambient current direction and outfall characteristics such as port size, spacing and orientation. The model output includes the dimensions of the plume at each integration step, time of travel to points along the plume centerline, and the average dilution at each point.

Guidelines for the selection of the appropriate mixing model are given in Appendix C.

In those permitting situations where input data is not available, the permit manager should require the permittee to develop the data and run the appropriate model. The requirements may be communicated in an order, as a part of the permit application, or within the permit. The EA Program can also do this as a requested project.

Where the hydraulic conditions at the discharge point are complex, such as in the tidal reach of a river, a dye or tracer study should be used to confirm the model output at the chronic compliance boundary.

The mixing analysis should determine centerline or minimum mixing at the compliance zone boundaries for unidirectional flow situations and flux average for multidirectional flow situations such as tidal areas.

For flowing fresh water the water quality standards require, for chronic mixing, the more stringent of the dilution factor that results from the mixing at the boundary of the assigned mixing zone at critical condition (usually 7Q10 flow) or effluent mixing with 25% of the 7Q10 flow. For acute mixing, the allowed mixing is the more stringent of the modeled mixing that occurs at the boundary of the acute compliance zone (10% of the chronic zone) at 7Q10 condition or 2.5% of the 7Q10. Exceptions to the size criteria for mixing zones (including the percent flow limitation) may be made in those circumstances where:

- The engineering report for the discharge was approved before November 24, 1992, or
- Where altering the size configuration would result in greater protection, or
- Where the effluent provides a greater benefit than removing it, if removing it is the only option, or
- Where the exceedance is clearly necessary to accommodate important social or economic development.

Before an exception can be made, it must be demonstrated to Ecology that:

- AKART is applied,
- All other options that are **economically achievable** are being utilized, ***and***
- Granting the exception would not have the **reasonable potential** to cause a loss of sensitive or important habitat, substantially interfere with the existing or characteristic uses of the water body, result in damage to the ecosystem, or adversely affect public health.

AKART is covered in Chapter 4, Part 3. A permit writer who makes a determination that a larger mixing zone is required or the percent of flow limitations are not applicable should discuss, in the fact sheet, the determinations of AKART, economically achievable options, and receiving water impacts. This determination should be discussed with the Watershed Planning Section.

2.1.2 Shellfish Protection

Ecology has a shellfish protection strategy in cooperation with the Department of Health (DOH) (Ecology 1984). Permit writers for marine dischargers should consult with DOH Shellfish Program to determine if the outfall is located in the general vicinity of shellfish resources, to gather other information about the discharge site, and to discuss dilution modeling.

The Shellfish Program of the Department of Health is responsible for establishing prohibited areas around the outfalls of wastewater dischargers in waters located near shellfish production areas. DOH utilizes many of the same assumptions used by Ecology in the selection of critical receiving water and effluent flow conditions. However, the area of interest to DOH for such discharges is far-field. Therefore, the results of modeling or field studies which stop at the edge of dilution zones are often inadequate in providing appropriate information to DOH in establishing shellfish prohibited areas in the far field.

Where shellfish beds are in the area of the discharge, the results from computer models or field studies should be extended to the farther field (usually in terms of several hundreds of yards). This initial screening may indicate a need to require the permittee to obtain additional information on receiving water conditions beyond the boundary of the dilution zone.

The Department of Health is also concerned about the discharge of human viral pathogens to shellfish beds from municipal treatment plants. They have asked that Ecology permit writers consider the following in developing municipal wastewater discharge permits:

- The efficiency of UV disinfection decreases with increasing tube age.
- The standard UV dosage is 16 milliwatt-seconds per square centimeter, however, some reactivation of bacteria occurs with dosages less than 30 milliwatt-seconds per square centimeter.

The use of detention time in the discharge pipe may be considered when deriving effluent limits for chlorine.

2.1.3. Miscellaneous

Water Quality Standards in Tidal Rivers

In tidal rivers in which the salt water wedge reaches the discharge point, the permit manager may apply the salt water criteria.

Alternatively the permit writer may apply the following process if the information is available:

> Where 95 percent of the vertically averaged daily maximum salinity values are less than or equal to one part per thousand the freshwater criteria are applied. Exceptions to this include dissolved oxygen in which the marine criteria apply at any point where the salinity is one ppt or greater and fecal coliform in which the marine criteria apply where the salinity is 10 ppt or greater.

Reflux in Tidal Rivers

In tidal rivers, some of the effluent that is discharged is carried back upstream during the flood tide (reflux). In conducting a mixing analysis for a tidal river, the permit manager should model as an outgoing current and then assume reflux reduces the dilution factor by 1/2. This is based on Ecology's studies of these situations. The permittee may supply information to show the factor is something else in their situation.

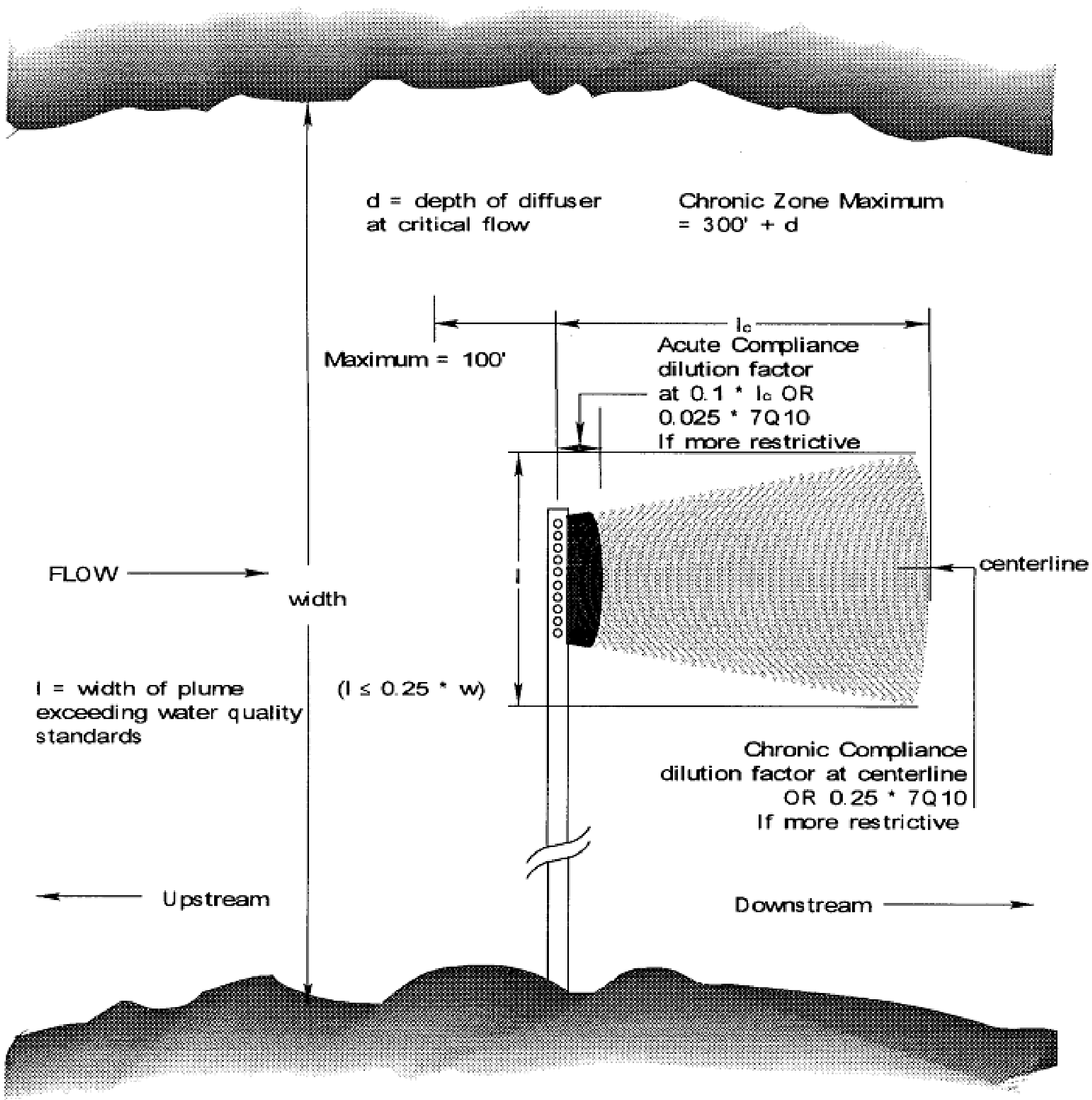


Figure 18. Mixing Zones in Rivers

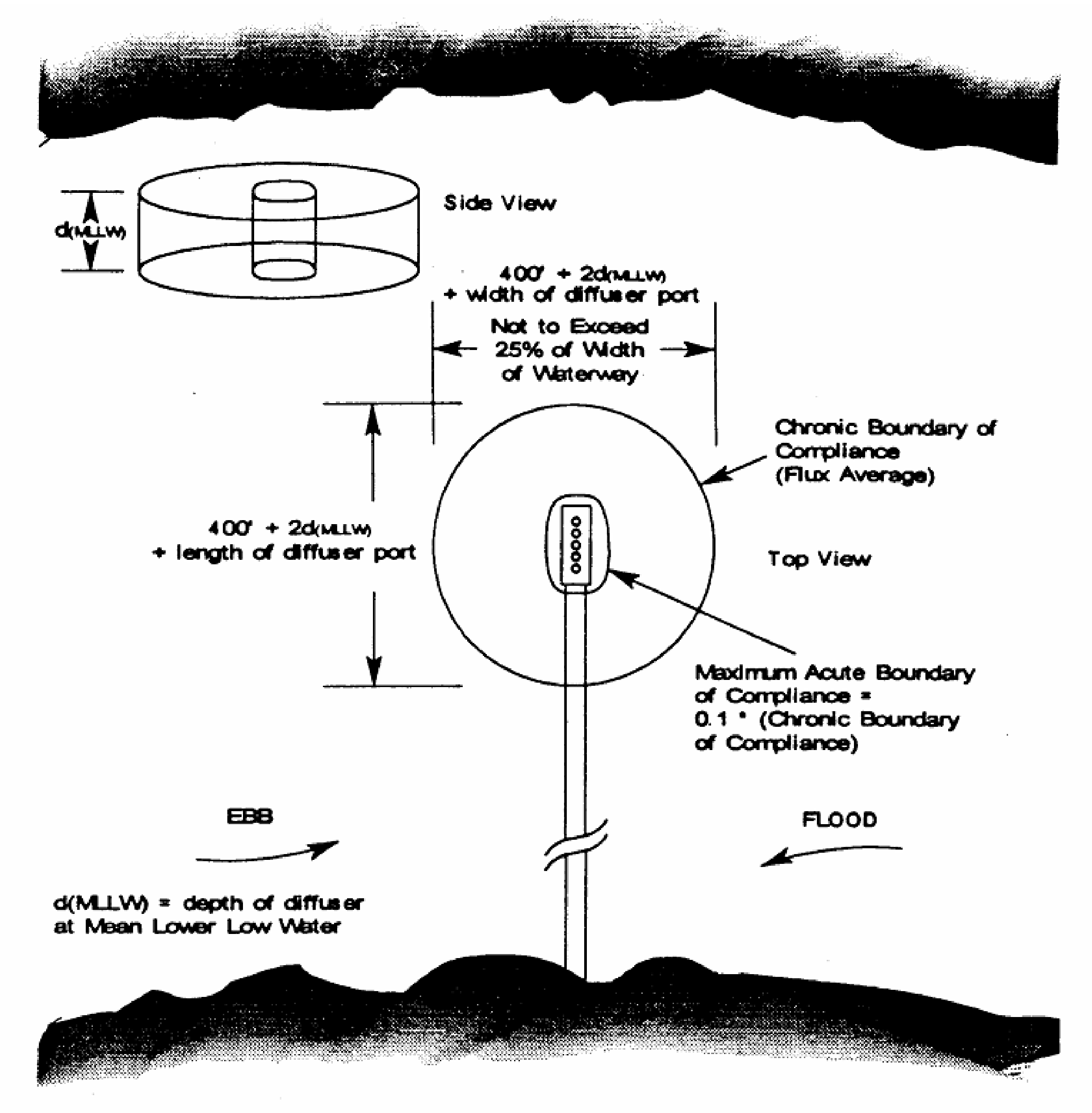


Figure 19. Mixing Zones in Estuaries

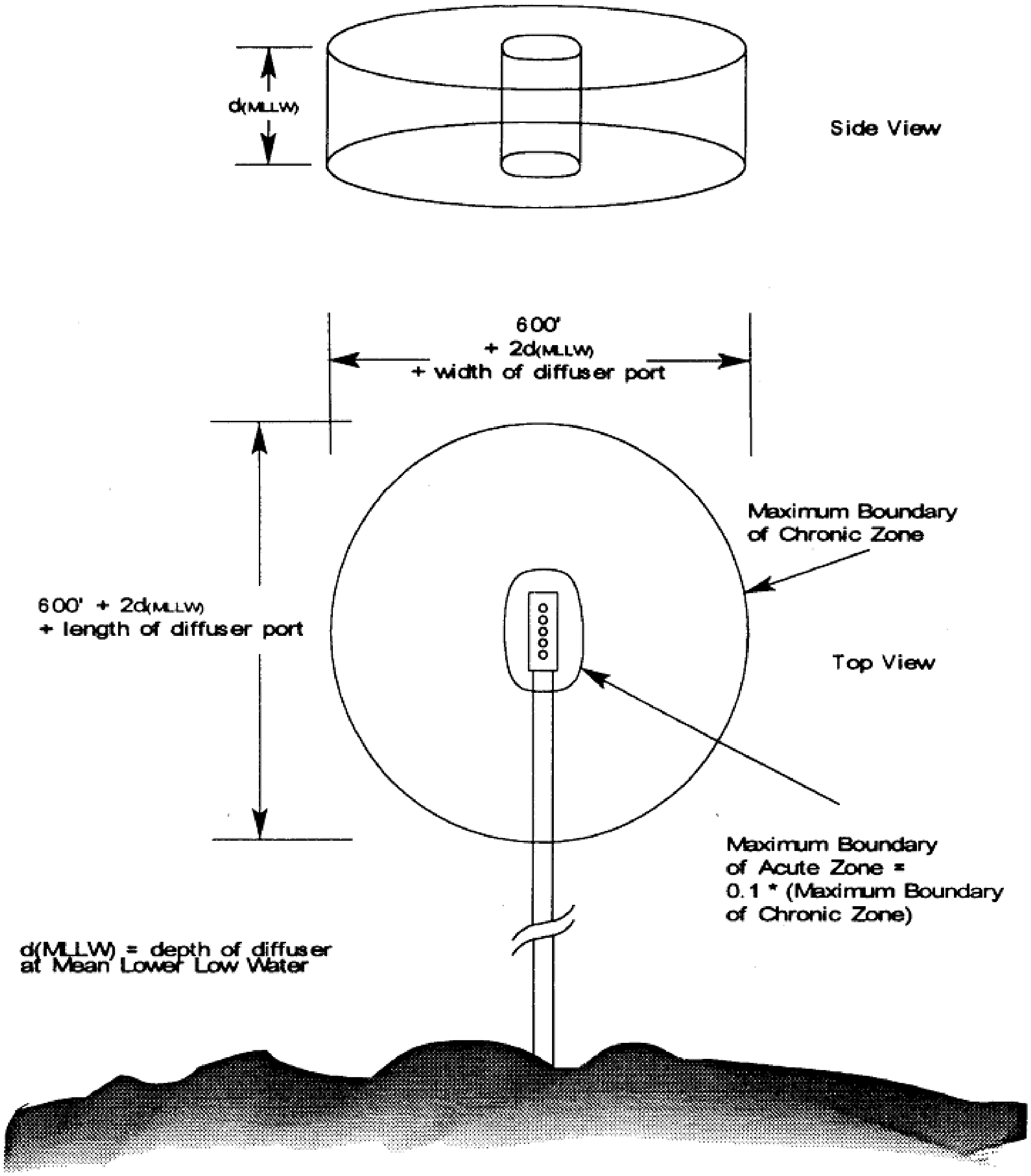


Figure 20. Mixing Zones for Oceanic Discharges

3. Predicting Impacts and Defining Effluent Limits for Numeric Criteria

The permit writer must make several decisions when developing effluent limits for a permit. One decision, noted previously, is whether or not technology-based effluent limits for a pollutant will protect the quality of the receiving water.

Generally, 2 types of analyses are done by the permit writer to predict impacts. One type of analysis is for pollutants such as BOD or nutrients which may cause an impact some distance from the point of discharge and for which mixing zones are not applicable. The other type of analysis examines the concentrations of specific pollutants or effects of pollutants within or at the edge of the mixing zone or the assigned dilution factor. These pollutants may be specific conventional, non-conventional, or toxic compounds.

Before performing site-specific analysis, the permit writer should remember to look first for any applicable wasteload allocations set by a TMDL. See Appendix E for more on TMDLs.

3.1 The Water Quality Impact of BOD and Nutrients

3.1.1 BOD

Biochemical oxygen demand (BOD) causes a depletion of dissolved oxygen in receiving water and consequently causes negative impacts on aquatic life and water quality in general. Many of the existing municipal and industrial permit conditions in Washington are based upon consideration of the water quality impact of BOD. In these cases, the treated effluent met the technology-based limitations but the small volume of receiving water warranted additional consideration.

In some cases, the dischargers were required to install advanced treatment to produce a lower effluent concentration of BOD. In other cases, they were required to change their point of discharge to new outfall locations or to land treatment during low flow periods.

The model used to predict dissolved oxygen deficit from BOD is the Streeter-Phelps equation (see PermitCalc, DOsag). The Streeter-Phelps equation has the basic form as follows:

Streeter-Phelps Equation:

$$D_t = DO_{sat} - DO_t$$
$$= [K_2BOD_u \div (K_1 - K_2)](10^{-K_2t} - 10^{-K_1t}) + D_o(10^{-K_1t})$$

Where:

D_t = dissolved oxygen deficit at any time t (days).
DO_{sat} = the dissolved oxygen level at saturation
DO_t = the dissolved oxygen level at any time t (days)
BOD_u = ultimate carbonaceous BOD of the stream immediately after mixing.
K_1 = reoxygenation rate constant (K_r).
K_2 = deoxygenation rate constant (K_d).
D_o = dissolved oxygen deficit immediately after mixing.

The impact of BOD is determined at the critical condition. The critical condition (design flow) for flowing freshwater is usually the 7-day average low flow with a recurrence interval of 10 years (7Q10). The critical period for marine waters is determined on a site-specific basis. The effluent design flow for industrial discharges is the highest monthly average flow for the past three years over the months when the 7Q10 is likely to occur.

The effluent design flow for municipalities depends on how close to the design flow the facility is operating. For those municipalities that are operating within 15% of the design capacity or are experiencing a rapid population growth use the dry weather design flow. For those facilities that are operating well below design flow and are expected to have a stable population over the permit cycle, use a projected average dry weather flow for the five year period. The projected flow can be estimated from trend analysis or population projections from the engineering report.

This model is for a determination of reasonable potential for violation of the dissolved oxygen criteria. If the model indicates a probable violation of the dissolved oxygen criteria in the receiving water, the permit writer should contact the EA Program for assistance in verification of the model or confirmation with more sophisticated models.

3.1.2 Nutrients

Nutrients are another class of pollutants which would be examined for impacts at some point away from the discharge. The special concern is for those water bodies quiescent enough to produce strong algae blooms. The algae blooms create nuisance conditions, dissolved oxygen depletion, and toxicity problems (i.e., red tides or blue-green algae). High nutrient concentrations can also create nuisance conditions in flowing waters. The impact of nutrients is very difficult to predict and usually there are several point and nonpoint sources contributing to a nutrient problem. The Water Quality Standards contain recommendations for total phosphorus concentrations for lakes in several ecoregions of the state. The Gold Book also contains some guidelines for phosphorus loading to freshwater streams and reservoirs. A permit manager should point out any suspected nutrient problems to the unit and section supervisor. Suspected water quality problems due to nutrients are best handled by a TMDL process conducted by the EA Program.

3.2 Other Specific Pollutants - Conventional and Nonconventional

This section addresses dissolved oxygen, fecal coliform, pH, turbidity, temperature, total dissolved gas and aesthetics. The design flow for dissolved oxygen, fecal coliform, pH, turbidity, and temperature is the maximum monthly flow which may be estimated for existing facilities by using the discharge data for a period of the last three years for the months in which the critical flow is likely to occur.

3.2.1 Dissolved Oxygen

An effluent may cause a violation of the dissolved oxygen criteria near the point of discharge from two components. If the effluent is low in dissolved oxygen it may cause a violation of the dissolved oxygen criteria near the point of discharge from mixing with receiving water. The effluent may also have chemical components which cause rapid oxygen depletion called Immediate Oxygen Demand (IDOD). For most discharges the IDOD is not significant relative to the effect of mixing of the effluent, containing a low concentration of dissolved oxygen, with the receiving water.

The process for calculating dissolved oxygen concentration following initial dilution is a simple mixing calculation found in PermitCalc. This process requires data on the dissolved oxygen concentration of the effluent, the receiving water at the critical period and the dilution factor. The point of compliance is the chronic mixing zone boundary and the receiving water design concentration is the 10th percentile dissolved oxygen concentration.

3.2.2 Pathogenic Bacteria

Ecology uses fecal coliform (fc) and enterococci bacteria (en) as indicator organisms for the control of pathogenic bacteria in wastewater effluent. Fecal coliform is limited on a technology basis in municipal permits to 200 colonies/100 ml as a monthly geometric mean and 400 as a weekly geometric mean. This limit is based on the performance of standard disinfection treatment processes. It is a promulgated performance standard in Chapter 173-221 WAC.

The water quality criteria for fecal coliform are quantified on a geometric mean of the number of colonies per 100 mL with an additional 10% or single sample limit (in parenthesis below). They are based on the probable exposure to pathogenic bacteria causing intestinal upset. EPA finalized new recommended recreational criteria based on Enterococci and Escherichia coli in 2012. Ecology will review the new recommendations and consider an update to the criteria.

The criteria are:

Extraordinary Primary Contact Recreation	freshwater	50 (100)/100 mL fc
Shellfish and Primary Contact Recreation	marine	14 (43)/100 mL fc
Primary Contact Recreation	freshwater	100 (200)/100 mL fc
Secondary Contact Recreation	freshwater	200 (400)/100 mL fc
Secondary Contact Recreation	marine	70 (208)/100 mL en

The point of compliance for the fecal coliform standard is at the boundary of the chronic mixing zone if one is allowed. The design flow for application of the standard is the 7Q10 low flow for flowing freshwater and the 50th percentile current velocity for marine.

Permit writers must demonstrate that the technology-based limits will protect water quality and address any human exposure within the mixing zone. Water quality limits analysis may be accomplished with one of the following methods:

1. Use technology-based limits; show that effluent fecal coliform of 400/100 ml with simple mixing meets the lower WQ standard of 14/100 ml (marine) or 100/100 ml (fresh). This is the method in PermitCalc. For marine water, chronic dilutions over 30 with zero background (45 with 5/100 ml background) will meet the shellfish water quality standards.

2. Set a limit equal to the WQ standard of 100/100 ml as a daily maximum and 200/100 ml as a monthly geometric mean (fresh water only). This minimizes the mixing zone and may be appropriate for fresh water dischargers with reliable UV disinfection.

3. Calculate a daily maximum and monthly geometric mean using the simple mixing spreadsheet with the chronic dilution factor and background data.
   a. Adjust the “Effluent Fecal Coliform” entry until the result at the mixing zone boundary meets the one-sample WQ standard of 43/ml (marine) or 200/ml (fresh). Use the results as a daily maximum limit.
   b. Adjust the “Effluent Fecal Coliform” entry until the result at the mixing zone boundary meets the geometric mean WQ standard of 14/ml (marine) or 100/ml (fresh). Use the lower number of this result, or the technology-based limit, as a monthly geometric mean.

4. Calculate a daily max and monthly average using TSD statistical methods (EPA, 1991).
   a. Calculate a maximum daily limit (MDL) as in 3.a. above.
   b. Calculate long-term average (LTA) and average monthly limit (AML) using actual effluent coefficient of variation and number of samples/month.
      i. LTA_c – Chronic long-term average – $MDL/\exp(z_{99}\sigma-0.5\sigma^2)$
      ii. AML – Average Monthly Limit – $LTA_c*\exp(z_{95}\sigma_n-0.5\sigma_n^2)$

The options above apply to primary contact marine and fresh waters. Use other methods, or modify the above as appropriate in situations where other water quality criteria apply.

3.2.3 pH

The pH in most permits in Washington is limited to a range of 6.0 to 9.0 unless pH has been defined by the federal effluent guidelines as a process pollutant. The range of pH 6.0 to 9.0 in permits for most dischargers is based on the demonstrated performance of simple equalization or neutralization. Unless pH is a process pollutant, the discharge of effluent outside this range generally indicates spills or treatment plant upset.

The criteria for pH in the water quality standards restrict the pH change caused by a source to 0.2 units for core summer salmonid habitat and within a range of 6.5 to 8.5. The point of compliance with the pH standard is the boundary of the chronic dilution zone at 7Q10 or critical condition.

The resultant pH of a mixture of two flows is calculated by processes described in EPA (1988). A spreadsheet for the calculation is found within PermitCalc.

Modeling of freshwater discharges is usually unnecessary unless the effluent pH is above 8 and the receiving water is poorly buffered or unless the volume of the discharge is very large.

Source-caused pH changes are seldom a problem in salt water because of the high buffering capacity of sea water. A spreadsheet within PermitCalc is available to predict pH effects of a point source discharge.

3.2.4 Turbidity

Turbidity is not a parameter generally considered in point source discharges except for water treatment back flush wastewater. Control of particulates as total suspended solids in an effluent usually results in low turbidity. However, depending on the size of the particulates and the pore size of the filter media used to determine TSS, some effluents may cause some turbidity in the receiving waters while meeting TSS limits. Turbidity does not have a linear response to dilution. Any data that indicate a violation of water quality standards should be verified in the receiving water.

3.2.5 Dissolved Gas Supersaturation

The Watershed Management Section monitors compliance with dissolved gas supersaturation. Dam operators can control dissolved gas by controlling the amount of spillage. The design condition for dissolved gas is the 7Q10 high flow (7Q10hf). During these very large natural runoff events, the resulting high flows make it impossible for dam operators to abate for dissolved gas. Guidelines for deriving the 7Q10 high flow are in Appendix B, Section 3.

3.2.6 Temperature

Temperature in the water quality standards has multiple criteria and requirements. These include:

1. Annual summer maximum threshold criteria.
2. Supplemental spawning-season criteria.

3. Incremental warming restrictions.
4. Protections against acute effects.
5. Antidegradation requirements.

1. *Annual summer maximum threshold criteria.*

   In freshwater, each of eight categories has a 7-day average daily maximum (7-DADmax) upper temperature limit and a maximum allowable rise. See the table below from WAC 173-201A.

Table 200 (1)(c) Aquatic Life Temperature Criteria in Fresh Water	
Category	*Highest 7-DADMax*
Char Spawning	9°C (48.2°F)
Char Spawning and Rearing	12°C (53.6°F)
Salmon and Trout Spawning	13°C (55.4°F)
Core Summer Salmonid Habitat	16°C (60.8°F)
Salmonid Spawning, Rearing, and Migration	17.5°C (63.5°F)
Salmonid Rearing and Migration Only	17.5°C (63.5°F)
Non-anadromous Interior Redband Trout	18°C (64.4°F)
Indigenous Warm Water Species	20°C (68°F)
Category	*Highest 1-DMax*
Extraordinary quality	13°C (55.4°F)
Excellent quality	16°C (60.8°F)
Good quality	19°C (66.2°F)
Fair quality	22°C (71.6°F)

In marine water, the categories have a 1 day maximum (1-DMax).

Aquatic Life Temperature Criteria in Marine Water	
Category	*Highest 1-DMax*
Extraordinary quality	13°C (55.4°F)
Excellent quality	16°C (60.8°F)
Good quality	19°C (66.2°F)
Fair quality	22°C (71.6°F)

2. *Supplemental spawning-season criteria.*

In some waters, a second threshold criterion is assigned to protect the spawning and incubation of salmonids (9°C for char and 13°C for salmon and trout) [WAC 173-201A-200(1)(c)(iv)], and Ecology publication [06-10-038]. These criteria include explicit date-windows for application, and must be applied in addition to the annual summer maximum criteria discussed above. For fresh water bodies identified in Part VI of the standards the following are applicable:

- Maximum 7-DADMax temperatures of 9°C (48.2°F) at the initiation of spawning and at fry emergence for char; and,
- Maximum 7-DADMax temperatures of 13°C (55.4°F) at the initiation of spawning for salmon and at fry emergence for salmon and trout.

3. *Incremental warming restrictions.*

In addition to the criteria discussed above, the water quality standards limit the amount of warming human sources can cause at any time water temperatures are cooler than the assigned threshold criteria. This criteria is designed to provide protection for the overall temperature regime [See WAC 173-201A-200(1)(c)(ii), 210(1)(c)(ii)].

- At any time the background temperature is cooler than the assigned threshold criterion, point sources are permitted to warm the water by only a defined increment, *t*.

  Calculate *t* as follows:
  - $t = 28/(T_{ambient} + 7)$ in freshwaters, or
  - $t = 12/(T_{ambient} – 2)$ in marine waters.

4. *Protection against acute effects*

- Moderately acclimated (16-20°C, or 60.8-68°F) adult and juvenile salmonids will generally be protected from acute lethality resulting from discrete human actions by maintaining the 7-DADMax temperature at or below 22°C (71.6°F) and the 1-day maximum (1-DMax) temperature at or below 23°C (73.4°F).

- Lethality to developing fish embryos can be expected to occur at a 1-DMax temperature greater than 17.5°C (63.5°F).
- To protect aquatic organisms, discharge plume temperatures must be maintained such that fish could not be entrained (based on plume time of travel) for more than two seconds at temperatures above 33°C (91.4°F) to avoid creating areas that will cause near instantaneous lethality.

3.2.6.1 Determining Reasonable Potential for Temperature

Permit writers should first determine if an applicable temperature TMDL has been approved, or is in development, before conducting reasonable potential analysis. If an approved TMDL exists, reasonable potential does not need to be established. WLAs in the TMDL must be used to determine appropriate water quality-based effluent limits.

The process of determining reasonable potential is similar to other pollutants except no transformation or prediction of the 95th percentile is required. Figure 21 below illustrates the administrative process. PermitCalc contains spreadsheets for determining reasonable potential and effluent limits for temperature, when required. A companion document explaining temperature implementation is available on the Water Quality web site (Ecology Publication 06-10-100).

Guidance for permittees to conduct temperature sampling and a model QAPP are available.

Permit writers should realize that in cases where dilution factors are approximately six or less, an effluent limit derived for the critical mid-summer or supplemental period may cause a slight exceedance of the incremental allowance during the winter time. This probability of exceedance depends on changes in dilution factor and effluent temperature from summer to winter. The incremental restriction was formulated to prevent a change of temperature regime in situations where the ambient temperature was well below the criteria. An incremental rise of 1 or 2 degrees Celsius is well within the normal daily fluctuation in mid-winter and will not cause a change in the temperature regime.

Table 11. Effluent and Receiving Water Design Conditions for Temperature

Chronic criteria	
Ambient background temperature[1]	90th percentile annual maximum 7DADMax, or 90th percentile of annual maximum 1DMax; whichever matches the criterion.
Ambient flow	7Q10 for critical periods: ▪ July-Aug for summer criteria ▪ First month of any fall supplemental spawning criterion and last month of any spring supplemental spawning criterion.
Effluent temperature[2]	95th percentile (0.05 probability) of 7DADMax, or 95th percentile of 1DMax; whichever matches the criterion.
Effluent flow	Selected from Table 12 of the Permit Writer's Manual.
Acute criteria	
Ambient background temperature[1]	90th percentile annual maximum 1DMax, or 90th percentile annual maximum 7DADMax; whichever matches criterion.
Ambient flow	7Q10 for critical periods: ▪ July-Aug for summer criteria ▪ First month of any fall supplemental spawning criterion and last month of any spring supplemental spawning criterion.
Effluent temperature[2]	99th percentile (0.01 probability) of 1DMax, or 99th percentile of 7DADMax; whichever matches the criterion.
Effluent flow	Selected from Table 12 of the Permit Writer's Manual.

[1] The highest annual upstream ambient temperature (1-DMax or 7-DADMax, whichever matches the criterion) observed from 3 or more years of monitoring (1/2 hour measurement for the period) should be used to represent the 90th percentile background receiving water temperature when limited data are available.

[2] The highest annual effluent temperature (1-DMax or 7-DADMax, whichever matches the criterion) observed from 3 or more years of monitoring should be used to represent both the 95th and 99th percentile effluent temperature when limited data are available.

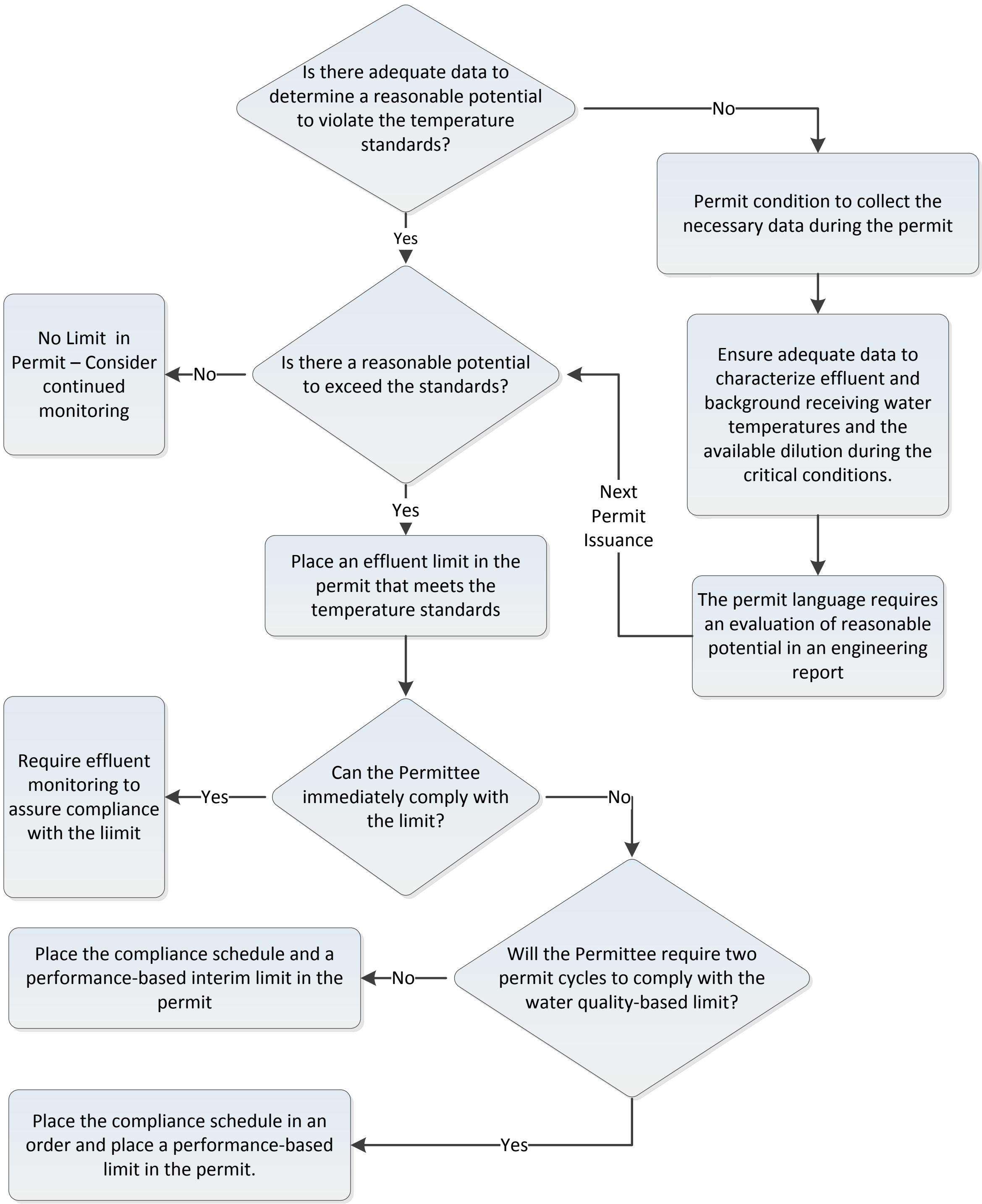


Figure 21. Decision Process for Temperature

3.2.7 Aesthetics

The Water Quality Standards require that aesthetic values shall not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch, or taste. These values will, of course, be mostly considered for new discharges or when a complaint has been received on an existing discharge. Examples of measures that could be required of a discharger to preserve aesthetic values include:

- Control of oil sheens,
- Submerged discharges, and
- Locating the discharge away from sensitive locations/persons.

3.3 Deriving Effluent Limits for Toxic Pollutants, as Seasonal Limits and for Impaired Waters

Defining water quality impacts and developing effluent limits is usually more complex for toxic pollutants than for the other pollutants. As noted in the earlier discussion on water quality criteria and standards, the toxic numerical criteria are given at two levels (acute and chronic) each of which contains three components (magnitude, duration, and frequency). The analysis to predict water quality impacts and thus to define effluent limits must be conducted for both acute and chronic criteria in order to define the most limiting criteria. Many of the criteria for toxic pollutants are variable and depend on receiving water conditions. This section covers these subjects and others and presents an example of how to develop effluent limits for toxic pollutants. For discharges to impaired waters, read Section 3.3.11 first.

Whole effluent toxicity (WET) is evaluated separately and explained in Section 5 of this chapter. After determining a technology-based limit for a toxic pollutant, the permit manager must decide if the limit will cause the discharge to meet the water quality standards**.** Federal regulations require the permit manager to determine whether a discharge has a reasonable potential to violate water quality standards and if so to place a water quality-based effluent limit in the permit (40 CFR 122.44). To determine this, the permit manager must know the criteria, the background concentration**,** the point of compliance, design flows for the receiving water and effluent flow, how to deal with multiple pollutants and effluent variability and the process of developing an effluent limit.

The EPA document, *Technical Support Document for Water Quality-based Toxics Control* EPA/505/2-90-001, is the basic reference document for the rest of this chapter and it is assumed that the permit manager has read it. The rest of this chapter will focus on Washington's process and will not review the background material which is presented in the Technical Support Document (TSD).

3.3.1 Points of Compliance

The points of compliance for toxic pollutants are the same as discussed previously in this chapter. A permit manager may authorize a mixing zone as necessary with the size and other restrictions as specified in the water quality standards for acute and chronic criteria.

3.3.2 Design Flows

The design flows for effluent and receiving water have been discussed above for some pollutant parameters. They are summarized in Table 12.

The traditional receiving water design flow or critical condition for steady state modeling of pollutant discharge such as BOD to freshwater is the 7-day low flow period with a recurrence interval of 10 years (7Q10). This flow is typically when the least amount of mixing occurs, temperature is the highest, and dissolved oxygen is the lowest. Ecology will use the 7Q10 as the design flow for the acute and chronic toxic criteria also. The permit manager should use this design flow unless another design flow is more suitable because of the nature of a particular pollutant or receiving water.

For saltwater discharges the critical mixing condition is defined according to the characteristics of the receiving water such as tidal exchange, river inflow, stratification by temperature and salinity, the characteristics of the outfall location, and the characteristics of the effluent such as temperature and salinity. It may be necessary to run a computer simulation of the discharge and receiving water to determine critical condition.

3.3.3 Criteria Vary with Background Conditions

Some criteria vary with other chemical or physical parameters. For example, the aquatic life criteria for some metals in freshwater vary with hardness of the receiving water. The criterion for ammonia varies with temperature and pH. The critical period for ammonia is often difficult to calculate because the criterion varies on the two parameters. The EA Program or the Program Development Services Section can assist if the permit manager has difficulty.

3.3.4 Multiple Pollutants

Each toxic pollutant in a single discharge is considered independently. Many toxic pollutants are interactive but any additive or synergistic effects are difficult to predict. Interactive effects in a single effluent will be detected with whole effluent toxicity testing. The chance for interactive effects is reduced by not allowing overlap of acute compliance zones and by not allowing the overlap of mixing zones for the same parameters.

3.3.5 Effluent Variability (Coefficient of Variation)

A permit manager must have an estimate of variability to determine reasonable potential and to calculate a permit limit. The estimator of variability which is most commonly used is the coefficient of variation (CV). The CV is the ratio of the standard deviation to the mean. The best estimate of effluent variability can be derived from a set of results from random effluent samples for the toxic parameter.

As a general rule of thumb, because the distribution of values from wastewater treatment is non-normally distributed, any number of samples less than 20 is probably not valid as a predictor of distribution. The number of samples required depends on the true variance of the population being sampled which is usually not predictable except by sampling.

For sample sizes less than 20 use the default CV of 0.6, which was derived by EPA on a large database of municipal effluent. The spreadsheet PermitCalc has a default CV of 0.6.
A permit writer may be able to obtain a value for variability from the development document for the category of discharger.

The permit writer may calculate an effluent CV if data is available. Non-detect concentrations in the data set may be estimated by using one half of the detection level or estimation techniques described by Gilbert (1987) or EPA (1991).

3.3.6 Background (Receiving Water) Data

Permit writers should identify the need for background receiving water quality data. Information and data necessary to develop a water quality-based permit may be requested from the discharger by letter or order, or as a permit requirement. First, the permit writer should check Ecology's Environmental Information Management (EIM) database (https://fortress.wa.gov/ecy/eimreporting/Default.aspx) for data that may be acceptable for use in the analysis. Permit writers should also check with the appropriate regional Total Maximum Daily Load (TMDL) lead. TMDL leads may be aware of local data or monitoring projects underway that are not reflected in EIM.

Table 12. Applicable Criteria/Design Conditions for Determining the Acute and Chronic Dilution Factors for Aquatic Life

DESIGN CONDITIONS FOR MIXING ZONE/RATIO ANALYSIS - AQUATIC LIFE CRITERIA		
Parameter	**Mixing Zone**	**Critical Design Condition**
Plant Effluent Flow – Municipal	Acute	The critical plant effluent flow, for those plants operating at less than 85% of the dry weather design flow during the critical period, is defined as the highest daily maximum plant effluent flow for the past three years during the critical flow or when the critical condition is likely to occur. If the facility is operating between 85 and 100% of dry weather design flow during the critical period then use a peaking factor applied to dry weather design to determine acute design flow. The peaking factor is a ratio of daily maximum to monthly average flows derived from actual plant data during critical period. A peaking factor may also be available in the engineering report for the facility.
	Chronic	The critical plant effluent flow is defined as the dry weather design flow if the facility is operating between 85 and 100% of design during the critical period. If the facility is operating at less than 85% of design flow during the critical period the critical plant effluent flow is defined as the highest monthly average plant effluent flow for the past three years during the critical flow or when the critical condition is likely to occur.
Plant Effluent Flow – Industrial	Acute	The critical plant effluent flow is defined as the highest daily maximum plant effluent flow for the past three years during the critical flow or condition is likely to occur. If plant effluent flows are expected to increase during the life of the permit, the highest daily maximum flow must be estimated.
	Chronic	The critical plant effluent flow is defined as the highest monthly average plant effluent flow for the past three years during the critical flow or condition is likely to occur. If plant effluent flows are expected to increase during the life of the permit, the highest average monthly flow must be estimated.
Receiving Water (Characteristics)	Acute and Chronic-Freshwater	The critical receiving water current velocity is defined as the current velocity at both the 7-day low flow and high flow periods with a recurrence interval of 10 years (7Q10 by the appropriate statistical method). The diffuser depth is defined as the depth at the 7Q10 low flow period.
	Acute – Saltwater	The critical receiving water current velocity is defined as the critical 10th and 90th percentile current velocities derived from a cumulative frequency distribution analysis. The current velocity frequency distribution analysis should be conducted, at minimum, over one neap and spring tide cycle. The critical ambient density profile is defined as the density profile that results in the lowest mixing. The diffuser depth is defined as the depth at MLLW (marine waters) or at MLLW during a 7Q10 low flow period (tidally influenced freshwater regions).
	Chronic – Saltwater	The critical receiving water current velocity is defined as the 50th percentile current velocity derived from a cumulative frequency distribution analysis. The current velocity frequency distribution analysis should be conducted, at minimum, over one tidal cycle. The critical ambient density profile is defined as the density profile that results in the lowest mixing. The diffuser depth is defined as the depth at MLLW.

Miscellaneous Design Conditions for Mixing Zone/Ratio Analysis		
Parameter	**No. of Data Points**	**Methodology**
Maximum expected Receiving Water Concentration (Analytical Data)	1 to 20	The geometric mean of the receiving water values at time of critical condition should be multiplied by a factor of 1.74 to estimate the 90th percentile. This value should then be used in conjunction with the plant effluent data to evaluate reasonable potential to cause an exceedance of the criteria for aquatic life protection and derive effluent limits.
	Over 20	The critical background receiving water value is defined as the 90^{th} percentile value derived from a cumulative frequency distribution analysis of data from time of critical condition. This 90^{th} percentile background value should be used in conjunction with the plant effluent data to evaluate reasonable potential to cause a violation of the criteria for aquatic life protection and derive effluent limits.
Maximum Expected Effluent Concentration (Analytical Data)	1 to 20	Use the highest single effluent concentration, assume a coefficient of variation (CV) of 0.6 and use the reasonable potential multiplying factors from Table 3-2 of the TSD (page 57) to estimate the maximum expected effluent concentration (PermitCalc does this by formula). This value should then be used in conjunction with the background receiving water data to evaluate a reasonable potential to cause a violation of the criteria for aquatic life protection and derive effluent limits.
	Over 20	Calculate CV and the 95^{th} percentile effluent value. This effluent value should then be used in conjunction with the background receiving water data to evaluate a reasonable potential to cause a violation of the criteria for aquatic life protection and to derive effluent limits.
Dilution Factor unidirectional flows	N/A	Centerline for acute and chronic dilution.
Dilution Factor marine and rotating direction	N/A	Flux average for acute and chronic
Reflux	N/A	Assume reflux reduces the dilution factor by 1/2 in the absence of site-specific data.

Mixing Zone/Ratio Analysis - Point of Compliance	
Parameter	**Point of Compliance**
pH, DO, Fecal Coliform, Temperature	Compliance at the edge of the chronic mixing zone.
Human Health Criteria	Compliance at the edge of the chronic mixing zone.
Whole Effluent Toxicity and Numeric Criteria	Compliance at the edge of the acute dilution zone for acute WET/numeric criteria and at the edge of the mixing zone for chronic WET/numeric criteria.

Chronic design conditions are used for both the initial mixing and the far-field mixing calculations.

3.3.7 Determining Reasonable Potential

Ecology has adopted EPA's (1991) process of determining reasonable potential including their statistical assumptions for estimating the 95th percentile effluent concentration from a limited data set of effluent data.

The current version of the TSD (1991) documents EPA's assumptions in determining the multipliers to derive the 95th percentile effluent concentration based on a limited sample.

An alternate method for estimating quantiles from limited data sets with an assumed log normal distribution is presented in Gilbert (1987). This method produces an estimate of an upper percentile value that is a maximum likelihood estimator which is proportional to the geometric mean. This estimator is lower for limited data sets than the EPA estimator and is used for estimating the 90th percentile receiving water concentration when making determinations of reasonable potential for aquatic life criteria. The details of this method are given in Appendix B, Section 2.

3.3.8 Calculating the Effluent Limits

Water quality-based effluent limits are calculated by the two-value wasteload allocation process as described on page 100 of the TSD (EPA, 1991) and shown below.

1. Calculate the acute wasteload allocation WLA_a by multiplying the acute criteria by the acute dilution factor and subtracting the background concentration. Calculate the chronic wasteload allocation (WLA_c) by multiplying the chronic criteria by the chronic dilution factor and subtracting the background concentration.

   WLA_a = (acute criteria × acute zone dilution factor) - (background concentration × (acute zone dilution factor - 1))

   WLA_c = (chronic criteria × chronic zone dilution factor) - (background concentration × (chronic zone dilution factor - 1))

2. Calculate the long-term averages (LTA_a and LTA_c) which will comply with the wasteload allocations WLA_a and WLA_c.

   $$LTA_a = (WLA_a)(e^{[0.5\sigma^2 - z\sigma]})$$

   where:

   $\sigma^2 = \ln(CV^2 + 1)$

   $z = 2.326$

   $$LTA_c = (WLA_c)(e^{(0.5\sigma^2 - z\sigma)})$$

   where:

   $\sigma^2 = \ln[(CV^2 \div 4) + 1]$

   $z = 2.326$

3. Use the smallest LTA of the LTA_a or LTA_c to calculate the maximum daily effluent limit and the monthly average effluent limit.

Maximum Daily Limit = MDL

$$MDL = (LTA_{\min})(e^{(z\sigma - 0.5\sigma^2)})$$

where:

$\sigma^2 = \ln[CV^2 + 1]$
z = 2.326 (99th percentile occurrence probability)
LTA_{min} = smallest long-term average (LTA_a or LTA_c)

Average Monthly Limit = AML

$$AML = (LTA_{\min})(e^{(z\sigma_n - 0.5\sigma_n^2)})$$

where:

$\sigma_n^2 = \ln[(CV^2 \div n) + 1]$
n = number of samples/month
z = 1.645 (95th percentile occurrence probability)
LTA_{min} = smallest long-term average (LTA_a or LTA_c)

The numeric water quality standards and the dilution factors define wasteload allocations (WLA) for pollutants. The WLAs are numbers not to be exceeded in order to protect aquatic life. In the statistical world, however, there is no such thing as 100% certainty. Ecology uses an estimate of variability (coefficient of variation or CV) for these parameters in the effluent to define a distribution of values with a long-term average (LTA) such that there is a one percent probability (0.01) of exceedance of the WLA. There are two long-term averages defined for each parameter. One is for acute and one is for chronic.

Effluent limits for each parameter are defined for the more limiting of the acute LTA or the chronic LTA. Effluent limits are control parameters to determine when a process is out of control. A process is deemed out of control when the extreme values are higher than expected (expressed as the daily maximum limit) or the average is higher than expected (expressed as the monthly average limit). The 95% percentile (0.05 probability) used in calculating the average limit and the 99% percentile (0.01 probability) is used in calculating the daily maximum. These probabilities are the probability of determining the process is out of control when in fact the process is still in control.

The 95th percentile (0.05 probability) is used for calculating the average limit for the following reasons:

1. Exceedance of an average (average limit) indicates a more serious potential for environmental

harm than exceedance of a daily maximum. Even so, the Department rarely enforces the occasional exceedance of monthly average limit. Typically, enforcement occurs after several consecutive violations of the monthly average limit or when both the daily maximum and the monthly average have been exceeded. This effectively reduces the probability of false noncompliance to something far less than 0.05.

2. The Department also uses the 95th percentile (0.05 probability) because this is a recommendation of EPA in the TSD (EPA 1991).

3. The 95th percentile (0.05 probability) for monthly average was used for development of technology-based effluent limits when EPA developed the industrial effluent guidelines and secondary treatment standards.

The above formulas may also be used to derive performance-based limitations where the long-term average (LTA) is the demonstrated performance and assuming the data is log normally distributed.

3.3.9 Seasonal Effluent Limitations

The permit writer may elect to develop seasonal effluent limitations for a discharger, especially in those situations where meeting water quality-based effluent limitations has a high operational cost and there is a considerable difference of magnitude between the seasonal limits. Generally, seasonal effluent limitations are developed on a semi-annual or quarterly basis.

3.3.10 Dynamic Modeling

The use of dynamic modeling is an acceptable alternative to the static modeling discussed above in those situations where the discharger is willing to meet the data requirements and submit the analysis for approval. A discussion of the three main types of dynamic modeling techniques is given in the TSD (EPA 1991).

3.3.11 TMDLs, WLAs and 303(d) – Discharges to Impaired Waters

Discharges to impaired waters require additional consideration when issuing permits. The wasteload allocations (WLA's) which are used to derive effluent limits may be derived on an individual permit basis. However, if a TMDL is present that addresses waters affected by the discharge, WLAs must be determined using the TMDL. Water quality based effluent limits (WQBELs) in permits must be consistent with the assumptions and requirements of any available wasteload allocations within a TMDL prepared by Ecology (or EPA) and as approved by EPA [40 CFR Part 122.44(d)(vii)(B)].

Appendix E provides a detailed overview of the TMDL process and how a permit writer can interact with a TMDL under development to help produce optimal results for permitted discharges. Permit writers are encouraged to familiarize themselves with the relevant portions of Appendix E prior to reading the following sections.

In the absence of a basin TMDL and the resultant WLA, the permit writer must develop an individual WLA.

The general principles of this section are:

1. A water body listed on the 303(d) list is not a presumption of impairment unless the listed section is the point of discharge.
2. A point source discharging to a water body with multiple sources (point and nonpoint) of impairment, which is a minor source of the impairment, and may gain relief from a TMDL is not required to have a final limitation as the numeric water quality criteria before a TMDL is completed.

No TMDL and No 303(d) Listing – Existing Discharge

Occasionally, the permit writer, in the course of renewing a permit, will have information that the receiving water concentration (background) at the point of discharge during critical condition does not meet the aquatic life or human health criteria and that the receiving water is not listed on the 303(d) list (Water Quality Assessment and 303(d) list).

The applicable federal regulations in this case are 40 CFR 122.44(d)(1)(i), (ii), (iii) and (vii).

In these cases, where the excursion is documented with data that meets the criteria for 303(d) listing (see the 303(d) listing policy), the permit writer should develop interim effluent limits based on existing performance (no increase in loading) to be placed in the permit (see EPA 1991 and Chapter 4 of this Manual for development of limits based on existing performance). These interim limits are effective on the effective date of the permit. A final limit based on the water quality criteria is calculated and placed in the permit (with a compliance schedule). The compliance schedule must be as short as practicable and must include specified required actions that demonstrate reasonable progress toward attainment of the final limit or water quality criteria.

If technology-based limits have not been established for the pollutant, the permit must also cause the permittee to investigate the feasibility and reasonableness of meeting the final limit with technology and cost tests established for BCT or BAT. This is accomplished by requiring an engineering report completed in accordance with current Ecology guidance. In some cases additional source control investigation may be productive and should be included in the permit.

At this point the permit writer should consider how the effluent pollutants would be permitted if the background was not exceeding the criteria. This analysis is for near-field pollutants. If an analysis of reasonable potential shows an exceedance of the numeric criteria with a background of zero (for human health pollutants), the effluent quality must be improved regardless of the outcome of the TMDL. For other chemical pollutants, use an expected reduction of 50% of observed background (this is probably more than can be achieved in a TMDL). A determination of reasonable potential in these cases requires a reduction of effluent pollutant concentration during the permit term.

For temperature, the permit writer should target an effluent temperature that will meet a 0.3° C rise at the boundary of the chronic mixing zone. The two likely outcomes of a temperature TMDL are 1) That the estimated natural condition exceeds the current numeric water quality criteria or 2) That with non-point controls in place there may be some small amount of dilution. In either case, a 0.3° C increase at the boundary of the mixing zone is a reasonable target. The permits in the situations described above should contain requirements for source control or evaluating treatment options to reduce the effluent pollutants regardless of the status of a TMDL.

Receiving water data received by the permit writer that meets the listing criteria should be given to the Watershed Management Section. These data must be in Ecology's EIM format. The periodic Water Quality Assessment will evaluate the data (see water quality policy 1-11) and subsequently categorize the water body. If it is impaired it will be put in Category 5 (the 303(d) list) and prioritized for a TMDL.

If the data on the excursion are likely to be valid but does not meet the 303(d) listing criteria, the permittee should be required, usually by compliance order, to investigate receiving water quality to determine if the receiving water exceeds water quality standards at the time of critical condition. A quality assurance project plan (QAPP) must be prepared by the permittee and approved by Ecology. The order should require the data be submitted directly into EIM according to the instructions on the EIM website (see current permit shells on SharePoint). No interim limits are necessary in this situation, however, if technology-based limits have not been explored for the pollutant, the order should also include the requirement for an engineering report on treatment options and costs (see Ecology engineering report guidance).

If the receiving water study does show impairment, the decisions on final limits, interim limits and compliance schedules are the same as discussed above. Depending on the timing of the receipt of the data, the permit may be modified or adjusted at the next renewal. If the data shows no impairment and dilution is available then reasonable potential analysis and effluent limits are developed as discussed elsewhere in this chapter. The data from the receiving water are given to the Watershed Section for 303(d) listing.

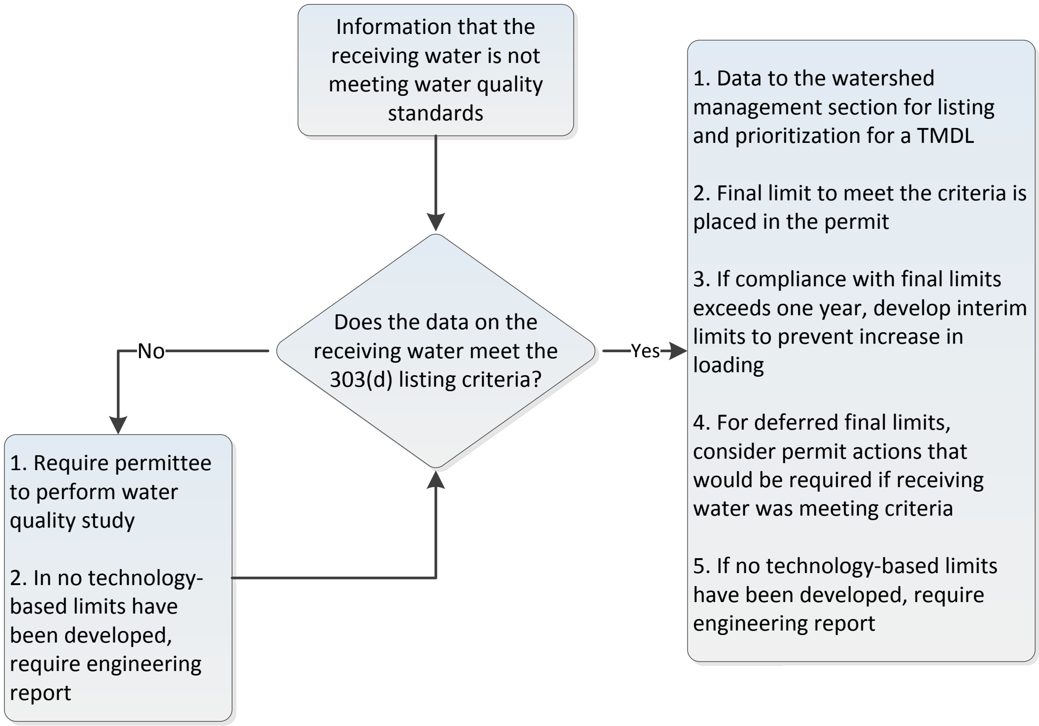


Figure 22. Discharges to Water Bodies Not Meeting Standards But Not Yet Listed on 303(d)

No TMDL and on the 303(d) List – Existing Discharge

It's more likely that a permit writer will be renewing a permit and discover the receiving water body is in Category 5 in the Water Quality Assessment (303(d) list). The applicable federal regulations in this case are the same as the previous case.

If the pollutant that caused the listing is not present in the discharge no limit is required.

If the pollutant is a far-field pollutant, is present in the discharge and is the subject of a TMDL in progress, the permit writer may defer any water quality-based limits on the pollutant until the TMDL is completed and a WLA is assigned. When the WLA is assigned the permit writer may modify the permit or incorporate the WLA at the next reissuance, depending on timing.

If the pollutant is present in the discharge and the TMDL is not started the options are given below in Figure 23 and the text that follows.

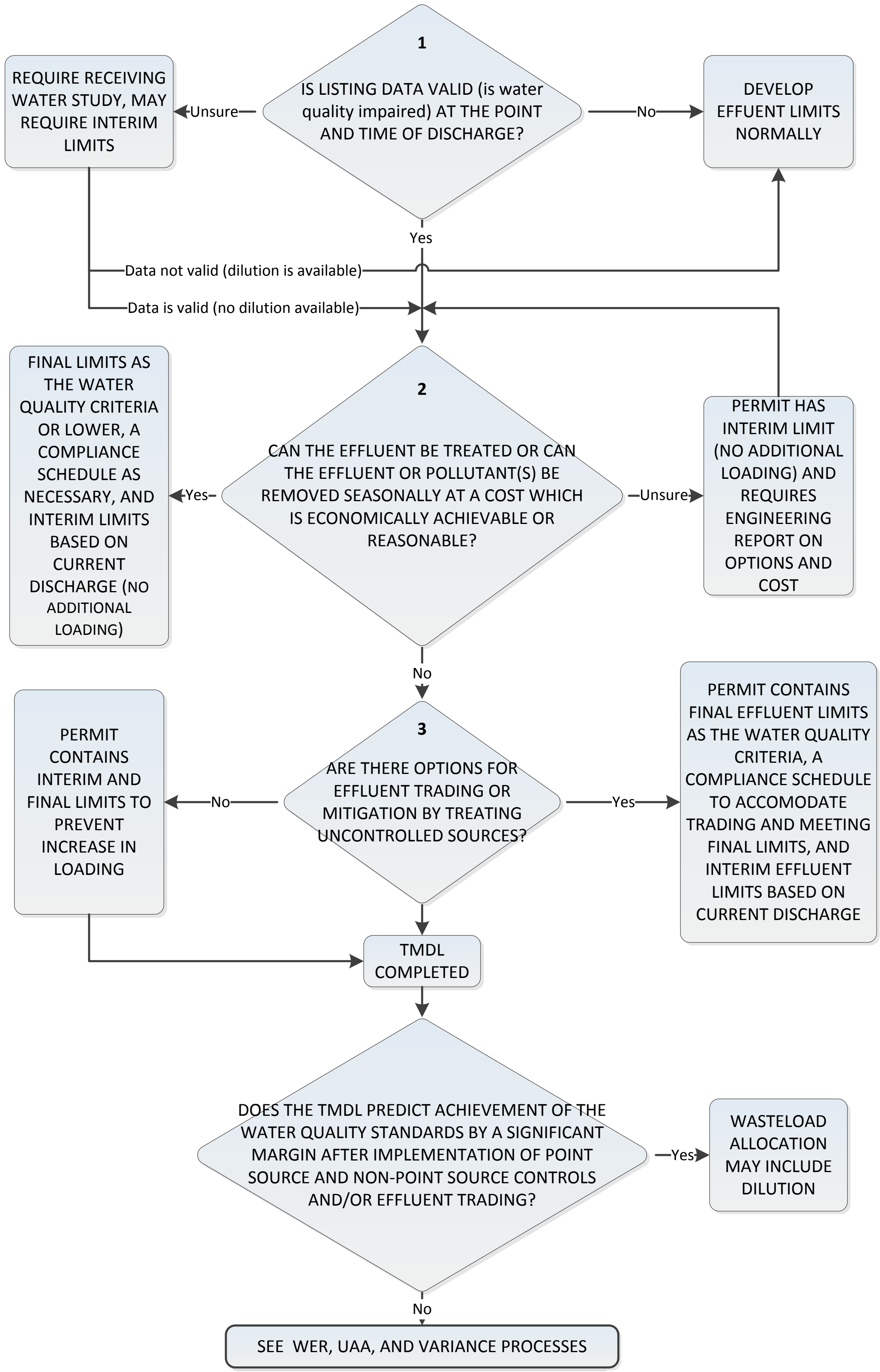


Figure 23. Permitting Discharges to a 303(d) Listed Waterbody with No TMDL

If an AKART analysis has not been completed for the pollutants at issue, Decision Boxes 1 and 2 are conducted concurrently.

Decision Box 1 (Are Listing Data Valid?) – Non-conservative Pollutants

The permit writer must make a judgment, based on the circumstances of the 303(d) data on how to proceed with the listed pollutant in the effluent. This judgment is influenced by the proximity of the listed section to the point of discharge. The judgment is also influenced by the type of pollutant and whether it is a conservative or non-conservative pollutant. Non-conservative pollutants are pollutants that degrade in the receiving water. Some typical non-conservative pollutants are BOD, ammonia nitrogen, and fecal coliform.

If the discharge is to a listed section, the receiving water is impaired. If the listing is for one station at some distance from the point of discharge then there may be some uncertainty about the water quality at the point of discharge for non-conservative pollutants. If there are station listings above and below the point of discharge or one station close to the point of discharge then there is more certainty that the water quality does not meet the criteria at the point of discharge. Another judgment must be made regarding the degradation rate of the pollutant in relation to the point of discharge and the listing station(s). Some volatile pollutants may degrade in a matter of hours in a turbulent river but others such as BOD may not reach full effect on dissolved oxygen until several days travel time down-river. A permit writer who is unsure of the dynamics of the water quality at the point of discharge may wish to consult with someone in the EA Program.

Decision Box 1 (Are Listing Data Valid?) – Conservative Pollutants

Conservative pollutants do not degrade in the receiving water. However, they may change form or their media association. Metals are a common conservative pollutant. They may be in a bound or dissolved form in the water column or go to the sediments. The decision-making process is much the same as for non-conservative pollutants except that if the listing station is downstream of the discharge, the effluent is assumed to be contributing to the impairment.

A factor of uncertainty with metals is the correctness of the data if the receiving water or effluent data wasn't collected using ultra-clean sampling and analysis. In this case, the concentrations of metals in the receiving water and the effluent should be confirmed using clean sampling and analytical techniques.

Decision Box 1 (Are Listing Data Valid?) – Human Health Pollutants

The listing for human health pollutants may be made on the basis of water column concentration or on the basis of fish tissue analysis. If the listing is on the basis of resident fish tissue concentration above or below the point of discharge assume the effluent is contributing to the impairment (assuming the pollutant is present in the effluent). If the listing is on the basis of water column concentration the decision criteria given above for other pollutants are applicable.

Decision Box 1 (Are Listing Data Valid?) – Water Quality Studies

If there is some uncertainty about the conditions at the point of discharge and whether dilution is available, the permit writer may require a receiving water study. A water quality-based effluent limit is not always required in the permit that requires the study (see the following discussion on timing), but an effluent limit based on demonstrated performance should be placed in the permit. This limits the discharger to their current loading until the uncertainty about the receiving water condition is resolved.

Permit conditions which require receiving water studies should require that the study plan be submitted as a QAPP to be approved by Ecology before the study proceeds. The permit should require the data be submitted directly into EIM (see current permit shells on SharePoint). The permit should also require that the critical conditions be determined for the 10 year critical condition. This can be done for some parameters by correlating the site data to a long-term monitoring station. For other parameters where long-term data are not available, the techniques for estimating 90^{th} (or 10^{th}) percentile values from a small data set are given in Table 12.

If receiving water data indicates there is no dilution available for part or all of the year, then other options can be explored as indicated on the flow chart. If no dilution is available, however, a final effluent limitation of the criteria concentration (amount) is placed in the permit. An interim limit based on existing performance is also placed in the permit. A compliance schedule may be authorized for meeting the final limit but it must be as short as possible and must require demonstration of reasonable progress toward meeting the water quality criteria or final limit. If the schedule exceeds one year, the permit must include interim milestones and at least annual progress reports towards final compliance.

Decision Box 2

Once the water quality impairment is confirmed or verified the following principle is in effect:

- There can be no additional loading or higher concentration allowed for the listed pollutants at times of impairment until the TMDL is completed and it shows dilution available at full implementation of the TMDL.

Ceasing discharge to surface waters may be an option for some small dischargers especially for summer discharges with high temperatures and low dilution. Other options include using the wastewater for irrigation or simply storing the wastewater. In some cases there may be opportunities for seasonal pollutant removal. These options are explored in an engineering report required as part of the compliance schedule if these options were not originally explored in the AKART analysis. If seasonal removal appears feasible for a facility, the final effluent limit should be either:

- The water quality criteria or
- No discharge during critical period.

The final limit is placed in the permit. An interim limit, based on existing performance, is also placed in the permit. For some pollutants, treatment may be available that is within the financial capability of the facility. If the treatment option is used the permit should contain a final effluent limitation of the criteria concentration (amount) and an interim limit based on existing performance or a compliance schedule to meet final limitations. If the schedule exceeds one year, the permit must include interim milestones and at least annual progress reports towards final compliance.

Decision Box 3

For some limited number of pollutants and discharges there may be some options for pollutant trading in which a discharger would pay some upstream point source or non-point source for treatment in order to gain some allowable dilution at the dischargers location. If this option is used, the permit should contain a final effluent limitation of the criteria concentration (amount) and an interim limit based on existing performance or a compliance schedule to meet final limitations. If this option is considered, there must be available data on the upstream source that would be used for the trade. This option is administratively very time consuming.

Timing for Decision Boxes 1, 2, and 3

The permit language requiring examination of the options in boxes 1, 2, and 3 in Figure 23 may be sequential within one permit term depending on the size and priority of the discharge. For example, a permit for a large industrial source which is being required to do a water quality study in the initial years of the permit, should also require an engineering report for treatment options in the later years of the permit if the studies show violations of water quality standards. In other cases, such as small municipalities, which may require several years to fund a water quality study, the initial permit may only require the water quality study. The next permit would then require the engineering report.

New Discharge – On 303(d) List and no TMDL

The applicable regulation is 122.4(i)
Section 122.4 Prohibitions. *No permit may be issued:*

i) To a new source or a new discharger, if the discharge from its construction or operation will cause or contribute to the violation of water quality standards. …

A new discharge to a listed water body can not be allowed (issuance of permit is prohibited) if the discharge will cause or contribute to a violation of water quality standards. A new discharge may be allowed to discharge at the water quality criteria (for those pollutants with criteria) or at the quantitation level for those pollutants without criteria, such as BOD.

A permit applicant may be allowed to demonstrate that the listed water body has the ability to accept additional loading at the proposed point of discharge without measurable impairment or measurable increased impairment to the water body.

In some cases a new discharger may be allowed to discharge listed pollutants by trading effluent reduction (effluent trading) or discharging seasonally. Effluent trading may entail treating a previously untreated but quantified pollutant source, such as a stormwater outfall such that the net effect of the new discharge is zero. Water reuse is encouraged by Ecology and it may be a good option for new dischargers to avoid discharge during the critical condition, typically the low flow period.

New Discharge – TMDL Completed

The applicable regulation is 122.4(i)
…The owner or operator of a new source or new discharger proposing to discharge into a water segment which does not meet applicable water quality standards or is not expected to meet those

standards even after the application of the effluent limitations required by sections 301(b)(1)(A) (BPT) and 301(b)(1)(B) (Secondary treatment) of CWA, and for which the State or interstate agency has performed a pollutants load allocation for the pollutant to be discharged, must demonstrate, before the close of the public comment period, that: (1) There are sufficient remaining pollutant load allocations to allow for the discharge; and (2) The existing dischargers into that segment are subject to compliance schedules designed to bring the segment into compliance with applicable water quality standards. The Director may waive the submission of information by the new source or new discharger required by paragraph (i) of this section if the Director determines that the Director already has adequate information to evaluate the request. An explanation of the development of limitations to meet the criteria of this paragraph (i)(2) is to be included in the fact sheet to the permit under Section 124.56(b)(1) of this chapter.

A new source or new discharger proposing to discharge to a listed water body for which a TMDL has been completed and WLA's assigned may obtain a permit for discharge into a water segment which does not meet applicable water quality standards by submitting information demonstrating that there is sufficient loading capacity remaining in the waste load allocations for the stream segment to accommodate the new discharge and that existing dischargers to that segment are subject to compliance schedules designed to bring the segment into compliance with the applicable water quality standards.

General Permits

General permits are issued under the same laws and regulations as individual permits. The permit coverages should include monitoring for the impairment pollutant for use in the TMDL. The application for coverage under the General Permit for **new** facilities will ask if the discharge is to a listed water body and will provide information for the applicant to determine if they will be discharging to a listed water body. When possible, the pollutants specific to the type of discharge covered by the general permit will be identified in the permit application materials. If the permit applicant indicates they will be discharging a named pollutant to a listed water body at or near the impaired section, they may become subject to specific limits identified in the permit, receive an individual permit, or receive special limits in the permit coverage.

TMDL Completed – Existing Discharge

If the TMDL has been completed at the location, the steps for compliance may be similar to those given above especially when the WLA doesn't allow for any significant dilution. The permit may contain a compliance schedule if necessary to meet a WLA.

Natural Conditions

A determination that estimated natural conditions in a water body exceeded water quality standards can only be made from: (1) data from the water body prior to any human disturbance in the watershed, (2) correlation of the water body to a nearby undisturbed water body, (3) a model of the water body and watershed, or (4) a TMDL.

In some cases the permittee or applicant may try to demonstrate that conditions in the water body were not meeting standards before the addition of wastewater and therefore are natural conditions or natural background levels. Natural conditions are defined in the Water Quality Standards as the surface water quality that was present before any human-caused pollution

(WAC 173-201A-020). Human-caused pollution includes non-point sources such as channel modification, timber harvesting and farming. Therefore, unless data is available from the watershed before there was any human disturbance or from a nearby less disturbed watershed showing exceedance of standards, a determination of natural conditions should not be made by the permit writer. An estimate of natural conditions can be made by modeling. This may be developed as part of a TMDL or may be conducted by Permittees using methods approved by Ecology.

3.3.12. Effluent Limits

Derive effluent limits for those pollutants that are determined to have a reasonable potential (to violate the water quality standards). Effluent limits are also derived using the criteria as total. The process for deriving limits was described earlier and the calculations are available in PermitCalc. Figure 24 illustrates the process of compliance.

3.3.13. Compliance Schedules

[STILL UNDER DEVELOPMENT – to be completed following EPA's approval/disapproval contingent upon ESA review.]

If an existing permittee cannot immediately comply with the water quality-based effluent limits the permit writer may allow a compliance schedule with interim limits. The interim limits and compliance schedule are placed in the permit. The interim limits may be based on existing performance and calculated by using PermitCalc. Rules for the use of compliance schedules are found in: 40 CFR 122.47, Chapter 173-220-140 WAC, and Chapter 173-201A-510(4) WAC. As part of the human health criteria revision, compliance schedules for meeting human health water quality based effluent limits may be used, now.

The schedule must require compliance as soon as possible. If final compliance exceeds one year from the permit issuance date, interim milestones must be included in the permit. If the schedule exceeds the permit term, the permit must include a final limit. The permit should clearly indicate when final and interim limits are applicable. See the permit shells in SharePoint for options.

Prior to the effective date of modifications to Chapter 173-201A-510(4) WAC on December 15, 2016, all compliance schedules were limited to a maximum of ten years. This rule still requires compliance in the shortest practicable time but now the schedule may exceed ten years when the pollutant of concern is based on human health criteria and permit writer has confidence that a final water quality-based effluent limit can be met at the end of the compliance term.

The December 2016 update is ***not*** applicable to compliance schedules for aquatic life criteria exceedances, but can be used for compliance schedules based on numeric or narrative criteria for other designated uses. EPA must complete Endangered Species Act consultation prior to approving the rule modifications for aquatic life. Permit writers should refer to the version of the standards in place before the December 2016 revision when developing compliance schedules based on aquatic life criteria. In this instance, compliance periods may not exceed 10 years. This section will be updated following receipt of a separate approval from EPA.

Revisions to Chapter 173-201A-510(4) also added specific compliance schedule provisions for

TMDLs. When an approved TMDL has established wasteload allocations for a permitted discharge, a longer compliance schedule may be authorized when:

- The permittee is not able to meet its waste load allocation in the TMDL solely by controlling and treating its own effluent.
- The permittee has made significant progress to reduce pollutant loading during the permit term.
- The permittee is meeting all of its requirements under the TMDL as soon as possible.
- Actions specified in the compliance schedule are sufficient to achieve water quality standards as soon as possible.

Again, note that none of the language in the revision can be used for compliance schedules based on aquatic life criteria.

When appropriate under *Decision Box 1* above, the compliance schedule will direct the permittee to do ultra-clean sampling and analysis of effluent and receiving water. If the schedule for permit issuance allows, the permit writer may request the permittee to do this analysis on a voluntary basis as a part of the permit application. The guidance for ultra-clean sampling and analysis is available from EPA (1995). The receiving water sampling is necessary because historic data on metals may be biased on the high side. For industrial dischargers and municipal dischargers that receive industrial wastewater, the compliance schedule should also require a determination of the source of the metals and opportunities for reduction.

The ultra-clean analysis of effluent and receiving water and any source reduction may result in lower concentrations of metals. If this results in a determination of no "reasonable potential," then the effluent limits and interim limits may be removed from the permit by permit modification. This will not violate the anti-backsliding provision of the Clean Water Act because this constitutes new information which, if available at the time of permit issuance, would have caused a different action (no limits).

3.3.15. Larger Mixing Zones

If the permittee cannot meet the final effluent limits then the permittee may request an exception to the mixing zone size as allowed and conditioned by WAC 173-201A-400(12),(13), and (14).

The permittee may also conduct a Use Attainability Analysis to demonstrate the classification for the water body is inappropriate. This option will require a set of studies to demonstrate the natural potential of the water body to support beneficial uses and the ability of the point and nonpoint source dischargers to control pollutants to those waters. It is unlikely that a single discharger would elect to conduct this type of analysis.

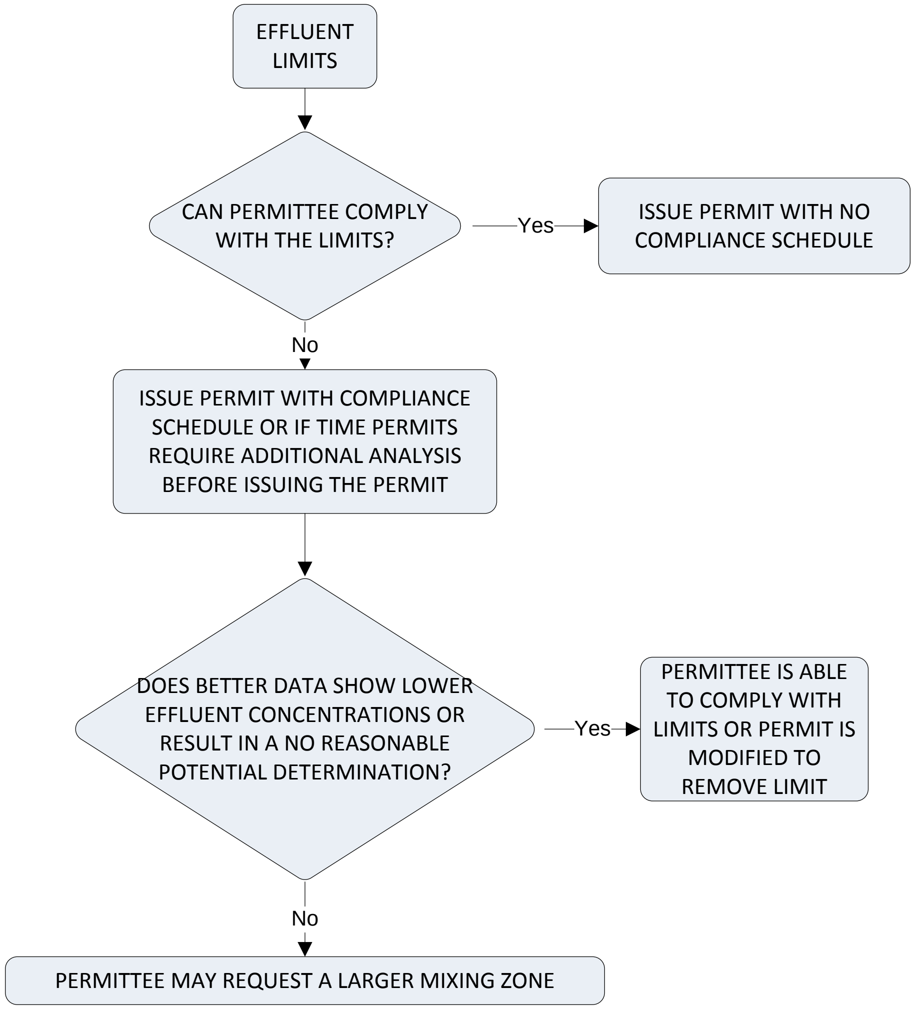


Figure 24. Compliance with Water Quality-Based Effluent Limits

3.3.16 Interim Interpretation of Water Quality Standards for Existing Municipal Discharges (Less Than 0.5 MGD) To Intermittent Streams

Section 1 of this chapter discussed the use-based water quality standards that were adopted in 2006. Numeric criteria are associated with the designated uses for each water body. In most cases, waters receive the same designated uses as it is downstream receiving stream, regardless if it is shown on the map application. To view the designated uses and link to the numeric criteria use one of the applications available through this web site: https://fortress.wa.gov/ecy/waterqualityatlas/StartPage.aspx

At this time, the WQ Standards do not address the "permanency" of streams, such as perennial intermittent or ephemeral. If a stream is isolated (does not contribute water to another stream) it would receive a Salmonid Spawning and Rearing Use.

Facility managers should evaluate the impacts of a municipal effluent upon the characteristic uses of a stream and its water volume, including seasonal fluctuations. The impacts are compared to the beneficial effects of the effluent going to a stream reach that would otherwise be dry. In order to protect characteristic uses associated with streams during flow and non-flow periods, and to provide small municipal dischargers with options for treatment and disposal, the facility manager should require the facility to evaluate the following alternatives treatment options:

1. A treatment/disposal system that meets all numeric criteria and characteristic uses for the receiving water body. This may require removal of the discharge from the stream either seasonally or completely.
2. A treatment/disposal system that protects the characteristic uses in the stream during seasonal fluctuations, including nonflow periods. This option requires the evaluation of treatment technology commonly available which exceeds secondary treatment and which produces the following effluent quality (as monthly averages):
   - BOD and TSS - 15 mg/l
   - Total Ammonia - 1 mg/l

Ecology may allow total ammonia average of 2 mg/l if costs for achieving 1 mg/l are disproportionate to costs for achieving BOD and TSS.

If Chlorine is used for disinfection, dechlorination is required. The facility should evaluate other disinfection methods.

If treatment option 2 is chosen, the discharge should be modeled or instream sampling required of the facility to demonstrate that all numeric criteria are met at the point of perennial flow.

3.3.17 Flow Adjusted Effluent Limits

Typically, effluent limits are derived using a static model at the time of critical condition (discussed elsewhere in this Chapter). Critical condition is typically at time of low flow because of the reduced dilution. Many people have considered that limits derived from a static model were more conservative than those from a dynamic model or a Monte Carlo simulation. The static model was considered conservative because of the many probability factors or design conditions considered in deriving limits. These probabilities for an industrial discharge to freshwater are given in Table 13 below.

Table 13. Statistical Probabilities in Static Model Effluent Limits

Design Parameter	Design Condition	Probability of Occurrence or exceedance
Effluent Flow (Acute)	Highest daily maximum effluent flow for past 3 years	1 day in 1080 days (assuming daily effluent monitoring)
Effluent Flow (Chronic)	Highest monthly average effluent flow for the past three years.	1 month in 36 months
Receiving Water Flow (Fresh Water)	Typically 7Q10 low flow. (7 day average daily low flow with an expected return period of 10 years based on historical record)	1 year in 10 (as a 7 day average). Flows with a smaller averaging period will occur more frequently.
Acute Criteria (metals)	One hour exposure concentration not to be exceeded more than once in three years	
Chronic Criteria (metals)	Four day exposure concentration not to be exceeded more than once in three years	
Effluent Concentration	95th percentile	5% for period of data collection
Receiving Water Concentration	90th percentile	10% for period of data collection
Waste Load Allocation	Water Quality Criteria times the dilution factor or from TMDL	
Long Term Averages (Acute and Chronic)	Based on WLA and CV	1% exceedance of WLA (Water Quality Criteria)
Daily Maximum Effluent Limit	Based on limiting LTA	Type 1* error = 1% Type II error = ?
Monthly Average Effluent Limit	Based on limiting LTA	Type I error = 5% Type II error ≈ 20% with d=0.2 and CV = 0.6

* Type I error in this case is the probability that the facility will violate the limit but actually be in compliance with the expected long-term average. Type II error is the probability that the facility will be meeting effluent limits but not meeting the expected long-term average.

The derivation of effluent limits is typically done by static modeling for conditions existing at the time of critical condition. Critical condition is usually at times of low flow because the amount of dilution is lowest at that time.

Some elements of the process of deriving water quality-based effluent limits by the static process are conservative (cause effluent limits to go down) while other are liberal (cause effluent limits to increase) and some people have argued that the combination of extreme probabilities causes unnecessary conservatism. On the other hand, many toxic water quality criteria are expressed as one hour or four day exposure and our typical definition of critical flow is a seven day average low flow. In addition, effluent monitoring for toxic pollutants is typically weekly or monthly and is rarely conducted on an hourly basis.

Alternates to the static model are the dynamic models as discussed in the TSD (EPA, 1991). These models require large amounts of data to model properly. It had been assumed that dynamic models more accurately predicted water quality conditions and did not compound probabilities. It was also assumed that effluent limits derived from dynamic models would be higher than if derived from a static model. However, a paper (Dilks and Pendergast, 2000) demonstrated that limits from static models are generally higher.

Some permittees have requested effluent limits which would vary based on the amount of flow and subsequent dilution occurring at the point of discharge. These permittees have the ability to modify their flow or pollutant loading within a short time period. There are two major difficulties with these types of flow-based limits. One problem is simply the administrative problem of trying to keep track of the effluent limits so as to assess compliance. Any flexible process for formulating effluent limits increases the difficulty of measuring compliance. Difficulty with measuring compliance means difficulty assuring compliance with the water quality standards and enforcing the provisions of the permit.

The second difficulty with flow based limits is maintaining the margin of safety. With the static model, it is assumed that the combination of probabilities described above would result in a probability of violating the water quality standards in any given year during the critical period to be 10% or less. When effluent limits are based on the existing receiving water flows (and resulting dilution factor) there is no margin of safety.

Options for Flow Based Limits

Case 1. Continuously Variable

Continuously variable limits, if allowed, would only be applicable for a very small group of dischargers who are able to vary production on a short term basis. In this case effluent limits would be fixed to the data produced by a nearby hydrograph on the receiving water. The margin of safety would have to be explicitly set at 10% by reducing the calculated limit or dilution factor by 10%. This case would be virtually impossible to track for compliance because effluent limits, calculated on a daily basis, would have to be entered individually into the data base. In consideration of the limited applicability of this case and the impossible data management, Ecology will not consider continuously variable effluent limits.

Case 2. Step Variable

In this case effluent limits are increased or decreased in a stepwise manner as actual river flows increase or decrease respectively. This option affords flexibility but reduces the administrative burden if the number of increments is limited. The margin of safety can be set explicitly at 10% or by introducing a one-step lag. This option is not feasible on an individual basis because of the difficulty of developing limits that retain a margin of safety with a falling hydrograph (Figure 25).

Case 3. Seasonally Variable Limits based on Historical Flows or Predicted Flows

In this case (a variation of stepped limits) the seasonal effluent limits are based on a seasonal flow with a return frequency adjusted to give an annual probability of exceedance of 10%. For example, for two season limits the 7Q20 flows would be determined for each season and used for determining the effluent limits. For three season limits the 7Q38 flows would be determined for each season and for quarterly limits the 7Q114 flows would be determined for each season. Determining these flows requires a good historical record of flows for the water body to accurately predict these flows. In reviewing cases where seasonal effluent limits have been proposed, it's apparent that there is little difference between 3-season limits and 4-season limits.

In some cases, the seasonal high and low flows are predicted from snow pack measurements. These are primarily for hydropower management, however, they could be used for determining seasonal effluent limits for the water year. The margin of safety is adjusted on the basis of the historical error rate of predicted flows to actual observed flows to an annual 10% probability of exceedance.

Case 4. Seasonal Removal of Effluent

In some cases there will not be any assimilative capacity in the receiving water at low flows. In this case the only option (other than administrative) is to remove the effluent by land applying, reusing or storing the effluent. The margin of safety is applied by selection of the dates of removing and re-discharging the effluent. The dates should be chosen such that the annual probability of exceeding the water quality standards is 10% or less.

Considerations for Flow Adjusted Limits

Permit writers who are considering flow-adjusted limits need to take into account the fluctuation in other variables that affect the compliance with water quality standards. For example, the dilution factor and background pollutant concentration will typically change seasonally and may be higher or lower than low flow measurements depending upon the specific water body.

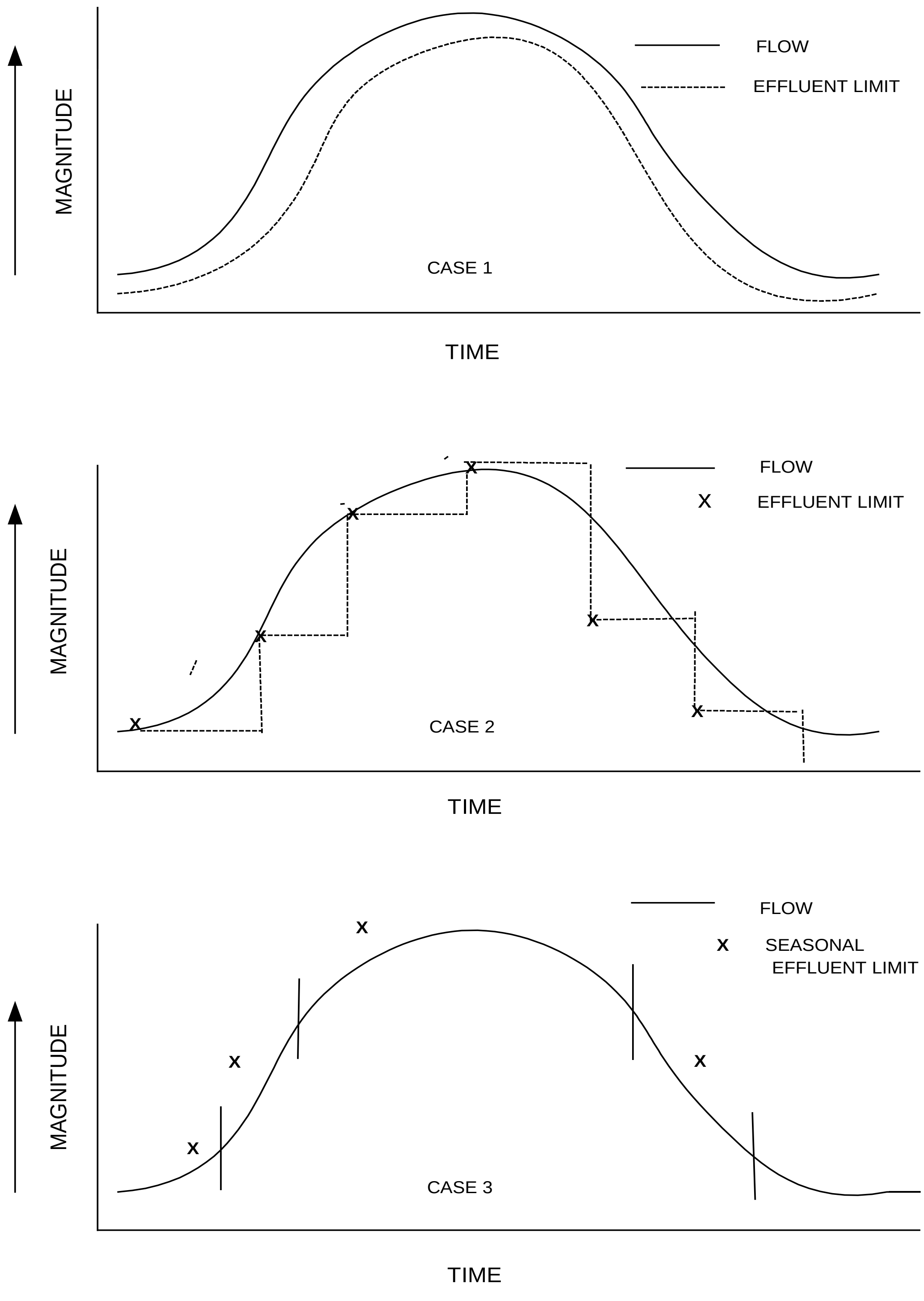


Figure 25. Flow-Based Effluent Limitations

Hardness, pH, and temperature which affect the numeric criteria for some metals and ammonia will also vary seasonally and must be accounted for in setting limits. The information on these variables should be developed by the permittee. The permit writer should also consider the difficulty of accounting for upstream dischargers if there are multiple dischargers to a reach. Where conditions become too complex to authorize flow adjusted limitations, the permit writer should consider doing static water quality-based limits and authorizing a compliance schedule to incorporate the time necessary to do the TMDL.

4. Analytical Levels

This part discusses detection and quantitation levels and outlines an approach to assess compliance with water quality standards and with effluent limits that are near or below the levels of quantitation. The approach is primarily for organic and metal pollutants where criteria and effluent limits may be very low. Chemical-specific concentration levels that can be used for compliance assessment are presented, as well as guidance on how to tailor those levels to fit regulatory concerns regarding the possible impacts of the discharge. Compliance levels are expected to change over time as analytical methods improve and as we gather more data on laboratory performance.

For NPDES permits, the permit writer must require EPA Methods as given in 40 CFR Part 136 (see: https://www.epa.gov/cwa-methods) and specify the specific method to achieve detection and quantitation levels for permit application or permit compliance monitoring. If a test method is not listed in part 136 for a permitted pollutant then the permit must specify an appropriate test method [40 CFR Part 122.44(i)(1)(iv)].

One group of compounds where analytical methods are evolving rapidly are Polychlorinated Biphenyls (PCBs). Additional guidance on this group of compounds is found later in this section.

4.1 Introduction

Effluent limits based on water quality criteria may be set at very low concentrations (in the range of parts per billion to parts per quadrillion). Laboratory analytical methods approved for use in the NPDES program are often not capable of measuring chemical concentrations at the concentrations of the permit limits. In many cases we are unable to determine if pollutants contained in discharges are at concentrations that merit concern, and when we set an effluent limit, we are often unable to determine if that limit is being exceeded.

Historically, the **method detection limit (MDL)** was used to determine compliance (all data at or above the MDL were considered adequate for assessing compliance and supporting enforcement actions). The MDL, however, is the level at which a chemical's presence or absence can be detected, and provides limited information with regard to actual concentration. The low concentrations of many of the aquatic life-based and human health-based criteria have made the issue of quantitation important to both the regulator and the discharger. This section uses the term "**quantitation level**" as equivalent to the term "**minimum level of quantitation (ML)**" which is used by EPA. The ML is defined by EPA as the lowest concentration of an analyte that can be measured with a defined level of confidence (see further discussion below). This may also be called the **reporting level** by some laboratories.

Historically, analytical results of wastewater effluent testing were used only to demonstrate compliance with effluent limits. The analytical results are now being used to determine loading of pollutants to receiving waters and compliance with human health criteria. This requires the use of lower detection and quantitation levels.

In 2014, EPA published a final rule titled: *National Pollutant Discharge Elimination System (NPDES): Use of Sufficiently Sensitive Test Methods for Permit Applications and Reporting* (79 FR 49001). The rule became effective on September 18, 2014, modifying portions of 40 CFR Parts 122 and 136. The rule provides criteria for determining that a method is "sufficiently sensitive" when:

- The method minimum level (ML) is at or below the level of the applicable water quality criterion for the measured pollutant or pollutant parameter; or
- The method ML is above the applicable water quality criterion but the amount of the pollutant or pollutant parameter in a facility's discharge is high enough that the method detects and quantifies the level of the pollutant or pollutant parameter in the discharge; or
- The method has the lowest ML of the analytical methods approved under 40 CFR part 136 or required under 40 CFR chapter I, subchapter N or O for the measured pollutant or pollutant parameter.

Additional portions of the rule allow for consideration of matrix effects and other site specific factors in the determination. The rule does not provide a definition for the method minimum level (ML). Ecology adopted a process for requiring sufficiently sensitive methods in 2008 through use of permit and permit application appendices providing expected levels of detection and quantitation as discussed below. Ecology will continue this process to remain consistent with the 2014 final rule.

4.2 Background Information

Two types of analytical levels are in common use. The first type is the Method Detection Limit (MDL) or Detection Level which is defined as 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. This may be called the Instrument Detection Level (IDL) for some analyses. The Quantification Level (QL) or Minimum Level is defined as the practical quantitation level (PQL) in Ecology's groundwater quality standards.

Another type of quantitation level commonly used is the Contract Required Quantitation Levels (CRQLs) listed in the EPA Contract Laboratory Program (CLP). The CRQLs are a list used historically in EPA's groundwater and waste programs for laboratory contracts, and have been routinely used to measure concentrations at waste sites. The advantage of these levels is that numerous laboratories throughout the country provide the services, but the levels specified are not always based on the use of the most sensitive analytical test methods that EPA has approved for the NPDES permitting program. Both quantitation types have advantages in a regulatory program. Using the Method Detection Limit times a safety factor is straight forward and easy to understand, and is widely used in many regulatory programs throughout the country. The CLP values are also well known to the regulatory community, and are attainable for most labs. However, with each quantitation type, certain regulatory issues can increase or decrease the cost of the compliance monitoring program for dischargers and regulators.

The 2016 Methods Update Rule (MUR), effective August 2017, clarifies how the minimum level of quantitation (ML) are defined and calculated. Previously, no formal definition was provided for the ML except to recognize the reported parameter as a component of the specific analytical method. The following text of the ML procedure previously used for defining the reporting level can be found below (FR 3/12/2003). The MUR clarifies how the EPA considers the *reporting limit* (RL) and *quantitation limit* (QL) to be synonymous with ML and interchangeable in QC data reporting for the purposes of NPDES effluent compliance monitoring. While not covered in the MUR, the term *lower level of quantitation* (LLOQ) used in the non-compliance Method 8082A- Update V is distinct from both the ML and RL. See 4.5.2 in this section for a discussion on the LLOQ.

B. Definition and Procedure for the Determination of the Minimum Level of Quantitation (ML)

1.0 Definition

The minimum level of quantitation (ML) is the lowest level at which the entire analytical system gives a recognizable signal and acceptable calibration point for the analyte. The ML represents the lowest concentration at which an analyte can be measured with a known level of confidence. It may be equivalent to the concentration of the lowest calibration standard, assuming that all method-specified sample weights, volumes, and cleanup procedures have been employed. It is functionally analogous to the "determination limit" described by Currie (1968) and the Limit of Quantification (LOQ) described by the American Chemical Society (Keith *et al.*,1980, McDougal *et al.*, 1983) and Currie (1995).

Note to Section 1.0: The ML is directed at obtaining a 10% relative standard deviation for determination of an analyte in an environmental sample. This error may be reduced by making multiple determinations of the analyte in the sample.

2.0 Scope and Application

2.1 The ML is typically established by the organization that develops or modifies an analytical test method. A laboratory that employs the method would be expected to include calibration standards that encompass the ML when it calibrates an analytical system, unless a higher quantitation level is acceptable for a specific application. If an ML is not specified in a method, a laboratory may use the ML procedure to establish the lowest calibration point.

2.2 This procedure is intended for use in EPA's Clean Water Act (CWA) programs. An alternative procedure may be used (*e.g.*, from a voluntary consensus standards body) to establish the sensitivity of an analytical method provided the resulting quantitation limit meets the sensitivity needs (*i.e.*, data quality objective) for the specific application.

2.3 Laboratories are encouraged, but not required, to periodically demonstrate recovery of the target analyte near the published ML or laboratory-established ML by preparing a reference matrix sample spiked at the ML and analyzing it using all sample handling and processing steps described in the method. If the method does not provide acceptance criteria for such an ML standard, the laboratory can make an assessment of whether acceptance criteria for other spiked reference matrix samples (*e.g.*, laboratory control samples, laboratory fortified blanks, ongoing precision and recovery samples, etc.) are appropriate to evaluate analyte recovery at the ML. Alternatively, the laboratory may develop its own acceptance criteria based on data gathered by the laboratory over time.

3.0 Procedure

3.1 The ML is based on 10 times the standard deviation of the results of replicate analyses of a matrix containing the analyte. The method detection limit (MDL) is also based on the same standard deviation, multiplied by the Student's *t*-value appropriate for a 99% confidence level and corresponding degrees of freedom. Because the standard deviation may not be readily available, the ML is often calculated as a factor times the MDL.

3.1.1 Calculating the ML based on MDL study data

When available, obtain the actual standard deviation value from the MDL study and calculate the ML directly, as 10 times the standard deviation. If an iterative MDL study is performed, calculate the MDL as 10 times the pooled standard deviation.

3.1.2 Calculating the ML based on the MDL Assuming a single iteration of seven replicates is used to determine the MDL, the number of degrees of freedom is 6, and the Student's *t*-value is 3.143. Therefore, the MDL is:

$$MDL = 3.143 \times s$$

and the ML is:

$$ML = 10 \times s = \frac{10}{3.143} \times MDL \approx 3.18 \times MDL$$

3.1.3 If the MDL is calculated from other than seven replicates or using the iterative procedure, the factor of 3.18 will change, and the table below is used to establish the correct multiplier. For example, if an iterative MDL study is performed consisting of exactly 7 replicates in each iteration, the resulting pooled MDL would incorporate 12 degrees of freedom, and the equation for the ML above would be modified accordingly, using a multiplier of 3.73.

TABLE OF STUDENT'S *t*-VALUES AT THE 99% CONFIDENCE LEVEL AND ML MULTIPLIERS

Number of replicates for: Single MDL (df=n − 1)	Number of replicates for: Iterative MDL (df=n − 2)	Degrees of freedom (df)	$t_{(n-1,1-\alpha=0.99)}$	ML multiplier
7	N/A	6	3.143	3.18
8	N/A	7	2.998	3.34
9	N/A	8	2.896	3.45
10	N/A	9	2.821	3.54
11	N/A	10	2.764	3.62
12	N/A	11	2.718	3.68
13	14	12	2.681	3.73
14	15	13	2.650	3.77
15	16	14	2.624	3.81
16	17	15	2.602	3.84
17	18	16	2.583	3.87
18	19	17	2.567	3.90
19	20	18	2.552	3.92

Note to Table: Degrees of freedom = (n − 1) if a single iteration MDL study is performed and ($n_h + n_l - 2$) if an iterative MDL study is performed; N/A indicates that the number of degrees of freedom in this row does not apply to an iterative MDL study.

4.0 Rounding

The ML may be used to establish the lowest calibration point for the analyte. Therefore, in order to facilitate the preparation of calibration standards containing the analyte without undue difficulty, the ML may be rounded to the nearest multiple of 1, 2, or 5×10^n, where n is an integer.

5.0 References

5.1 Currie, Lloyd A. (1968), Limits for Quantitative Detection and Quantitative Determination, Analytical Chemistry 40: 586–593.

5.2 Currie, Lloyd A. (1995), Nomenclature in Evaluation of Analytical Methods including Detection and Quantification Capabilities, Pure and Appl. Chem. 67:10, 1699–1722.

5.3 Glaser, J.A., D.L. Foerst, J.D. McKee, S.A. Quave and W.L. Budde (1981), Trace Analyses for Wastewaters, Environ. Sci. Technol., 15:1426.

5.4 Keith, Lawrence H., *et al.* (1983), Principles of Environmental Analysis, Analytical Chemistry 55:14, 2210–2218.

5.5 McDougal, Daniel, *et al.* (1980), Guidelines for Data Acquisition and Data Quality Evaluation in Environmental Chemistry, Analytical Chemistry 52:14, 2242–2249.

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The definition of ML as proposed by EPA in the text above is still controversial among chemists, including some chemists within Ecology.

4.3 Implementation - NPDES and State Permits

An analytical result below the MDL means there can be no judgment regarding the presence of analyte in the sample. The actual concentration may fall from 0 to just below the detection level. Given this uncertainty, single analytical results below the MDL may be treated as 0. A few measurements below the MDL may be set equal to half of the detection level to calculate an average if the data set also contains measurements above the QL.

An analytical result that falls between the MDL and the QL means there is a level of certainty that the analyte is in the sample. The actual concentration may lie anywhere between the MDL and the QL. These values may be reported by the laboratory but are accompanied by a qualifier. Ecology's Manchester Laboratory uses a J qualifier in this case. A value falling between the MDL and the QL may be used for calculating averages (daily maximum and monthly average) but should not be used for enforcing the daily maximum if the daily maximum value consists of a single daily analysis.

All analytical result above the QL may be used as valid single values for assessing compliance with the daily maximum and for use in the monthly averages.

The objective in wastewater characterization (permit application) is to quantify at or below criteria levels. The monitoring used for effluent characterization and priority pollutant scans in the permit application also comply with the *Sufficiently Sensitive Test Methods Rule* as discussed in 4.1 of this section.

Effluent limits near detection and quantitation levels may require additional clarification in a permit. Where the calculated limit is below the QL for a parameter, include the limit as calculated in *S1. Discharge limits* of the permit. Also include a footnote indicating the value that will be used for assessing compliance with the limit as described above. For example, the footnote may list the QL of the recommended method for that parameter as the compliance assessment level for a single analytical result compared to a daily maximum value.

Beginning in 2017, draft permits with both numeric PCB limits and adaptive management strategies need to undergo a QA/QC review by Ecology's permit review team prior to public notice. It is anticipated that these permits will likely implement effluent limits that are near the detection and/or quantitation levels allowed in analytical methods. See Section 4.5 of this chapter for a description of the different PCB analytical methods used for effluent limit compliance versus source evaluations.

Where the calculated limit is below the QL for a parameter, include the limit as calculated in *S1. Discharge limits* of the permit. Indicate the value that will be used for assessing effluent limit compliance with the limit as described above, especially if different from current Appendix A. For example, list the QL of the recommended method for that parameter as the compliance assessment level for a single analytical result compared to a daily maximum value.

4.4 Choosing a Quantitation Level

Table 14 below provides an example of the list Ecology maintains of the recommended detection and quantitation levels for wastewater analysis in permitting. The values should be used for application and permit requirements unless the Ecology laboratory advises differently for a particular pollutant. Use of the list will help ensure compliance with “sufficiently sensitive” methods requirements in federal rule.

Effluent matrices (interfering substances) may affect the MDL of an analysis. If a discharger cannot provide a required Method Detection Limit or quantitation level because the matrix of their particular effluent causes interferences with the analysis, the discharger also could face non-compliance because of inability to provide a quantitation level required in a permit. This situation can be addressed by allowing the discharger to develop a matrix-specific quantitation level.

If a discharger suspects that the quantitation level cannot be attained in its effluent because of matrix effects (e.g., high salinity), the discharger could run a laboratory spike of their sample matrix along-side an unspiked sample. If the recovery in the laboratory spike is poor, the discharger may need to develop an effluent specific MDL and quantitation level.

Based on data from Wisconsin and communication with the State of New York, matrix effects are not a common problem, however, dischargers should be allowed time schedules in permits to provide required quantitation levels if local labs cannot provide them, and should be allowed to develop matrix specific quantitation levels if their effluent matrices cause analytical interference.

In order to qualify for development of a matrix specific quantitation level, the discharger must show that it is matrix effects, and not lack of a laboratory's ability to perform a method, that is affecting the MDL. This demonstration can be made by providing laboratory performance data showing all information needed to calculate the needed MDL, as defined in 40 CFR 136. All sample measurements and supporting QA/QC data should be submitted to Ecology.

Metals - Method detection limits have not been developed for metals. Instead, instrument detection limits (IDLs) are available for each method. The method detection levels for metals listed in the sources given below with Table 14 are typically given as IDLs in 40 CFR Part 136. The quantitation levels for metals were estimated by multiplying the IDL by a factor of 4.

Organics - The quantitation levels recommended by Ecology at sources given with Table 14 below should prove attainable by most dischargers, and protective of most surface waters. Those dischargers unable to attain the recommended QLs may be allowed to develop matrix specific quantitation levels or given time schedules to attain appropriate laboratory services.

The approach outlined above will:

1. Reduce the uncertainty dischargers are faced with if data below quantitation levels were used to assess compliance.
2. Provide dischargers with schedules to provide laboratory services and the ability to determine

matrix specific effects from their effluents.

3. Promote high quality laboratory services in a reasonable time frame.
4. Provide the agency with data reasonable to use in enforcement.
5. Provide receiving waters with protection by specifying the best approved methods for measuring compliance.
6. Provide a clear process for determining compliance with "sufficiently sensitive" methods requirements in federal rule.

Following is an excerpt of the table of analytical levels used by permit applicants for effluent characterization in NPDES new permit applications and applications for permit renewal. The table is also used by Ecology permit writers as a guide for routine effluent monitoring. The table contains values which have been shown to be consistent for wastewater analysis and may be slightly higher or lower than published values in 40 CFR Part 136.

The objectives of the table are to reduce the number of analytical "non-detects" in applications and monitoring reports and to measure effluent concentrations near or below criteria values where possible at a reasonable cost. If an applicant or Permittee knows that an alternate method from 40 CFR Part 136 is sufficient to produce measureable results in their effluent, that method may be used for analysis. The table is also used to ensure compliance with "sufficiently sensitive" methods requirements in federal rule.

Ecology updates the table as new information becomes available on existing and new methods, detection levels, and quantitation levels. The full table is available in three locations:

- Ecology permit writers can find the latest version on SharePoint as *Appendix A*.
- Permit applicants and the general public can find the latest version on Ecology's Permit Application Forms web page: https://ecology.wa.gov/Water-Shorelines/Water-quality/Water-quality-permits/Water-Quality-individual-permits#forms.
    - As *Attachment 1-I* (to Form 2C)
    - As Appendix A of *EPA/Ecology Form 2A*.

Table 14. Methods, Detection and Quantitation Levels Recommended for Effluent Characterization and Effluent Monitoring

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
Conventionals			
Biochemical Oxygen Demand	SM5210-B		2 mg/L
Chemical Oxygen Demand	SM5220-D		10 mg/L
Total Organic Carbon	SM5310-B/C/D		1 mg/L
Total Suspended Solids	SM2540-D		5 mg/L
Total Ammonia (as N)	SM4500-NH3-B and C/D/E/G/H		20

1. **Detection level (DL)** or detection limit means the minimum concentration of an analyte (substance) that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero as determined by the procedure given in 40 CFR part 136, Appendix B.
2. **Quantitation Level (QL)** also known as Minimum Level of Quantitation (ML) – The lowest 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. The QL is calculated by multiplying the MDL by 3.18 and rounding the result to the number nearest to (1,2,or 5) x 10^n, where n is an integer. (64 FR 30417).

   ALSO GIVEN AS:
   The smallest detectable concentration of analyte greater than the Detection Limit (DL) where the accuracy (precision & bias) achieves the objectives of the intended purpose. (Report of the Federal Advisory Committee on Detection and Quantitation Approaches and Uses in Clean Water Act Programs Submitted to the US Environmental Protection Agency December 2007.

4.5 Polychlorinated Biphenyls (PCBs)

PCBs are a persistent, bioaccumulative, and toxic group of manmade compounds found throughout the environment. Federal NPDES permitting regulations require use of analytical test methods approved under 40 CFR Part 136 for assessing compliance with permit limits. The method currently approved for use in PCB analysis under 40 CFR Part 136 is Method 608. Method 608.3, released in December 2016, contains updates for PCBs; however, this method was not published in the Federal Register prior to the change in Executive Administration in January 2017. As is common with new Administrations, Federal Agencies issued a mandatory recall of all actions that were not published in the Federal Register prior to the Administrative change. The final rule was published in August 2017. After the delayed publication, Method 608.3 became the preferred method by Ecology for effluent limit compliance evaluation; however, laboratories have one year to comply with this revised method due to the MDL development procedural changes. Through August 2018, laboratories may still use modified Method 608 for compliance if they have not yet received accreditation for Method 608.3. See 4.5.1 in this chapter for detail on using modified 608 for effluent limit compliance.

As of January 2017, the three methods that are used for permitting purposes are Methods 608, Method 8082A (Update V) and Method 1668C. Methods 8082A and 1668C are not-EPA approved methods under 40 CFR 136. Recent EPA revisions to 608.3 and 8082A refine QA processes and increase method sensitivity. Method 608 (or 608.3) and Method 8082A are methods for reporting Aroclor concentrations (7 individual Aroclors). Method 8082A can also report some congeners. Method 1668C is a very sensitive method for reporting congener concentrations (209 individual congeners). All three methods sum the results (Aroclors or congeners) to calculate a total PCB concentration. Surface water regulatory standards for chronic aquatic life and human health criteria are set at levels lower than EPA Method 608 (or 608.3) are able to evaluate. The two other methods used to evaluate PCBs, 8082A and 1668C, provide lower analytical limits and may be used for permitting purposes to evaluate sources, but not for numeric effluent limit compliance. Section 4.5.5, Table 18, gives a comparison of the different reporting limits for all methods discussed in this chapter.

4.5.1 Method 608

In response to a Pollution Control Hearings Board decision (Case Number P13-137c) in July 2015, Ecology conducted a phone survey of over 20 labs in Washington to determine achievable detection levels (DLs) and quantitation levels (QLs) for water samples under Methods 608 and 8082A. Labs indicated that DLs and QLs lower than required by Ecology in NPDES permits were achievable with modifications to both methods. Common techniques were reported to lower detection limits: extracting a larger than one liter sample, large volume injection, concentrating the sample extract, and solid phase extraction (SPE). But the relatively high QL for 608 was problematic and bound by the strict requirement that the method-specific standard deviations (e.g., calibration factor or response factor) be less than ten percent for the calibration curve of each Aroclor. Also, some techniques like SPE were allowed with 8082A but not with 608.

Recently, EPA promulgated the Methods Update Rule (December 2016) that includes Method 608.3 for PCB Aroclor determination. This update was recorded into the Federal Register in August 2017 and recognizes advancements in laboratory techniques and technology that were identified by local labs. Specifically, the new method includes more techniques for extraction and clean-up, revised MDL determination procedures to account for lab blank contamination, and sets the calibration curve to twenty five percent standard deviation. Extraction techniques such as separatory funnel, continuous liquid-liquid for extraction and SPE are now included. These modifications have prompted updates to lab standard operating procedures (SOPs), and labs have worked with Ecology's Laboratory Accreditation Unit (LAU) for accreditation beginning August 2017 for NPDES permit requiring analysis using Method 608.3. LAU has granted accredited laboratories a compliance period of one year so that they may implement the new MDL procedures. The end of this compliance period is expected to occur in September 2018. In the interim, laboratories accredited for Method 608 may use the modified procedures discussed earlier in this section to increase the methods sensitivity.

Permit writers must work with permittees to ensure they use the 2016 update for Method 608.3 in NPDES permits as soon as their associated laboratory becomes accredited. This may occur before September 2018. The update sets the DL at 0.065 µg/L and the QL at 0.195 µg/L (3x the DL). These reporting limits apply to all Aroclors even though it is only specified for PCB-1242 in the method. Laboratories may use Aroclor 1242 as an indicator for determination of the method validation statistics. Language in the method states: *"When analyzing the PCBs as Aroclors, it is only necessary to establish an MDL for one of the multi-component analysis (e.g., PCB 1254), or the mixture of Aroclors 1016 and 1260 may be used to establish MDLs for all of the Aroclors" (EPA, Method 608.3)*. The method QL revision in Method 608.3 results from a change in the tolerance for the relative standard deviation from 10% to 20% (for external standard calibrations) and 15% (for internal standard calibration). Permit managers should verify the laboratories QA/QC report supplied with analytical results against both the reporting limits in Appendix A and also Table 4 of the EPA published method text. If there are questions related to laboratory quality assurance verification, contact LAU or someone else at Ecology that has experience in interpreting laboratory data. *NOTE: Table 2 of published method 608.3 erroneously reports the QL for Aroclor 1242. The correct value is 0.195 ug/L, not 0.095 ug/L as recorded.*

Permit writers may consider lower QLs for a permit only if laboratories can demonstrate quality assurance using Method 608.3 procedures for samples from highly treated wastewater or other discharges with relatively low levels of pollutants. This is due to less potential for matrix interference. If electing to modify the DL and QL, Appendix A should reflect that change. It is the permittee's responsibility to ensure the laboratory can meet the change in the method validation statistics.

The lower DL and QL level achievable with Method 608.3, may lead to an increase in qualified data (estimated values reported below the QL, but above the DL) in lab reports. See Section S3 Reporting and Recording Requirements for an explanation of how Permittees must report data qualifiers in WQWebDMR. In addition, fact sheets must provide a description of how Ecology uses qualified data in the permit data summary and subsequent reasonable potential analyses. See Section 4.3 of this chapter for a description of how to use analytical results that fall between the DL and QL in permitting. Part IV of the fact sheet shells also contains optional language handling qualified data when effluent limits are near detection or quantitation levels. This language should be used and modified, if necessary, for the specific permitting situation.

Method 608 must be used for permit compliance until a laboratory used by a permittee becomes accredited for Method 608.3. Lowering the DL and QL for Method 608 through refinement of laboratory procedures does not affect the method's approval for permit compliance. Table 15 lists both the unrevised and revised DLs and QLs for Method 608 Ecology used for permitting prior to promulgation of Method 608.3. See Appendix A for the most up to date reporting limits for PCBs as defined in Method 608.3. Table 18, later in this chapter, lists reporting limits for all three PCB analytical methods discussed in this chapter.

Table 15. Method 608 Limits of Reporting prior to 608.3

EPA Method	DL, µg/L	QL, µg/L
608 (unrevised)	0.25	0.5
608 (revised)	0.05	0.2

Laboratories electing to use the Method 608 revisions must update their SOPs for the change in analytical technique. Once updated, the LAU must conduct a review prior to the laboratory running analyses for NPDES permit compliance. Labs are responsible for contacting LAU to verify what is needed for receiving approval to run the revised Method 608 procedure. Initial documentation for this method revision at a minimum must include: acceptable proficiency testing (PT) sample results, initial demonstration of capability (IDC) with an alternative source standard (see Section 8.2 of Method 608), a MDL summary, and a calibration curve showing acceptable quality control.

Permit writers need to notify Permittees if requiring use of the revised Method 608 during permit development. An explanation regarding the requirement of the revised method should also be provided in the Fact Sheet. **Note that after September 2018, the appropriate compliance method is 608.3.** Laboratories transitioning to Method 608.3 are responsible for contacting LAU to verify what is needed for accreditation. When effluent concentrations fall below the DL and QL of Method 608-revised, or Method 608.3, and the permit writer has reason to suspect PCB contamination, the permit writer should consider a characterization monitoring requirement using Methods 8082A and/or 1668C discussed in Sections 4.5.2 and 4.5.3 of this chapter. In the event of an EPA-approved TMDL that assigns numeric wasteload allocations, permits must require monitoring using Method 608.3 to assess compliance with the wasteload allocation assigned to the discharge. In this instance, for example, there is no need for characterization monitoring using a more sensitive method because PCB loading in the discharge has already been quantified. Other methods for other purposes, such as source control and adaptive management, may still be necessary. In general, discharges from small municipal facilities do not need characterization monitoring as there is little risk of direct PCB inputs to the collection system. Permit writers should still consider potential site specific information for these small dischargers and use best professional judgement when developing monitoring requirements. See Section 4.5.5 of this Chapter for additional discussion.

4.5.2 Method 8082A

In August 2015, EPA promulgated 'Update V' to SW-846 Methods, including an update to the organic compound series - 8000D Determinative Chromatographic Separations, which includes Method 8082A. Ecology's LAU will begin to accredit labs related to Update V during routine on-site audits beginning in January 2017.

Key features of Update V for Ecology's NPDES program are the steps taken to improve the quality assurance of the laboratory data, particularly reduction to a single limit for reporting. Chapter One of SW-846 defines the Lower Level of Quantitation (LLOQ) as: The lowest point of quantitation which, in most cases, is the lowest concentration in the calibration curve. Update V now requires laboratories to only report the LLOQ (no QL or DL), which is a function of both the method and the sample being evaluated.

Previously the DL only considered the blank spike which often resulted in unachievable MDLs for complex matrices such as stormwater or process wastewater. The LLOQ considers the effect of sample matrix throughout the entire analytical process for a batch of samples. Therefore, it is better suited for samples with complex matrices (e.g., process wastewater and solids). Results above the LLOQ are quantifiable within acceptable precision and bias, and are reported with a known level of confidence. The LLOQ is verified periodically with laboratory control samples (blank spikes), using lab-specific statistically based recovery limits or project limits. The new QC protocol for this method requires validation to the lowest point on the calibration curve developed by the individual laboratory. LAU is available to answer questions regarding LLOQ requirements if permit writers have specific questions during permit development, developing Quality Assurance Project Plan requirements, or when interpreting laboratory reports.

As a performance-based method with a single reporting limit, laboratories now have more flexibility with sample preparation. These modifications provide more trust in the analytical data as it results in fewer qualifications due to a necessary increase in accuracy and precision. In 2015, just prior to Update V (using 8000C), local labs using Method 8082A reported they consistently achieved DLs of 0.008 µg/L and reporting limits of 0.016 µg/L in most samples using routine extraction and clean-up techniques such as continuous liquid-liquid or solid phase extraction (SPE).

Starting in 2017, Ecology expects laboratories to update method SOPs for accreditation of the 8082A –Update V. While waiting on laboratory accreditation through LAU, permit writers may consider using both an LLOQ set to 0.016 µg/L and variable DL dependent on the quality of the individual discharge. Samples from highly treated wastewater or other discharges with relatively low levels of pollutants are more likely to pass the LLOQ quality assurance due to less potential for matrix interferences. Permit writers may consider lower LLOQs using Update V Method 8082A procedures for a permit only if the laboratory can demonstrate quality assurance in those samples.

Whether a lab will report on qualified data (data between the DL and LLOQ) is a decision made by each lab, project or permit. Ecology understands that laboratories may report both a DL and LLOQ for a period of time while labs become accredited under Update V. Until accreditation is reached, permit writers must specify both the DL and LLOQ for the method, not just the LLOQ, and verify reporting limits in the lab report received provided with the results. When specifying the DL in addition to the LLOQ, permit writers should work with the appropriate laboratory to ensure the reporting limits are sensitive enough for the site specific analysis. Permittees can continue to request laboratories to use the dual reporting method even after receiving accreditation for Update V. Permit writers should use their judgement on requiring the dual reporting method. In general, the change to the single reporting method is considered to be an important improvement. Use of the LLOQ supports the Water Quality Program's need for Permittees to generate verifiable data while meeting necessary precision and accuracy thresholds for source identification, source control, discharge characterization and other required monitoring.

Qualified data (estimated values reported above the DL and below the LLOQ) is anticipated to decrease in frequency as labs are accredited for 8082A-Update V and move to the single reporting limit. Method quality objectives (MQOs) for Update V should only be used once a laboratory has become accredited for the revision. See Section 4.5.4 for a discussion on MQOs and sampling plan development.

Permit writers should specify the LLOQ for the compliance assessment level and include footnotes explaining the monitoring requirement in S2. In addition, the permit writer needs to clearly state how qualified data (below the LLOQ) will be used. If the permit contains a requirement for monitoring PCBs using Method 8082A and the dual reporting method is used, follow procedures in 4.3 of this section, replacing QL with LLOQ, for calculating averages and other statistics. After becoming accredited for Update V, the procedure listed in Section 4.3 still applies; however, laboratories will flag results that fall below the LLOQ and are unlikely to return a numeric result. Data below the LLOQ should not be used in calculating averages as it lacks a level of certainty that the analyte is in the sample.

The permit should provide clear direction about how to report data qualifiers in PARIS if requiring the data be submitted with a DMR. Alternatively, the permit writer has the option of requiring the data to be submitted separately from a DMR. Regardless, the fact sheet should provide a full description of how Ecology will use (or disregard) qualified data. This becomes especially important when permit writers use qualified data in calculating or evaluating numeric limits. Some source identification activities may adjust how qualified data is used and this should also be well described in the permit, fact sheet and PARIS. The method modification to a single reporting limit (LLOQ) should help to reduce qualified data as reported by the laboratory.

A permit writer should require MQOs for Method 8082A in permits based on necessary performance measures needed for the specific monitoring event. In some permits, permit writers may require the Permittee to develop a QAPP to provide more information for the data evaluation procedures. If using Method 8082A, a QAPP is recommended as a permit requirement especially if requiring dual reporting limits. Use of a QAPP will implement reporting limit requirements for laboratories so that data collected by permittees is properly quantified and qualified for permitting decisions and data quality objectives. Ecology has QAPP templates which are available to both permit writers and permittees. See Section 4.5.4 for an example of MQOs to be provided in a QAPP for 8082A Update V analyses, which must be modified based on project specific needs. Analytical laboratories should be contacted for input regarding the MQOs for the analysis prior to QAPP finalization.

Permit writers still need to evaluate the percentage of qualified data in the laboratory report, especially in the instance when laboratories have not been accredited for Update V. When data qualifiers or ND values start to exceed a 25% threshold, permit writers should apply their best professional judgement and consider utilization of Method 1668C. An instance where more sensitive monitoring may not be required is when PCB concentrations start to fall after successful installation and management of BMPs. Best professional judgement must be applied and explained in the fact sheet in this situation.

4.5.3 Method 1668

Method 1668c is a very sensitive analytical method that has the capability of detecting 209 different PCB congeners. Water quality standards are based on Total PCBs (the sum of all Aroclors, isomers, homologs, or congeners), and have most frequently been measured as a calculated sum of all or a select group of congeners (e.g. a grouping representing an Aroclor) found in a sample. The data generated by Method 1668C is more complex and extensive than data generated by the other two methods, and must be carefully managed, assessed and applied. As of 2018, PARIS is not equipped to handle analytical results from Method 1668C due to method complexity. This data must be required as part of a separate submittal or report. Raw data files from these analyses should be filed as part of the permit record and associated with the specific submittal number in PARIS.

The process to interpret lab data and evaluate usability of data produced by Method 1668C toward permit needs should be spelled out in a Quality Assurance Project Plan (QAPP). See

Section 4.5.4 for a discussion on QAPP development considerations. Based on expertise from elsewhere in the U.S. (e.g. Delaware River Basin PCB Monitoring), additional data management standard operating procedures that explicitly deal with analytical method QA/QC, column types, blank contamination, raw vs. censored data, matrix interference, and co-eluting PCB congeners are needed to allow for consistent use of PCB congener data in permits.

When conducting sampling for analysis using Method 1668C, the permittee must submit a QAPP for approval as site specific requirements will determine measurement quality objectives (MQOs). A permit related QAPP will document a consistent manner with respect to procedures (e.g. interpreting lab control samples, blank censoring, calculating total PCBs) specific to the level of certainty required in decision-making. Data produced from this method could be used as the basis for developing effluent limits, to measure attainment of water quality standards, and other critical measures (see section below), therefore, the QA/QC must be rigorous. It is recommended to follow data qualifiers used by Manchester Environmental Lab for consistency during the quality assurance process. This helps to eliminate confusion related to labs using custom qualifiers with differing definitions.

As a rule, any Method 1668C analysis should include both field and laboratory blanks in the required sample sets as a way to increase result precision. Permit writers should never use raw data generated in a Method 1668C analysis for congener summation. When PCB concentrations are very low, background contamination in lab or field blanks may interfere with the calculation of total PCB. For reference, equipment or field blanks are sample containers filled with distilled water and are used to determine contamination from glassware, any preservatives used, or from ambient field conditions. Laboratory blanks, or method blanks, are used by the laboratory to ensure no contamination occurs at any point during the analytical procedure. Labs also use these blanks as part of their quality assurance procedure. Comparison of the field and laboratory blanks is useful in determining a source, if any, of sample contamination. As an example, MDLs for Method 1668C can range from 7 – 50 pg/L in water (depending on matrix interferences). For reference, levels of PCBs in laboratory blanks using highly distilled laboratory water (e.g., ‘nanopure’ or ‘Milli-Q’) can be as high as 50 pg/L. Permit writers should generally expect to see blank contamination in analytical results when using Method 1668C. It is important to know how to evaluate data after confirming blank contamination.

A common technique to deal with blank contamination is called censoring and is described in EPA's National Functional Guidelines for the Contract Laboratory Program. These guidelines recommend censoring congeners (not including them in the calculation of total PCBs) if they are in the sample at a concentration of less than 10x the concentration found in the *laboratory* blank. Each sample set should have both a field and laboratory blank for censoring purposes. Using 10x censoring for summation of the 209 PCB congeners removes false positives that are not significantly above (e.g. less than 2 standard deviations from the mean) the blank level. The value of 10x equates to 95% confidence level that the congener is present in the sample and is also quantifiable. For the purposes of developing effluent limits, the process of applying the 10x laboratory blank censor is appropriate. Utilizing a blank censoring procedure becomes important in low concentration scenarios and does not need to be applied to results reporting high congener concentrations. Note, if results show higher concentrations where blank contamination has little effect on the data analysis, permit writers should confirm that 1668C is the most appropriate method. A less sensitive method may be appropriate in this instance. Overall, the choice of a censoring technique and factor (e.g. 3x, 5x or 10x) is specific to data, project needs, and the study objective. For comparison, blank censoring at 3x or 5x is used for identification of sources and can be a semi-quantitative analysis that may yield false positives which prevents it from being useful for the purpose of determining reasonable potential. The censoring technique and selected factor must be defined in the approved QAPP. Defining these techniques becomes part of the study's MQO and should be determined early on in the project phase. Table 16 provides an example of the blank censoring procedure.

Table 16. Method 1668C Blank Censoring Procedure

Congener	Ambient Sample, pg/L	Ambient Qualifier	Qualifier Correction, pg/L	Lab Blank, pg/L	Blank Qualifier	Qualifier Correction pg/L	10x Censor pg/L
PCB-001	2.04		2.04	1.37	J	1.37	0
PCB-002	1.65	J	1.65	0.537	NJ J	0	1.65
PCB-003	2.27		2.27	1.14	NJ J	0	2.27
PCB-004	8.82		8.82	1.33	UJ	0	8.82
PCB-005	0.802	UJ	0	1.03	UJ	0	0
PCB-006	2.05		2.05	0.91	UJ	0	2.05
PCB-007	1.06	NJ J	0	0.938	UJ	0	0
PCB-008	6.35		6.35	1.09	J	1.09	0
PCB-009	0.943	NJ J	0	0.913	UJ	0	0
PCB-010	0.691	UJ	0	0.886	UJ	0	0
PCB-011	44.4		44.4	4.36		4.36	44.4
						Sum:	59.2

*Note: U, NJ, and UJ qualifiers set at zero

Method 1668C is not currently approved by EPA for effluent limit compliance under 40 CFR Part 136. And, Ecology is ***not*** proposing to seek EPA approval of this method under 40 CFR 136.5 as there are known problems in regards to the repeatability and accuracy of the method in addition to the expense of the analysis. Permit writers should continue to use the most sensitive methods approved by EPA for compliance with numeric effluent limits, which is Method 608.3. As previously stated, Ecology's permitting database (e.g., PARIS) is not yet modified to reflect such standardizations for effluent PCB congener data. EIM, the environmental database, does contain some receiving water information from studies initiated by both the Water Quality and Environmental Assessment Programs. If interested in data within EIM, permit writers must contact the appropriate project manager before using the results in any part of the permitting process. Often times, the associated laboratory blank results are not included with site specific data in EIM or the database contains previously censored data. Both sets of results from the raw sample data and the laboratory blank are necessary for evaluation purposes. With permit required sampling, permit writers should also request raw data from the analytical laboratory even if the QAPP requires blank censoring as part of the procedure. There may be times when permit writers may want to evaluate PCBs for specific congener patterns at a more refined level or with a different blank censor. All raw data should be maintained as part of the permit record.

This section will be modified following development of a standardized procedure for storing PCB congener data in an Ecology environmental database.

Ecology recognizes many situations where targeted monitoring under Method 1668C is useful for identifying PCB sources or characterizing media of interest for use in assessments other than compliance with a numeric effluent limit (such as evaluating the effectiveness of a best management practice). The following section provides guidance on QAPP development and subsequent use of this data.

4.5.4 Data quality in low level methods

Permit writers should consider the following guidance when requiring monitoring using either method 8082A or 1668C.

The way to ensure characterization or source control monitoring returns viable results is to require a Quality Assurance Project Plan (QAPP) as a permit submittal. QAPPs are not generally required for effluent limit compliance monitoring as the methods approved by EPA (e.g., 608.3 for PCBs) contain specific tolerances and acceptance criteria. Rather, QAPPs should be required when permits require additional monitoring using Methods 8082A or 1668C. See 4.5.2 and 4.5.3 for a discussion of these methods and reporting requirements.

QAPPs document and outline the planning necessary for the collection and subsequent analysis of environmental data. Approved QAPPs ensure that the collected environmental data can be used for making decisions including BMP effectiveness or delineation of specific sources. Ecology has several examples of completed QAPPs for PCB analysis and also a QAPP template that the permittee can follow. The Environmental Assessment Program is a good resource if permit writers have questions regarding required QAPP elements. The responsibility of QAPP development falls on the permittee, not the permit manager, when the discharge permit contains the specific monitoring requirement. However, the permit manager must consult with the regional QA authority who may be in another program or WQ-PDS QA authority after receiving a completed QAPP. QAPP approval must come from the appropriate QA authority and not the permit manager. There may be times when the permit manager must develop a QAPP in conjunction with another program. The rest of this section will help to explain the QAPP development process.

The permit manager and permittee must understand the purpose of data collection, or the end use goal, because it may affect the data management procedures including statistical evaluations conducted on the analytical results. The data validation step following sample collection and analysis ensures results are usable to satisfy project objectives. Study objectives include determination of initial method target levels and the intended use of the final product. Essentially, successful study objectives involve knowing the question the additional monitoring is going to attempt to answer and what kind of data is needed to meet that end. When determining study objectives, permit writers should think about the problem statement. What are you trying to do? Making a decision verses estimating a problem are two examples of different study objectives. For example, when trying to find sources within a site, individual congener profiles may be necessary to identify contaminant specific signatures that can be used to pinpoint the origin of contamination.

Permit writers should work with permittees so that the QAPP's data quality objectives (DQOs) satisfy specific project needs. The stepwise DQO development process follows these functions with the QAPP satisfying the last step of the process:

1. Determine the problem.
2. Identify the project endpoint and/or goal.
3. Identify information needed to reach the endpoint.
4. Define the scope of the project.
5. Determine the analytical approach necessary to meet the project.
6. Set measurement quality objectives.
7. Prepare a plan for data collection and analysis (QAPP).

Effective QAPPs cover both quality control and quality assurance for the sampling event and subsequent data analysis. Quality control (QC) and quality assurance (QA) are not the same; although, some use the terms interchangeably. It is important to distinguish between the two as they represent portions of the study design and analysis. The process of data collection, management and subsequent analysis fall under QC. Development of a standard operating procedure (SOP) for the field collection and analytical laboratory is QA. The SOP provides details on how to evaluate and control data accuracy. When utilizing low level PCB analytical methods for effluent characterization or source evaluation, permit writers need to determine specific method performance criteria otherwise known as measurement quality objectives (MQOs). These MQOs must be part of the approved QAPP. For context, MQOs relate to the acceptance threshold for data. Data quality indicators (DQI) form the basis of an MQO and directly link both laboratory instrument and analytical performance forming the primary data validation criteria. Primary DQIs represent the following: precision, bias, sensitivity, representativeness, completeness, and comparability. The following offers examples and considerations when developing DQIs:

- **Precision**: Are field and/or lab duplicates necessary?
- **Bias (Accuracy)**: Are method (lab) blanks necessary to quantify laboratory contamination? What are the requirements for measuring both blank and matrix spikes? Both of these involve intentional dosing with a known concentration of the analyte of interest. This known concentration is used to evaluate the percent recovery for purposes of ensuring the analytical procedure meets specific method controls.
- **Representativeness**: Do the sampling locations represent site conditions?
- **Completeness**: How much data is necessary to meet project objectives? What is necessary for the laboratory to conduct data validation?
- **Comparability**: Are units comparable? What about methods or specific qualifiers if using different laboratories?
- **Sensitivity**: Make sure reporting limits are sufficient for the study objectives.

Table 17 provides an example of MQOs for water samples to quantify PCBs by Method 8082A, Update V. Contents of the table must be verified with both the lab prior to analysis and the appropriate agency QA authority.

Table 17. Laboratory MQOs for water samples to quantify PCBs by Method 8082A, Update V

QC Element	Performance Measure	Water samples for PCBs by EPA Method 8082A; Update V
Lowest Level of Quantitation (Reporting Limit)	Sensitivity	0.016 ug/L
Field Replicate (Split Sample)	Representativeness, Accuracy	RPD ≤ 40%
Analytical (Laboratory) Replicate	Bias and Precision	Compound specific RPD < 40%
Method Blank	Bias	Analyte concentration <MDL; if ≥ MDL, lowest analyte concentration must be ≥ 10x method blank concentration
Laboratory Control Sample / Certified or Standard Reference Material	Bias and Accuracy	50-150 % recovery
Matrix Spike and Duplicate RPD	Bias and Accuracy	50-150 % recovery; ≤40 R RPD
Surrogate Spike	Bias and Accuracy	Compound specific; within 25-150 % recovery

[1] = for laboratories not yet accredited by Ecology for Method 8082A Update V for LLOQ, default to the reporting limit or quantitation limit of 0.016 ug/L

LLOQ vs RL: The LLOQ

RPD: relative percent difference. RSD: relative standard deviation. MDL: method detection limit.

Analytical Replicates: Provide precision information on the actual samples; useful in assessing potential samples heterogeneity and matrix effects.

Method blank for water samples: Laboratory blanks are used for instrument calibrations and determining whether any contamination is present in laboratory handling and processing of samples. Method blanks are prepared in the laboratory using the same reagents, solvents, glassware, and equipment as the field samples.

Laboratory Control Samples: Sometimes called check standards or laboratory control samples, are method blanks spiked with surrogate compounds and analytes; useful in verifying acceptable method performance prior to and during routine analysis of samples.

Surrogate Spike Compounds: A type of check standard that is added to each sample in a known amount prior to extraction or purging.

Matrix spikes and matrix spike duplicates: A matrix spike provides a measure of the recovery efficiency and accuracy for the analytical methods being used under the same conditions as the field sample. A separate container of the field sample is needed to evaluate a matrix spike sample. Matrix spikes duplicates are used to determine method accuracy and precision. Common notation is matrix spike/matrix spike duplicate [ms/msd].

Matrix Spikes: Percent recoveries of matrix spikes are reported and should include a wide range of representative analyte types; compounds should be spiked about 5x the concentration of compounds in the sample or 5x the quantification limit.

Surrogate standards: Surrogate standards are added before extraction to monitor the efficiency of the extraction methods.

Standard Reference Materials (SRM): A material or substance whose property values are sufficiently well established to be used for calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.

Certified Reference Material (CRM): A reference material, provided by standard setting organizations (e.g., NIST, CRM), accompanied by or traceable to a certificate or other documentation that is issued by a certifying body.

Final QAPP elements document the required laboratory analysis QA procedures following the data collection phase. These procedures assess whether or not the collected data meets the specified DQIs in addition to the specific study objective. QA procedures include verification of sampling procedures, data verification and validation, in addition to determining the usability of data collected. Without QA, the data from the study cannot be used to inform the project specific questions related to the sampling event. Also, determining the DQOs prior to implementing a monitoring requirement for a source identification study or pollutant minimization plan can help maintain the cost effectiveness of a study, especially with multiple sampling events spanning several years.

When requiring characterization monitoring, it is important to consider the result you want to achieve and the appropriateness of additional sampling. These listed factors contribute to the selection of an appropriate monitoring method. Information collected through previous monitoring should help the permit writer understand which method to select. Cost of PCB analysis differs substantially from method to method with 608.3 being the least expensive and 1668C the most expensive. The difference lies in the rigorous QC processes for 1668C including the level of reporting. While 1668C will return information down to the lowest quantifiable level, it is not necessarily appropriate to require this method when method 8082A will also return detectible concentrations. The following section provides information to help determine which method is appropriate in your permit.

4.5.5 Selecting the appropriate analytical method

Before requiring any monitoring for PCBs other than priority pollutant scans, permit writers should evaluate their facility and the potential for exceeding the water quality standard. For example, small municipalities with no significant industrial users and without a legacy industry may not have PCBs in their effluent at levels that would likely exceed water quality standards. Therefore, PCB monitoring may not be necessary. This is an acceptable situation. Only include monitoring requirements when necessary for the facility and its specific discharge situation.

Data quality objectives (DQOs) should always be considered prior to placing low level monitoring requirements in a permit for purposes of characterization or source identification. Permit writers should consider the size of the facility, presence of any significant industrial dischargers, legacy source potential, the source and characteristic of the wastewater including pollutants that are or have potential to be discharged from the facility, and the result being achieved with the additional monitoring before requiring PCB characterization in permits. When in doubt, staff should consult with the permitting QA/QC lead inside the program who is familiar with permitting and monitoring challenges associated with this ubiquitous toxicant.

Understanding the potential use of collected data and which method is best suited for the required monitoring are both important considerations. Knowing the distinction between evaluating compliance with numeric effluent limits versus evaluating overall permit compliance is also necessary. While non 40 CFR part 136 methods cannot be used to evaluate numeric effluent limit compliance, a missed sampling event or late submittal of monitoring results from a non 40 CFR part 136 method constitutes an overall permit violation subject to enforcement. The following provides background to help permit writers understand both when and how to use the different methods for permit development, permit management, compliance and assessments.

Permit writers should consult Table 18 for an approximate range of reporting limits for PCB analytical methods. Reporting limits in Table 18 are to be used as general guidance in method selection. Actual reporting limits will depend on the lab performance and sample matrix. The laboratory must be contacted to verify the actual level of reporting achievable for the individual analytical method and sample matrix.

Table 18. Comparison of Reporting Limits for PCB Analytical Methods

EPA Method	DL, µg/L	QL, µg/L
608 (unrevised)	0.25	0.5
608 (revised)	0.05	0.2
608.3	0.065	0.195
8082A (LLOQ)	0.016	
1668C	0.00005	0.00007

As discussed previously, numerical effluent limit compliance must be evaluated using Method 608.3. When conducting monitoring for characterization or source control, the permit writer needs to determine a sufficiently sensitive method that will generate the most unqualified, usable data. The magnitude of PCB contamination differs across the state and can generally be attributed to historical industrial uses and atmospheric deposition. Therefore, effluent characterization and source control methods will differ based on site conditions, the type of facility (e.g. industrial or municipal), and the approximate concentration of contamination expected in the field.

It may not be necessary to have every permitted discharger enter into a characterization or source identification study. For example, minor dischargers (<1 MGD) do not need to complete priority pollutant scans and often have little to no effluent toxics data. This is because minor dischargers are not subject to the same federal regulations as major or industrial dischargers. While PCB monitoring may be appropriate for some dischargers based on individual facility characteristics, permit writers should consider the value and purpose of requiring PCB monitoring when developing discharge permits. If you received NDs on the Method 608.3 analysis, consider site specific needs. Low level PCB monitoring should only be used when working to identify sources or differing magnitudes of contamination.

Evaluating reasonable potential - Use all valid and applicable data, including data collected using methods not approved under 40 CFR Part 136 (e.g. Methods 1668C and 8082A).

- EPA's *Technical Support Document (TSD), Section 3.2* supports the use of all available information when evaluating reasonable potential, including available data and available narrative information.
- Effluent congener data from Method 1668C analysis should undergo 10x blank censoring (see Section 4.5.3) prior to the reasonable potential evaluation in order to sum the individual congener results. This reduces the probability of accounting for false positives in the final sum and avoids artificially high results.
- Evaluating reasonable potential for small dischargers can be done with a narrative site specific review. As with every reasonable potential determination, the process and rational should be included in the fact sheet. Most small dischargers will not have any

monitoring data for PCBs as they are not required to conduct priority pollutant scans. When a small facility discharges to an unlisted water body, evaluate reasonable potential based on non-numeric data (e.g. significant industrial dischargers (SIUs), legacy sources, and other site specific information). If no reasonable potential is found, no further action is required. In the event of a discharge to a 303(d) listed water body with no EPA approved TMDL, again evaluate reasonable potential based on non-numeric data. If no potential is found, no further action is required. In the event of a reasonable potential determination, first implement BMPs with pollutant minimization and adaptive management requirements designed to achieve compliance with water quality standards. Monitoring must be part of this narrative effluent limit to develop a usable data set during the current permit cycle. This should be used in the next permit cycle to develop numeric limits when they are feasible. An AKART determination (see below) may be required at this time. Also, it may be necessary to investigate the applicability of a compliance schedule or variance (see Chapter 6, Section 3.3.13 or Chapter 16, Section 2, respectively).

- The following evaluation of reasonable potential applies to both large municipalities (> 1 MGD) and industrial discharges. When discharging to an unlisted waterbody, evaluate reasonable potential based on existing SIUs, data in the permit application, and all site specific information. This may be a narrative evaluation when the only facility-specific data for PCBs shows non-detects. Document the evaluation and results in the fact sheet. In the event of a discharge to a 303(d) listed surface water body with no EPA approved TMDL, again evaluate potential to exceed based on SIUs, data in the permit application, and all site specific information. When reasonable potential is found and contamination is expected, begin data collection for further characterization and/or effluent limit development. In addition, implement BMPs with pollutant minimization and adaptive management requirements designed to achieve compliance with water quality standards. Monitoring must be part of this narrative effluent limit to develop a usable data set during the current permit cycle. Increasingly sensitive analytical methods may be necessary for quantification purposes. This data must be used in the next permit cycle to develop numeric limits when they are feasible. An AKART determination (see below) may be required at this time. Also, it may be necessary to investigate the applicability of a compliance schedule or variance (see Chapter 6, Section 3.3.13 or Chapter 16, Section 2, respectively).

Requiring monitoring to complete a permit application – Use only 40 CFR Part 136 methods (e.g. Method 608.3).

- 40 CFR 122.21(e)(3) says the application shall not be considered complete unless 40 CFR Part 136 approved methods are used.
- Review the laboratory's accompanying QA/QC report supplied with the required application monitoring for accurate reporting limits and methods. Handle qualified data in accordance with Section 4.3.

Calculating numeric effluent limits - Use all valid and applicable data, including data collected using methods not approved under 40 CFR Part 136 (e.g. Methods 1668C and 8082A). Refer to Section 4.3 for discussion related to qualified data manipulation.

- Effluent limits are required when there is reasonable potential (RP). Numeric effluent limits are required where it is feasible to calculate them (based on data availability, discharge duration, and variability). If valid data collected using a more sensitive but non-Part 136 method make it feasible to calculate limits, those data should be used to calculate the numeric effluent limit.
    - Ecology has previously determined that it is infeasible to calculate a numeric effluent limit based on human health criteria for intermittent wet weather discharges (e.g., stormwater, treated CSOs). See *Permit Writer's Manual, Appendix C, 6.1 Critical Effluent Flow* for details.
- Follow procedures in PermitCalc when developing water quality-based effluent limits (WQBEL). Performance-based effluent limits are appropriate when using a compliance schedule to meet a WQBEL.

Evaluating compliance with numeric effluent limits – Use only 40 CFR Part 136 methods. For PCBs, this is Method 608.3.

- 40 CFR 122.44(i)(1) specifically requires monitoring *to assure compliance with permit limitations* according to Part 136 approved methods. If available data were collected using a congener method (e.g. 1668C) and compliance is evaluated using an Aroclor method (e.g. 608), the fact sheet should note the differences between the methods, including a discussion of both the correlation of results between methods and overlap within each method when summing individual compounds to calculate a total value.

Conducting analysis for All Known Available and Reasonable Technology (AKART) - Use methods appropriate for the facility.

- As a toxic pollutant, PCBs are subject to WAC 173-220-130 and RCW 90.48.520, which require the application of all known, available, and reasonable methods to control toxicants in the applicant's wastewater (also known as AKART). Expect AKART determinations to be different based on the size, type, and location of treatment facilities. Application of AKART must be well documented in the fact sheet.
- Methods of control for PCBs may include, but are not limited to, treatment technology, source control, best management practices, and adaptive management.
- A general discussion about AKART and how it is applied in wastewater discharge permits is provided in Section 3 of Chapter 4 in Ecology's *Water Quality Program Permit Writer's Manual*.
- For the purposes of applying AKART, Method 1668C may be required where identification of sources based on congener profile is necessary, or where expected concentrations are below analytical levels achievable by 608.3, and where treatment to lower levels is found to be reasonable. Site-specific factors, wastewater characteristics and sources must be considered when choosing the appropriate test method.

Evaluating effectiveness of best management practices - Use methods appropriate for evaluating the effectiveness of the best management practice (BMP).

- PCB analytical method selection will depend on expected concentrations in the sampled media, the BMPs required or selected, and the potential sources of PCBs on and to the site or facility. For example:
    - A PCB Aroclor Method (608.3 or 8082A) would typically be required where it is sufficiently sensitive to evaluate the effectiveness of the BMP. For example, a source tracing program aimed at finding and addressing PCB sources to stormwater at individual industrial properties based on PCB concentrations in catch basin solids, which are routinely detectable using Method 8082A.
    - Method 1668C would typically be required for source identification when the potential sources are likely to have different congener profiles, are more diffuse, or where the media sampled is unlikely to show detections using 608.3 or 8082A. Where the sources of PCBs on an individual property are not known, PCB congener data may be useful in identifying sources on and to the site. Congener data may be effective in track down sampling within a collection system, too. Blank censoring is also used to evaluate sources through effectiveness monitoring. Section 4.5.3 discusses censoring congeners that are less than 10x the laboratory blank for verifying the presence or absence of the molecule in a sample. Other data quality objectives, such as source identification, could use different censoring techniques that use different multipliers (e.g. 3x or 5x). The QAPP must specify if a different multiplier is used to censor data. Otherwise, use the 10x multiplier as the default value. Use of these different censoring strategies equate to varying levels of confidence in the analysis and should be explained both in the fact sheet and required QAPP. These data may be used to evaluate trends over time and to quantify reductions in influent, effluent and/or receiving waters.
- Use of surrogate parameters to evaluate the effectiveness of BMPs may be appropriate in lieu of PCB analysis if a surrogate parameter is available and appropriate. A correlation between the surrogate parameter and PCB concentration must be made on a site-specific basis to apply this effectiveness evaluation. For example, it might be possible to develop a correlation between TSS reduction and PCBs.
- Monitoring of media other than water can provide appropriate surrogate data using a less sensitive method. For example, evaluation of PCB concentrations in sludge/biosolids in municipal wastewater treatment can be an indicator of the effectiveness of pollution prevention and pretreatment efforts to reduce PCB concentrations in discharges to both the treatment facility and receiving water.
- If a reasonable potential is found, numeric effluent limits are required when it is feasible to calculate them. BMPs may also be required in this case, but must not be used in-lieu of numeric limits. Permits with both numeric limits and BMPs may require monitoring using two different methods for two different purposes (e.g., Method 608.3 for monitoring to assess compliance with a numeric effluent limit and Methods 1668C or 8082A for BMP effectiveness monitoring).
- Where it is infeasible to calculate numeric limits (e.g. stormwater and satellite CSO treatment plants), non-Part 136 methods may be used for evaluating BMPs, conducting adaptive management, and source identification. See Chapter 7, Section 5.1, for more information on feasibility.

5. Whole Effluent Toxicity (WET)

5.1 Permit Writer's Task Summary

This Section describes how to implement Chapter 173-205 WAC, Whole Effluent Toxicity Testing and Limits. Sections 5.2 through 5.14 describe the rule's processes in detail. More information on test species, statistics, test review, and sampling is found in Ecology Publication WQ-R-95-80 (*Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria* aka "Canary Book"). It is available at: https://fortress.wa.gov/ecy/publications/documents/9580.pdf. Model permit language for implementing WET requirements is available for most situations. Contact the Program Development Services (PDS) Section about an unusual permitting situation.

Permits with No Previous Effluent Characterization for WET

Permit managers should decide:

- Whether the discharge needs an effluent characterization for toxicity (Section 5.4). WET limits will be triggered automatically depending upon effluent characterization results. See WAC 173-205-050(2)(a).
- On the test species to require in the permit (Section 5.11).
- On the monitoring frequency (PWM Chapter 13, Section 4).
- Whether to use acute rapid screening tests (see Sections 5.8 and 5.12).

Permit Renewals with Previous Effluent Characterization for WET

After contacting the PDS Section for the WET data record (Section 5.14), permit managers should decide:

- Whether an additional effluent characterization is necessary (Section 5.4).
- Whether a WET limit is eligible for removal (see Section 5.7).
- Which species to require in the permit (see Section 5.11).
- On the monitoring frequency (see PWM Chapter 13, Section 4).
- Whether to use acute rapid screening tests (see Sections 5.8 and 5.12).

5.2 Introduction

Whole effluent toxicity is the total toxicity of an effluent measured directly with a toxicity test. WET testing is necessary because EPA cannot develop water quality criteria for every toxic pollutant possible in wastewater discharges. The expense would be huge to try to measure every possible chemical. WET testing is the only method for assessing the toxic interaction of all pollutants in a discharge.

Chapter 173-205 WAC, Whole Effluent Toxicity Testing and Limits (the WET rule), became effective November 6, 1993. The goal of the WET rule is the elimination of the discharge of toxics in toxic amounts. The WET rule establishes the procedure for deriving whole effluent toxicity limits in accordance with RCW 90.48.520, 40 CFR 122.44(d), and 40 CFR 122.44(e). The rule helps to implement the requirement in RCW 90.48.520 for all known, available, and reasonable methods of prevention, control, and treatment (AKART) of toxicants and for attainment of state water quality standards.

It will be best to refer to WET rule text (http://apps.leg.wa.gov/WAC/default.aspx?cite=173-205) while using this section of the *Permit Writer's Manual*. The WET rule contains the authoritative language on the WET requirements. This guidance directs the reader to the section of the WET rule pertinent to each subject discussed below.

WET testing is used in NPDES permits for the following purposes:

- *To serve as a broad spectrum indicator of increases in effluent toxicity.* WET tests assess the overall toxicity caused by every toxicant and toxicant combination.
- *To assess and limit WET to levels allowable under the state Water Quality Standards.* Water quality standards prohibit ambient toxicity (WAC 173-201A-240(1)). Water quality standards also establish the point of compliance; there is no ambient toxicity allowed past the edge of an approved mixing zone (WAC 173-201A-400). The main purpose of Chapter 173-205 WAC is to characterize effluents for WET in order to establish whether a reasonable potential exists to violate this prohibition against ambient toxicity. If a reasonable potential exists, a permit limit is required on WET (WAC 173-205-050(2)(a)). The WET rule also describes how to monitor for compliance with WET limits (WAC 173-205-070(1) and (2)).
- *To assess and limit WET on a technology basis.* Technology-based limits on acute WET may be placed into permits on a case-by-case basis (WAC 173-205-130). WAC 173-205-130 does not provide for technology-based WET limits for chronic WET or for categories of dischargers.

The regulatory process for WET in NPDES permits is shown in Figure 26 and the compliance process is shown in Figure 27. The steps in the process in Figure 26 are described below.

Step 1. The process begins with an NPDES permit application.

Important - There is a federal requirement in 40 CFR 122.21(j) that POTWs with design influent flows greater than or equal to 1 MGD or a requirement to develop a pretreatment program must submit WET test results in Part E of the 2A permit application form. The federal permit application requirement is separate from the requirements in Chapter 173-205 WAC which are the subject of this section and illustrated stepwise in Figure 26.

Step 2. Section 173-205-040 of the WET rule contains a list of circumstances under which a discharge is required to be characterized for WET. These circumstances define discharges with a risk for aquatic toxicity. Unless section 173-205-060 applies, effluent characterization will only happen once in the lifetime of a discharge. See Step 8 and Section 5.4 below.

Permits for discharges which do not fit any of the circumstances in section 173-205-040 will not require WET testing. If circumstances change so that a facility no longer has a risk for aquatic toxicity pursuant to WAC 173-205-040(1), a permit writer may make a determination in accordance with WAC 173-205-040(2)(h) to stop WET testing.

Step 3. An effluent characterization usually occurs during the first year of the permit term. Effluent characterization establishes the baseline toxicity level and determines the need for WET limits. Every sample during effluent characterization will be tested with all of the WET tests listed in the permit (multiple species testing). The first effluent characterization for a permittee will include both acute and chronic WET tests. Sections 5.4 and 5.15.1 describe the circumstances when chronic WET is not included in effluent characterization. Acute and chronic WET might have different paths or rates around Figure 26.

If a previous permit required an effluent characterization, the permittee might be at STEP 7 (no WET limits) and STEP 8 will determine whether the new permit will require another effluent characterization. (The other permittees which have WET limits will be at STEP 5 which cannot directly lead to another effluent characterization without first going to STEP 7.)

Step 4. The permit will require a determination at the end of effluent characterization as to whether the WET performance standards have been met for acute and chronic toxicity. WET performance standards establish whether a reasonable potential to violate water quality standards exists. In order to do so, a safety margin is built into the performance standards.

- The performance standard for acute toxicity is no test showing less than 65% survival in 100% effluent.
- The performance standard for <u>chronic</u> toxicity is no toxicity in a concentration of effluent representing the edge of the <u>acute</u> mixing zone (ACEC).

Permittees meeting performance standards will not get WET limits or compliance monitoring and will go straight to STEP 7 on the diagram.

Step 5. Those permittees not meeting a performance standard during effluent characterization will receive a WET limit. The permit will require monitoring to determine compliance with the WET limit. Failing to comply with a WET limit will trigger additional WET testing and possibly other enforcement actions as described in Section 5.6 and Figure 27 below.

Step 6. The WET rule does not intend that WET limits are permanent. If a permittee with a WET limit meets the performance standard during compliance monitoring for a permit term, then the WET limit will not be placed into subsequent permits. By controlling toxicity well enough to meet the performance standard, the permittee has justified removing the limit and compliance monitoring from the permit.

Step 7. Permittees who have attained the performance standards can remain indefinitely without WET limits or compliance monitoring. The only requirement will be WET test results submitted with each permit application or rapid screening testing during the permit term. The results of the WET tests done for permit application or routine rapid screening testing will be used to determine if another effluent characterization is needed.

Step 8. If changes have occurred while at STEP 7 that might increase toxicity, then the next permit will require a new effluent characterization in accordance with WAC 173-205-060 and start the process over again at STEP 3. WET limits could result from a new effluent characterization or the permittee could go directly back to STEP 7 with no WET limits.

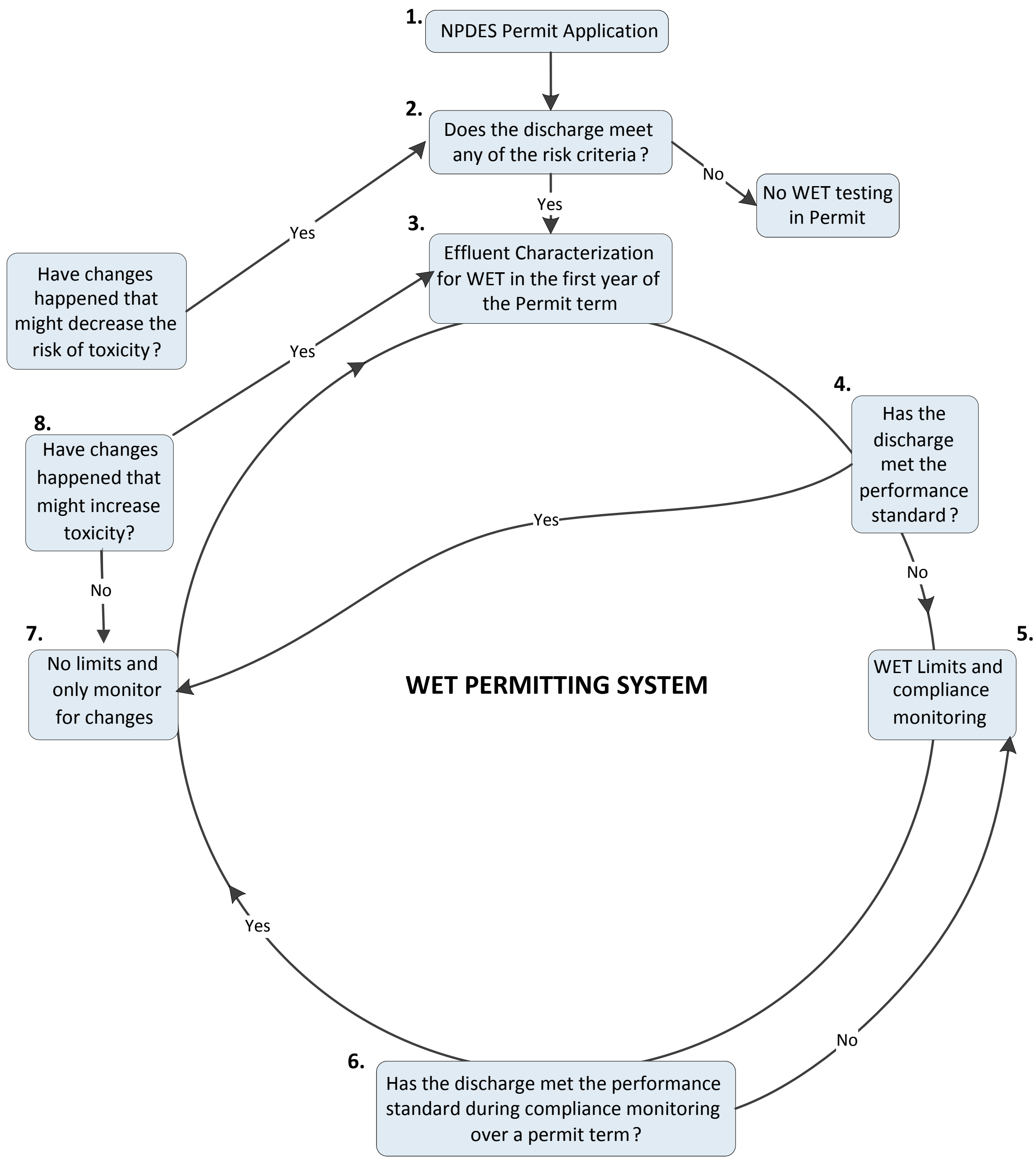


Figure 26. The WET Implementation Process

5.3 The Purpose of Effluent Characterization

Effluent characterization under Chapter 173-205 WAC is used to establish whether a reasonable potential exists pursuant to 40 CFR 122.44(d)(1)(v) which would require a WET limit. Permittees who cannot meet the WET performance standards defined in WAC 173-205-020 have demonstrated a reasonable potential for ambient toxicity and need WET limits in accordance with WAC 173-205-050(2)(a). Effluent characterization is also used to establish a baseline toxicity level. The effluent characterization process lasts for one year (WAC 173-205-020 and WAC 173-205-050(1)). During effluent characterization, each sample is tested with all WET test species listed in the permit. This multiple species testing provides an assessment of effluent toxicity in order to provide protection to as many different types of receiving water organisms as possible. See Section 5.11 for guidance on WET test species selection.

5.4 Determining the Need for Effluent Characterization

Effluent characterizations for WET are required when:

- A discharge has never before been characterized for WET and has one or more of the risk factors in WAC 173-205-040(1). These factors include the presence of hazardous substances (Table 12) at the facility which could be released to the wastewater system, the presence of toxic pollutants in the effluent for which there are no water quality criteria, being an industry listed in Table 13, or toxicity detected in past WET testing.
- A discharge that has been previously characterized for WET experiences changes in process or discharge characteristics (WAC 173-205-060(1)) and has not made the demonstration in WAC 173-205-060(2) showing that the changes have not increased effluent toxicity.
- Either a rapid screening test result during the permit term or a WET test result submitted with the permit application has shown toxicity in excess of the performance standard (WAC 173-205-060(3)).
- A new WET test has been approved pursuant to WAC 173-205-050(1)(d) that would measure effluent toxicity better than the WET tests used in the original effluent characterization. The discharge will then be characterized using only the new WET test (WAC 173-205-060(5) and (6)).

Effluent characterizations for WET are **not** required when:

- The discharge has none of the risk factors in WAC 173-205-040(1) and is excluded by WAC 173-205-040(2).
- The discharge has none of the risk factors in WAC 173-205-040(1) and the permit manager has made a determination the effluent doesn't have the potential to contain toxic substances in toxic amounts (WAC 173-205-040(2)(h)).
- The effluent receives at least 1000:1 dilution at the edge of an approved mixing zone, chronic testing is skipped but **characterization for acute toxicity is still done.** (WAC 173-205-040(3))

- The permittee is monitoring for compliance with a WET limit using species rotation, additional characterizations for WET are not required (WAC 173-205-060(4)) for the type of toxicity (acute or chronic) covered by that WET limit.

Effluent characterizations for WET must be **repeated** in subsequent permit terms when:

- Changes to processes, materials, or treatment have occurred which could result in an increase in effluent toxicity (WAC 173-205-060(1)(a)).
- Flow volume has changed by 10% or more for any discharger (WAC 173-205-060(1)(b)).
- A municipal sewage collection and treatment system acquiring a new industrial user with the potential for toxicity (WAC 173-205-060(1)(c)).
- WAC 173-205-060(3) considers effluent toxicity to have increased and calls for another effluent characterization when:
    - Toxicity tests conducted as a part of the end-of-permit-term check for permittees without WET limits (WAC 173-205-030(8)) fail to meet the performance standard.
    - Toxicity tests triggered by rapid screening test failure (WAC 173-205-120(2)(d)) fail to meet the performance standard.

No additional effluent characterization is required for a discharge that has experienced a change if the permittee has made a demonstration that the change has not increased toxicity (WAC 173-205-060(2)). The demonstration might include toxicity testing, chemical analysis, or both.

Other **important** effluent characterization information:

- Characterization for WET may be delayed for existing facilities that are under a compliance schedule to implement technology-based controls or to achieve compliance with water quality-based effluent limits (WAC 173-205-030(4)).
- The determination of the need for a chronic WET limit can be complicated or impossible if the acute critical effluent concentration (ACEC) is not specified in the permit and included in the concentration series of chronic WET tests. The ACEC and chronic critical effluent concentration (CCEC) are also needed for compliance monitoring if WET limits are assigned. Consider delaying effluent characterization until after mixing zones and dilution factors have been established.
- Effluent characterization may include WET tests conducted on ambient water collected downstream of the discharge or on effluent samples with upstream ambient water used as dilution water (WAC 173-205-030(6)).

5.5 Determining Compliance with WET Limits

Species Rotation. Because the relative sensitivity of the WET test species listed in the permit can change, testing will rotate through the species list during compliance monitoring. The rotation schedule need not have an equal testing frequency for all of the species. If one species was clearly the most sensitive during effluent characterization, then the rotation schedule should use the most sensitive species more often than the others.

Acute Wet Limits. Compliance with an acute WET limit requires a demonstration of no acute toxicity in a concentration of effluent equal to the ACEC (acute critical effluent concentration)(WAC 173-205-070(1)). The ACEC is defined in WAC 173-205-020 as the maximum concentration of effluent during critical conditions at the boundary of the zone of acute criteria exceedance.

Chronic WET Limits. Compliance with a chronic WET limit requires a demonstration of no chronic toxicity in a concentration of effluent equal to the CCEC (chronic critical effluent concentration) (WAC 173-205-070(2)). The CCEC is defined in WAC 173-205-020 as the maximum concentration of effluent during critical conditions at the boundary of the mixing zone.

Statistically Significant Differences In Response. Compliance with WET limits is determined by showing that the response of test organisms in the ACEC or CCEC is not different than in the nontoxic control. If there is a statistically significant difference in response between the ACEC or CCEC and the control, then toxicity in excess of the WET limit has been demonstrated.

Statistical significance means that the difference in response between a control and the ACEC or CCEC is more likely due to toxicity than to the variability in test organism response. If there is a statistically significant difference in response with *alpha* = 0.05 (95% confidence level), then we assume there is toxicity at the ACEC or CCEC because this means that there is at most a 5% chance that any difference is due to variability and not toxicity. There is at most a 1% chance with *alpha* = 0.01 (99% confidence level) that a difference is due to variability and not toxicity. Permit language specifies changing *alpha* from 0.05 to 0.01 under some circumstances in order to lessen the chance for a false positive result indicating toxicity.

Definition of Invalid Tests and Anomalous Test Results. Invalid WET tests occur when the lab does not follow the test method or when the results do not meet the test validation criteria (e.g., 80% or 90% control survival) in the method. Permittees are obligated to assure that all tests are valid because permits require that only the results of valid tests be submitted. Even so, the PDS Section reviews WET test results to see that they are based on valid tests.

The PDS Section also reviews WET test results to screen out anomalous test results. Anomalous test results happen even with valid tests. There is no requirement for permittees to attempt to identify anomalous WET test results. All valid WET test results must be submitted whether anomalous or not. (See Section 5.10.2 for a discussion of permittee identification of anomalous test results during WET limit compliance monitoring.)

Anomalous test results will not be used for compliance determinations (WAC 173-205-070(5)(c)). Most anomalous test results are identified by the lack of a good concentration-response relationship. If the toxic response does not increase as the concentration of effluent increases, then the test is considered to be anomalous. An anomalous concentration-response relationship can only be seen in the results of tests conducted with a full concentration series (at least five effluent concentrations and a nontoxic control). Permittees will usually be required to take another sample and repeat the WET test when results are anomalous.

False Negative Test Results and the Power Standards. When the number of replicates is inadequate, variability will sometimes prevent a large difference in response (in other words, a toxic effluent) from being determined to be statistically significant. Chapter 173-205 WAC handles false negatives through the establishment of power standards. The acute statistical power standard and the chronic statistical power standard are defined in WAC 173-205-020. Several parts of the WET rule require that toxicity tests meet the power standards (WAC 173-205-050(1)(f)(ii), WAC 173-205-050(2)(a)(iii)(A), WAC 173-205-070(4), and WAC 173-205-120(2)(c)).

The acute statistical power standard says that acute toxicity tests must be able to detect a minimum of a 30% difference in survival between the ACEC and a control as statistically significant. The chronic statistical power standard says that chronic toxicity tests must be able to detect a minimum of a 40% difference in response between the ACEC or CCEC and a control as statistically significant. If a WET test does not meet the appropriate statistical power standard, then the permittee will be required to immediately resample the effluent and repeat the toxicity test with the number of replicates increased in order to increase statistical power. The percent minimum significant difference (PMSD) reported for each WET test result can be compared to the power standard.

5.6 Noncompliance, Transient Toxicity Reports, and TI/RE Plans

Additional Testing and Transient Toxicity Reports. (Figure 27). When a discharge fails to meet a WET limit during the routine compliance monitoring, permits require additional testing to confirm ongoing effluent toxicity (WAC 173-205-090(1)). Follow-up acute tests on four weekly samples are required following noncompliance with an acute WET limit and three monthly chronic tests are required following noncompliance with a chronic WET limit (WAC 173-205-090(1)). Compliance with the WET limit is restored when the first additional sample meets the WET limit (WAC 173-205-070(1) and (2)). If all of the additional tests comply with the WET limit, the permit will require submission of a transient toxicity report describing the possible causes and prevention of effluent toxicity. The contents of a transient toxicity report are described in WAC 173-205-100(1). Compliance with all WET testing provisions of the permit is accomplished by passing all of the additional testing following a routine compliance test failure and submitting an acceptable transient toxicity report.

Toxicity Identification/Reduction Evaluation (TI/RE) Plans. If any toxicity test fails to meet the WET limit during the additional monitoring following the initial noncompliance, then the permittee must submit a TI/RE plan to Ecology within 60 days of the last additional sample (WAC 173-205-100(2)). Permittees may skip some or all of the additional monitoring and go straight to TI/RE plan submission in order to save time and money.

TI/RE plan content and approval:

- TI/RE plans are based on the latest versions of EPA guidance for conducting toxicity reduction evaluations or toxicity identification evaluations (WAC 173-205-100(2)(b)).

- A TI/RE plan need not include any procedure from the EPA manuals that does not contribute to the goal of controlling effluent toxicity (WAC 173-205-100(2)(b)(i)).
- Ecology may approve modifications or additions to the EPA procedures that will improve the ability to identify or reduce toxicity (WAC 173-205-100(2)(b)(ii)).
- The permittee is required to implement the TI/RE plan immediately upon notification by Ecology of plan approval (WAC 173-205-100(3)).

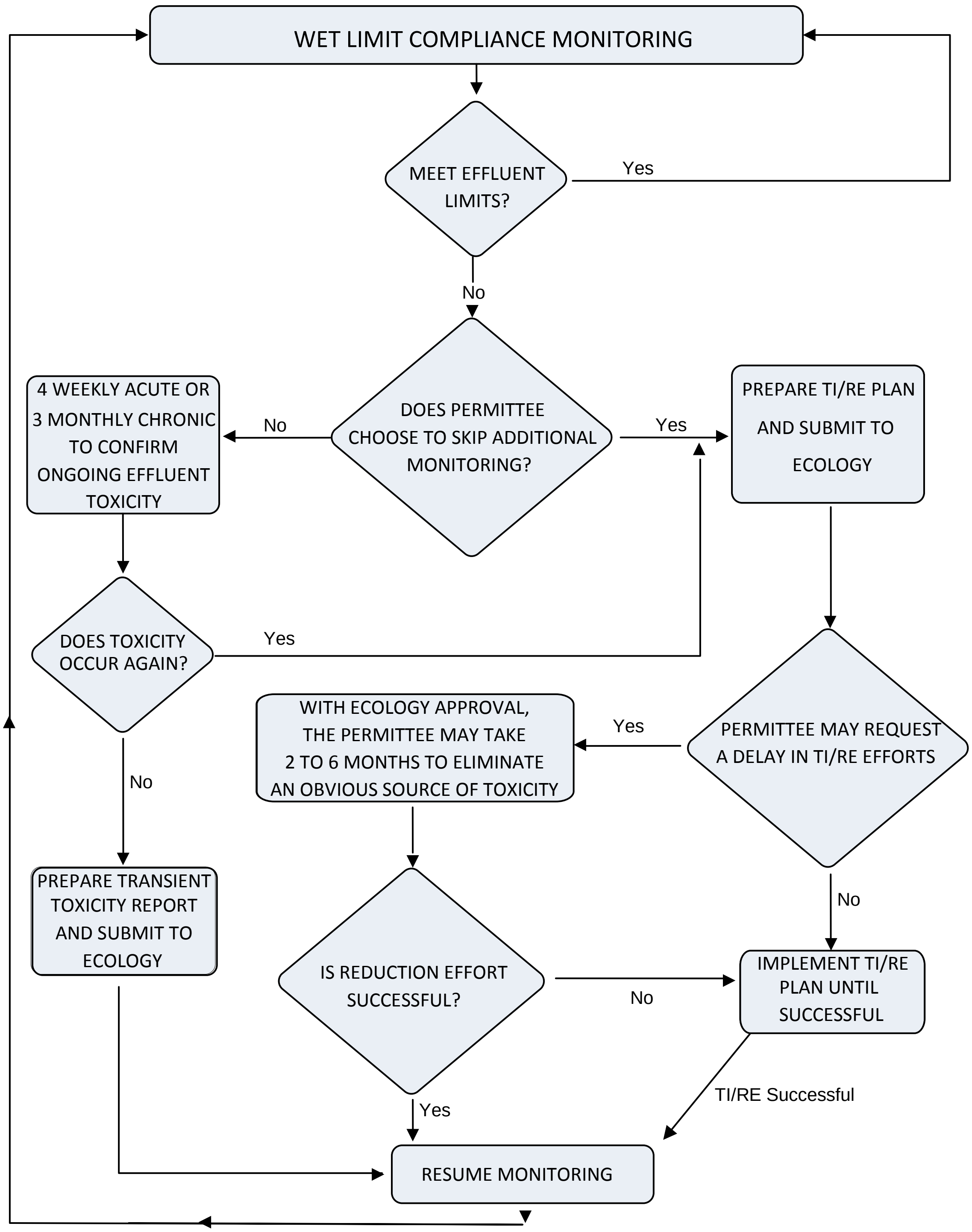


Figure 27. Compliance Process for WET

5.7 Removal of WET Limits

A WET limit is eligible for removal upon permit renewal if the discharge has demonstrated compliance with the WET performance standard associated with that limit for at least the last three consecutive years following effluent characterization or for an entire subsequent permit term. The permittee must also have not made any changes within the last three years which would otherwise require additional effluent characterization (WAC 173-205-120(1)).

Removing a WET limit is consistent with the system for regulating WET in Chapter 173-205 WAC. Chapter 173-205 WAC recognizes that the evaluation of WET is an ongoing process. Figure 26 shows this process and how WET limit removal is used as an incentive to control toxicity but is not the end of the process for regulating effluent toxicity.

5.8 Determining the Need for Rapid Screening Tests

Rapid Screening Tests. A rapid screening test is a screening toxicity test on one hundred percent effluent or some other high concentration of effluent in order to detect unanticipated increases in toxicity. Examples of rapid screening tests include twenty-four hour EPA acute tests, acute toxicity tests using rotifers produced from cysts, bacterial bioluminescence tests (Microtox®), and two-day life cycle tests with rotifers. See Section 5.12 for guidance on rapid screening test selection.

Rapid Screening Tests When Wet Limits Are Not Assigned or Are Removed. Permit managers may condition the nonassignment of a WET limit with a requirement for routine monitoring with a rapid screening test (WAC 173-205-120(2)). A permit manager should place rapid screening tests into a permit if there is the potential for an event at the facility which could result in a toxic discharge that would otherwise go unnoticed (WAC 173-205-120(2)(a)(ii)). A permit writer should consider the potential for treatment system upsets, control equipment failures, spills, accidental releases to the wastewater system, or any other event which could result in a toxic discharge. Chemical monitoring may also be required to assess increases in effluent toxicity when adequate for that purpose.

The Result of Rapid Screening Testing. Whenever a rapid screening test is failed, the permittee must immediately retest with all of the acute or chronic toxicity tests used in the last permit with WET (WAC 173-205-120(2)(d)). Toxicity detected by a rapid screening test must be confirmed by the traditional EPA WET tests. The results of acute or chronic toxicity tests conducted in response to a rapid screening test will be used to determine the need for a new WET characterization in the next permit.

Other Uses of Rapid Screening Tests. Rapid screening tests may be required of any permittee (WAC 173-205-030(5)). This means that, in addition to evaluating changes in the toxicity of discharges which have no WET limits, rapid screening tests can be used during effluent characterization to develop a correlation with the WET tests or in a permit with WET limits to raise the monitoring frequency. **Compliance with WET limits is never measured with a rapid screening test.** They can be required at a higher monitoring frequency than the WET tests and are used to trigger WET testing when toxicity is detected.

5.9 Technology-Based WET Limits

A permit manager may place the WET performance standard for acute toxicity into permits as a limit on a case-by-case basis pursuant to 40 CFR 125.3(d)(3) and WAC 173-205-130(2). 40 CFR 125.3(d)(3) contains a list of six factors which must be considered in setting case-by-case BAT limits. The factors include: the age of equipment, the process employed at the facility, changes to the process required to meet the performance-based limit, engineering aspects of the control techniques, and the cost of achieving the performance-based limit. These considerations require the assistance of the Program Development Services Section. The performance-based acute toxicity limit in WAC 173-205-130(2) cannot be applied to all permittees in a category. Chapter 173-205 WAC contains no provision for a technology-based chronic WET limit.

Not only would establishing a technology-based WET limit require a lot of work by several staff, but technology-based WET limits run counter to permittees being encouraged to meet the performance standards through the incentive of offering to remove WET limits and compliance monitoring from the permit. Good performance should generally be rewarded. For these reasons, technology-based WET limits are not a preferred option.

5.10 Options for Permittees

5.10.1 Conducting WET Tests

There are three options for permittees:

- Permittees may conduct any toxicity test using a full dilution series (WAC 173-205-030(9)). A full dilution series protects permittees by allowing anomalous test results to be identified by examining the concentration-response relationship. It also allows us to evaluate and improve our program by tracking baseline effluent toxicity, comparing the toxicity of different discharges, and evaluating the sensitivity of different WET tests.

- A permit manager may approve the request of a POTW discharging less than 0.5 MGD or a small business as defined in RCW 43.31.025(4) to conduct WET testing as effluent screening tests (WAC 173-205-050(1)(f)). Effluent screening tests are WET tests conducted using only 100% effluent (for acute tests) or the ACEC (for chronic tests). No other effluent concentrations (except the control) are tested until toxicity has been detected in the effluent screening test. This saves the permittee a little money if the effluent is consistently nontoxic. The effluent screening tests are about two-thirds to one-half the cost of a full dilution WET test. It is best to limit this option to dischargers that are likely to be nontoxic or it could cost even more than regular full series WET tests.

- The WET rule requires that samples, dilution water, and test solutions be handled as specified in the test method and the permit (WAC 173-205-080(1)). Permits also instruct permittees to follow Ecology Publication WQ-R-95-80 (*Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*, aka the Canary Book).

5.10.2 Notification of an Anomalous Test Result

The PDS Section reviews WET test results to see if these results are anomalous and should not be used for compliance determinations (WAC 173-205-070(5)(b)). A review for these kinds of WET test results will protect permittees from the consequences of noncompliance with a WET limit when the WET test itself was responsible for the appearance of noncompliance.

If the permittee believes that a compliance test failure will be identified by Ecology as an anomalous test result, the permittee may send Ecology notification with the compliance test result that the compliance test result might be anomalous. The permittee then takes only one additional sample for toxicity testing and waits for notification from Ecology before completing the additional monitoring discussed above in Section 5.6 and required by WAC 173-205-090(1). The notification must identify the reason for considering the compliance test result to be anomalous. Our definitions of anomalous tests are published in Appendix D of Ecology Publication WQ-R-95-80 (*Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*). The permittee must complete all of the additional monitoring required by the permit if notified by Ecology that the compliance test result was not anomalous. Ecology will review all compliance test results to determine if they are anomalous regardless of whether or not they are accompanied by permittee notification that they may be anomalous.

5.10.3 Conducting a TI/RE (Toxicity Identification/Reduction Evaluation)

- If another WET test fails the compliance test during the additional monitoring following the initial noncompliance, then the permittee must submit a plan for a TI/RE (WAC 173-205-100(2)). The permittee may request in the plan that Ecology allow up to six months before beginning the TI/RE for facility personnel to attempt to control the most likely source of toxicity (WAC 173-205-100(2)(a)). Ecology must approve the request in writing. If the attempt is successful, then everyone is saved the time and expense of TI/RE plan implementation. However, since the time and effort will be wasted if the attempt is unsuccessful, only attempts that have a good chance of success should be approved.

- A permittee may proceed directly to a TI/RE and not perform the additional testing (WAC 173-205-090(4)). Permittees that choose this option save themselves the expense of the additional monitoring and lessen the time between first detecting WET in excess of a limit and taking action to achieve compliance.

- Ecology may approve the interruption of a TI/RE if toxicity has disappeared (WAC 173-205-110(1)). The permittee then returns to the routine monitoring schedule and takes enough extra sample each time to begin a TI/RE if the effluent fails the compliance test. If all toxicity testing shows compliance with WET limits for one year after interruption of the TI/RE, then the permittee may cease taking the extra sample (WAC 173-205-110(2)).

5.11 Species Selection for WET Testing

5.11.1 Acute WET Test Species

Selecting acute WET test species is fairly simple. Effluents with a risk for aquatic toxicity are tested at a minimum for toxicity to a fish, an invertebrate, and any appropriate plant (WAC 173-205-050(1)(a)). Because EPA has not provided a test for acute toxicity to plants, effluents can only be tested for acute toxicity using a fish and an invertebrate. If the effluent itself is freshwater, freshwater species are generally used for acute WET testing. Freshwater WET tests are more readily available and more convenient for TI/REs. The saltwater and freshwater acute WET tests do not usually differ in sensitivity. However, discharges to saltwater of low hardness (< 50 mg/L) freshwater might be best tested using acute tests with saltwater organisms. Contact the PDS Section for permit language for using acute tests with saltwater organisms.

Choice of Invertebrate. Daphnids are the standard freshwater invertebrate acute test species. The permittee or lab may choose the most convenient species (*Daphnia pulex*, *Daphnia magna*, or *Ceriodaphnia dubia*). The sensitivity to toxicity of these species is similar. The Atlantic mysid (*Americamysis bahia*) is the standard saltwater invertebrate acute test species.

Choice of Fish. Fathead minnow (*Pimephales promelas*) are recommended for acute WET testing for several reasons. Fathead minnows are sensitive test organisms. More labs around the country have experience with fathead minnow WET testing or fathead minnow toxicity identification evaluations (TIEs) than any other fish.

TIEs will be more difficult and expensive with rainbow trout (*Oncorhynchus mykiss*). The volume of effluent that must be sampled, shipped, and fractionated is far larger for a rainbow trout TIE than it is for fathead minnow. EPA protocols require about 20 times the volume of effluent for rainbow trout testing than fathead minnow testing. For example, it might require 5 liters of effluent for a fathead minnow TIE and 100 liters for a rainbow trout TIE. Taking a representative sample of 100 liters of effluent, shipping it, and performing the chemical manipulations required in a TIE will be more difficult and expensive to accomplish than it would be with 5 liters of effluent.

If you have decided to require acute WET testing with rainbow trout in order to provide direct protection of salmonids, it is recommended that you also require fathead minnow testing so that any TIE can be performed with fathead minnow. Each sample would be tested using both of the fish and the information used to guide the fathead minnow TIE so that it protects rainbow trout.

The standard fish acute test saltwater species is topsmelt (*Atherinops affinis*). Silverside minnows (*Menidia beryllina*) can be substituted for topsmelt.

Acute Test Duration. WAC 173-205-050(1)(c) requires daphnid (or mysid) acute tests to be 48 hours in duration and fish acute tests to be 96 hours in duration.

5.11.2 Chronic WET Test Species

Unlike the situation with acute WET testing, permits for discharges to freshwater should have requirements for freshwater chronic WET tests and permits for discharges to saltwater or brackish water should have requirements for saltwater chronic WET tests. Ecology Publication WQ-R-95-80 (*Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*) has important detail on the chronic tests and their sublethal endpoints such as development, biomass, growth, reproduction, germination, etc. It also describes in detail the new supplemental chronic tests described below in Section 5.11.3.

Freshwater Chronic Wet Test Species. Chronic WET test species selection is fairly simple for discharges to freshwater. EPA recommends testing with a fish, an invertebrate, and a plant and has provided only one of each for freshwater chronic WET testing (fathead minnow, *Ceriodaphnia dubia*, and the phytoplankton *Pseudokirchneriella subcapitata*).

Effluents with a risk for aquatic toxicity should be tested for toxicity to a fish, an invertebrate, and if appropriate, a plant (WAC 173-205-050(1)(a)). The WET Rule required testing with a plant only when deemed appropriate because the plant tests (freshwater phytoplankon and east coast kelp) available in the early 1990s had deficiencies. Most of these deficiencies have now been resolved by improvements in the phytoplankton test and by inclusion in the EPA west coast manual of a good kelp test. If you have a suspicion that an effluent might be toxic to plants, use permit language that requires these plant tests. Please keep in mind that nutrients or chemical flocculants can interfere with the phytoplankton test.

Saltwater Chronic Wet Test Species. The selection of chronic WET test species for discharges to saltwater is complex for two main reasons:

- The reproduction of multicellular organisms in a marine environment usually begins with broadcast fertilization resulting in very small embryos and larvae which drift with the plankton. These early life stages of marine organisms are very sensitive to toxicity, and are part of the life cycle of most marine organisms including oysters, kelp, halibut, crab, etc. EPA has provided a larger list of chronic WET tests for protecting marine waters so effects on these sensitive early life stages could be assessed.

- The transition to west coast organisms is complete except for the mysid. The mysid in the EPA west coast manual cannot be cultured and must be caught in the wild for use in toxicity testing. Wild-caught organisms are less readily available, more expensive, and have an uncertain history. The east coast mysid is one of the more reliable test organisms and has been retained in the model permit language. All other recommended saltwater test species are from the west coast manual.

  The east coast mysid test is an excellent test. When EPA studied the toxicity of 13 effluents from a variety of sources, the *Americamysis bahia* test was found to be the most sensitive of the tests in the east coast marine chronic toxicity test manual 31% of the time. Another study found the *Americamysis bahia* test to be 42-times more sensitive than the average fish and crustacean in EPA's database of toxicity test results used in the development of the marine water quality criteria.

There is only one supplier of topsmelt. The supplier is highly reliable but not perfect. A shortage of topsmelt happens every several years. Silverside minnows (*Menidia beryllina*) are an acceptable substitute when topsmelt are temporarily unavailable.

Standard Fish and Invertebrate

Chronic WET tests with topsmelt (*A.affinis*) and the east coast mysid (*A. bahia*) should be included in permits for discharges to saltwater. The level of protection provided by these two tests is similar to the protection provided by the freshwater chronic tests. Permits containing WET testing requirements for only topsmelt (a fish) and mysid meet the minimum requirement of WAC 173-205-050(1)(a).

Bivalve Embryo-Larval Survival and Development Test

Pacific oyster (C. gigas) or blue mussel (M. spp.)
The bivalve embryo-larval development test is recommended for discharges to ecosystems of special importance or fragility. Put this chronic WET test into a permit along with the standard fish and invertebrate test when there is a risk of toxicity to sensitive larval life-stages of marine organisms. This test is especially appropriate for discharges to areas where mollusks are being cultivated or for discharges to spawning grounds for important marine organisms. This test is often the most sensitive of all the tests, except to polycyclic aromatic hydrocarbons (PAHs). Echinoderm embryos are more sensitive to PAHs than bivalve embryos.

Echinoderm Embryo-Larval Survival and Development Test

Sea urchin (S. purpuratus) or sand dollar (D. excentricus)
Put this test into a permit along with the standard fish and invertebrate test when there is a risk of toxicity to sensitive larval life-stages of marine organisms. This chronic WET test is the most sensitive test to PAHs. If an effluent contains PAHs and is discharged to a marine ecosystem of special importance or fragility, then the echinoderm development test should be required. Embryos of fish such as salmon or herring are also especially sensitive to PAH toxicity.

Echinoderm Fertilization Test

Sea urchin (S. purpuratus) or sand dollar (D. excentricus)
The echinoderm fertilization test has some advantages over the other WET tests. The combination of high sensitivity and short duration (forty minutes) is unique to this test. Very small volumes of effluent can be tested successfully and one spawning yields enough material for many tests. TI/REs are likely to be more convenient and successful than with other WET tests because of these advantages. It is recommended that permit writers require the echinoderm fertilization test when both high sensitivity and ease of use are important.

Kelp Germination and Growth Test

If the discharge is to an area with kelp beds, water shallow enough to admit sunlight, or to a rocky area that should be capable of supporting kelp, then the kelp germination and growth test using the giant kelp (*M. pyrifera*) should be considered.

5.11.3 Supplemental Chronic WET Test Species

The Environment Canada Trout Embryo Viability and EPA Rainbow Trout 7-day Survival and Growth test methods are used in the evaluation of stormwater treatment chemicals and can be used in permits. The trout embryo test has withstood challenge in front of the PCHB. Because they do not qualify under WAC 173-205-050(1)(d), they cannot be used for effluent characterization or monitoring for compliance with a WET limit. They can be used in permits as monitoring tools for effluents or receiving waters and trigger TI/REs if needed. Using these tests to trigger TI/REs has also withstood PCHB challenge. Contact the PDS Section if you want advice or permit language for these two trout tests.

Rainbow trout embryos (fertilized eggs) can be exposed in test chambers placed in streams and receive a realistic environmental exposure over three critical lifestages (embryo, alevin, and fry). This is a true chronic test (approximately 30 days depending on temperature) which has been done by both permittees and by Ecology. It would be a good choice for comparing downstream to upstream toxicity or for assessing stream health in general. Contact the PDS to discuss the use of this test. See: https://fortress.wa.gov/ecy/publications/publications/1403050.pdf.

Three Pacific herring (*Clupea pallasi*) toxicity tests have been developed at the Shannon Point Marine Center of Western Washington University. The three tests are a 16-day (7-day toxicant exposure) embryo development test, a 4-day acute test with yolk sac larvae, and a 7-day larval survival and growth test. None of the herring tests can be done outside of the herring spawning season. The herring tests do not meet the conditions in WAC 173-205-050(1)(d) for use in compliance monitoring. See: https://fortress.wa.gov/ecy/publications/documents/1110086.pdf.

The 4-day herring acute test has sensitivity similar to the EPA acute tests for fish. The herring embryo test has been found to be often less sensitive to effluent toxicity than the echinoderm embryo development test. Given the difficulty in acquiring herring for use in acute testing or embryo testing, it is better to use the comparable EPA tests.

The 7-day larval herring survival and growth test can be more sensitive than the EPA 7-day survival and growth tests. However, the herring larval survival and growth test can be a challenge even for an experienced lab. The difficulty, expense, and limited availability of the herring survival and growth test preclude its use for routine effluent monitoring. If toxicity to herring is a concern, then the most practical and effective approach is to require EPA fish and mysid survival and growth tests at a higher monitoring frequency.

5.12 Rapid Screening Test Selection

5.12.1 Acute Rapid Screening Tests

24-hr EPA screening tests:

The only rapid screening tests available in accredited labs are 24-hr EPA tests. Labs have let accreditation for rotifers lapse. The 24-hr EPA acute tests are conducted using the same EPA manuals and species that were used for effluent characterization.

5.12.2 Chronic Rapid Screening Tests

Labs have let accreditation for the 2-d rotifer chronic test lapse because it has not been required for many years. Microtox® is unpopular and has never been required as a rapid screening test. A chronic rapid screening test is a contradiction of terms (rapid and chronic). Rapid screening testing is better performed using acute tests.

5.13 Samples for WET Testing

5.13.1 Advantages of Grab Samples

Properly taken grab samples minimize changes in chemistry and provide the most accurate measurement of toxicity. Grab samples can be taken quickly with a minimum of equipment, sealed in a container with no void space, cooled to 4º C, and sent directly to the lab for testing.

The toxicity of an effluent sample begins changing at the time of sampling. Often the toxicity decreases, but it can also increase. These changes continue throughout the holding time. Composite sampling adds to sample holding time by as much as 24 hours and allows further changes in effluent toxicity. Changes in dissolved gases during compositing cause changes in pH which ultimately affect the chemistry and toxicity of the sample. Composite samplers contain a large amount of surface area which enhances toxicant adsorption or reaction. Composite samplers must be cleaned frequently to prevent toxicant build-up and the growth of bacteria which can infect test organisms.

5.13.2 Advantages of Composite Samples

24-hr composites usually provide a representative sample of effluent toxicity. The toxicity highs and lows over a day are all represented in the sample. If toxicity varies widely or unpredictably during a day, single grab samples cannot be representative. In addition, permittees can sometimes deliberately schedule grab sampling for times of day when the effluent is less likely to be toxic. Composite samples are more difficult for permittees to schedule for times predicted to have low toxicity.

5.13.3 Recommended Sampling Technique

If effluent chemistry and toxicity are consistent over time, use grab samples. If sampling can be scheduled for times of peak effluent toxicity, use grab samples for acute and 24-hr composites for chronic. If grab samples may not be representative of effluent toxicity, use only 24-hr composite sampling.

5.13.4 Sampling Chlorinated Effluents

Samples for WET should be taken before the chlorinator for discharges which can meet water quality-based effluent limits for chlorine and have an ACEC below 25% effluent. If the ACEC is 25% effluent or higher, the effluent is sampled after the chlorinator because extra control on chlorine is needed due to the effluent-dominated receiving water. If the treatment plant will begin dechlorination within two years, then the sample may be dechlorinated at the lab. See WAC 173-205-080.

5.13.5 Low Hardness Samples

Model permit language contains an option to allow dischargers of low hardness (< 50 mg/L) effluent to sample receiving water at the same time and, the lab to increase the hardness of the effluent sample to match the hardness of the receiving water sample before starting the toxicity test. If hardness is significantly lower in a sample than in the receiving water, metals toxicity will be significantly greater in the test than it would be in the environment. The use of a low hardness sample will produce a hardness gradient in the test concentrations with hardness declining as effluent concentration increases and make it difficult to screen for adverse effects due to low hardness. In other words, adverse effects due to the hardness gradient will mimic toxicity. For example, low hardness by itself can reduce *Ceriodaphnia* reproduction.

5.14 Managing Effluent Characterization Results

5.14.1 Whole Effluent Toxicity Information Assistance

As a service to permit managers and permittees, the Water Quality Program acquired CETIS in order to be able to provide quality assurance of WET test results and maintain a database able to support permitting decisions. CETIS is a computer program that creates a database record for each toxicity test and can perform all of the statistical procedures in the EPA test manuals.

The first step of the information management system is getting quality records of each permittee's WET test results into the database. Achieving quality records requires a review of each WET test, entry of the test into CETIS, and performance of the proper statistics. After the record of WET test results is completed for a permittee, then the database can be queried to produce a table of test results to assist permittees and permit managers during permit renewal. If requested, the PDS Section provides permittees with the same summary of their test results.

In order to accomplish all of these WET test QA and recordkeeping efforts with a reasonable investment of staff time, each submittal of WET test results must include an electronic copy of the lab's test report (filename.**pdf**) and a CETIS export from the lab of the test data (filename.**mdb**). All of our accredited WET testing labs use CETIS.

5.15 Special Challenges

5.15.1 Testing Stormwater for Toxicity

There are a variety of challenges when implementing WET testing on stormwater-only discharges. Some of these challenges include:

- The difficulty in predicting storm events with adequate sample volumes for the performance of WET testing.
- The short notice given to labs to procure test organisms, schedule adequate staff and ensure sufficient incubator space due to the nature of event-based testing.
- Stormwater treatment systems utilizing flocculants to reduce TSS or turbidity can remove test organism food required to maintain organism health during testing.
- Stormwater samples can have a much lower hardness than typical effluents or receiving waters which can affect overall toxicity and often necessitate hardness adjustment prior to

testing.

- Stormwater discharges are episodic and tend to be short and toxic or long and nontoxic for most of the discharge event. EPA test methods were developed to assess impacts from continuous point source exposure and were not designed to evaluate impacts from episodic discharges.

Toxicity testing is desirable for stormwater evaluations as they can directly measure the overall toxicity of complex mixtures, including many with contaminates that are not routinely monitored. However, existing WET methodologies need to be updated to better standardize these evaluations and more appropriately replicate the effects of episodic stormwater exposure. Updated WET methods for use with intermittent discharges are currently being developed by a DOD Environmental Research Program with input from a nationwide advisory panel including representation from Ecology. If approved, any validated methods developed for episodic discharges meeting Ecology's needs will be added to the *Whole Effluent Toxicity Testing Guidance and Test Review Criteria* manual. Individual permits should continue to manage non-contact stormwater discharges through a combination of appropriate strategies such as, best management practices, adaptive management, and chemical monitoring. Permit writers should contact the Water Quality Program's Lead for Aquatic Toxicity Assessments when evaluating WET testing requirements during stormwater discharge permit development.

5.15.2 Applying Chapter 173-205 WAC in a General Permit

Chapter 173-205 WAC was written specifically to be implemented in individual NPDES permits. Mixing zones are site-specific and cannot be assigned in a general permit. The consequence is an end-of-pipe WET limit. Acute WET limits are easy to trigger since only one acute test with < 65% survival in 100% sample will do so.

5.15.3 Requiring Ambient Toxicity Testing

WAC 173-205-030(6) allows permits to contain requirements to conduct toxicity tests on samples of receiving water. Not only can receiving water sampling avoid some of the problems mentioned above for stormwater or general permits, but the results are more environmentally relevant than results from effluent tests. Effluent limits cannot be assigned for receiving water toxicity test results, but results can be used to trigger an investigation of potential toxicity sources. A provision needs to be included for considering the influence of upstream sources. Chronic toxicity testing of receiving water samples is a stormwater requirement in the Sea-TAC Airport permit and has been upheld on appeal. The PDS Section can help write permit language.

Table 19. Chemical Screening List for WET Testing

(40 CFR 403, Appendix C)

Acenaphthene	Acetic acid, (2,4,5-trichlorophenoxy)
Acenaphthylene	Acetic anhydride
Acetaldehyde	Acetone cyanohydrin
Acetic acid	Acetyl bromide
Acetic acid (2,4-dichlorophenoxy)	Acetyl chloride
Acetic acid, lead(2+) salt	Acrolein

Acrylonitrile
Aldrin
Allyl alcohol
Allyl chloride
Aluminum sulfate
Ammonia
Ammonium acetate
Ammonium benzoate
Ammonium bicarbonate
Ammonium bichromate
Ammonium bifluoride
Ammonium bisulfite
Ammonium carbamate
Ammonium carbonate
Ammonium chloride
Ammonium chromate
Ammonium citrate, dibasic
Ammonium fluoborate
Ammonium fluoride
Ammonium hydroxide
Ammonium oxalate
Ammonium silicofluoride
Ammonium sulfamate
Ammonium sulfide
Ammonium sulfite
Ammonium tartrate
Ammonium thiocyanate
Amyl acetate
Aniline
Antimony pentachloride
Antimony potassium tartrate
Antimony tribromide
Antimony trichloride
Antimony trifluoride
Antimony trioxide
Aroclor 1016
Aroclor 1221
Aroclor 1232
Aroclor 1242
Aroclor 1248
Aroclor 1254
Aroclor 1260
Arsenic
Arsenic disulfide
Arsenic oxide As2O3
Arsenic oxide As2O5
Arsenic pentoxide
Arsenic trichloride
Arsenic trioxide
Arsenic trisulfide
Asbestos
Barium cyanide
Benz[a]anthracene
1,2-Benzanthracene

Benzenamine
Benzene
Benzene, 1-bromo-4-phenoxy-
Benzene, chloro-
Benzene, chloromethyl-
1,2-Benzenedicarboxylic acid, dioctyl ester
1,2-Benzenedicarboxylic acid, [bis(2-ethylhexyl)]-
1,2-Benzenedicarboxylic acid, dibutyl ester
1,2-Benzenedicarboxylic acid, diethyl ester
1,2-Benzenedicarboxylic acid, dimethyl ester
Benzene, 1,2-dichloro-
Benzene, 1,3-dichloro-
Benzene, 1,4-dichloro-
Benzene, 1,1'-(2,2-dichloroethylidene)bis[4-chloro-
Benzene, dimethyl
1,3-Benzenediol
Benzene, hexachloro-
Benzene, hexahydro-
Benzene, hydroxy-
Benzene, methyl-
Benzene, 2-methyl-1,3-dinitro-
Benzene, 1-methyl-2,4-dinitro-
Benzene, nitro-
Benzene, 1,1'-(2,2,2-tri-chloroethylidene)bis[4-chloro-
Benzene, 1,1'-(2,2,2-trichloroethylidene) bis[4-methoxy-
Benzidine
Benzol[a]anthracene
Benzo[b]fluoranthene
Benzo(k)fluoranthene
Benzo[j,k]fluorene
Benzoic acid
Benzonitrile
Benzo[ghi]perylene
Benzo[a]pyrene
3,4-Benzopyrene
Benzoyl chloride
1,2-Benzphenanthrene
Benzyl chloride
Beryllium
Beryllium chloride
Beryllium fluoride
Beryllium nitrate
alpha-BHC
beta-BHC
delta-BHC

gamma-BHC
(1,1'-Biphenyl)-4,4'diamine
[1,1'-Biphenyl]-4,4'diamine, 3,3'dichloro-
Bis (2-chloroethyl) ether
Bis (2-ethylhexyl)phthalate
Bromoform
4-Bromphenyl phenyl ether
1,3-Butadiene, 1,1,2,3,4,4-hexachloro-
2-Butenal
Butyl acetate
Butylamine
Butyl benzyl phthalate
n-Butyl phthalate
Butyric acid
Cadmium
Cadmium acetate
Cadmium bromide
Cadmium chloride
Calcium arsenate
Calcium arsenite
Calcium carbide
Calcium chromate
Calcium cyanide
Calcium cyanide Ca(CN)2
Calcium dodecylbenzenesulfonate
Calcium hypochlorite
Camphene, octachloro-
Carbaryl
Carbofuran
Carbon disulfide
Carbon tetrachloride
Carbonic dichloride
Chlordane
Chlordane, alpha & gamma isomers
Chlordane, technical
CHLORINATED BENZENES
CHLORINATED ETHANES
CHLORINATED NAPHTHALENE
CHLORINATED PHENOLS
Chlorine
CHLOROALKYL ETHERS
Chlorobenzene
4-Chloro-m-cresol
p-Chloro-m-cresol
Chlorodibromomethane
Chloroethane
2-Chloroethyl vinyl ether
Chloroform
beta-Chloronaphthalene
2-Chloronaphthalene
2-Chlorophenol
o-Chlorophenol
4-Chlorophenyl phenyl ether
Chlorosulfonic acid

Chlorpyrifos
Chromic acetate
Chromic acid
Chromic acid H2CrO4, calcium salt
Chromic sulfate
Chromium
Chromous chloride
Chrysene
Cobaltous bromide
Cobaltous formate
Cobaltous sulfamate
Copper
Coumaphos
Cresol(s)
Cresylic acid
Crotonaldehyde
Cupric acetate
Cupric acetoarsenite
Cupric chloride
Cupric nitrate
Cupric oxalate
Cupric sulfate
Cupric sulfate, ammoniated
Cupric tartrate
Cyanogen chloride
Cyanogen chloride (CN)Cl
Cyclohexane
Cyclohexane, 1,2,3,4,5,6-hexachloro-, (1 alpha,2alpha,3beta,4alpha,5alpha,6beta)-
1,3-Cyclopentadiene, 1,2,3,4,5,5-hexachloro-
2,4-D Acid
2,4-D Ester
2,4-D, salts and esters
DDD
4,4' DDD
DDE
4,4' DDE
DDT
4,4'DDT
Diazinon
Dibenz[a,h]anthracene
1,2:5,6-Dibenzanthracene
Dibenzo[a,h]anthracene
Dibutyl phthalate
Di-n-butyl phthalate
Dicamba
Dichlobenil
Dichlone
Dichlorobenzene
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
m-Dichlorobenzene
o-Dichlorobenzene

p-Dichlorobenzene
3,3'-Dichlorobenzidine
Dichlorobromomethane
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethylene
1,2-Dichloroethylene
Dichloroethyl ether
Dichloroisopropyl ether
Dichloromethoxy ethane
2,4-Dichlorophenol
Dichloropropane
1,2-Dichloropropane
Dichloropropane-Dichloropropene (mixture)
Dichloropropene
1,3-Dichloropropene
2,2-Dichloropropionic acid
Dichlorvos
Dicofol
Dieldrin
Diethylamine
Diethylhexyl phthalate
Diethyl phthalate
Dimethylamine
2,4-Dimethylphenol
Dimethyl phthalate
Dinitrobenzene (mixed)
4,6-Dinitro-o-cresol and salts
Dinitrophenol
Dinitrotoluene
2,4-Dinitrotoluene
2,6-Dinitrotoluene
Di-n-octyl phthalate
1,2-Diphenylhydrazine
Diphosphoric acid, tetraethyl ester
Di-n-propylnitrosamine
Diquat
Diuron
Dodecylbenzenesulfonic acid
Endosulfan
alpha - Endosulfan
beta - Endosulfan
Endosulfan sulfate
Endrin
Endrin aldehyde
Endrin, & metabolites
Epichlorohydrin
Ethanal
Ethane, 1,2-dibromo-
Ethane, 1,1-dichloro-
Ethane, 1,2-dichloro-
Ethane, 1,1'-oxybis[2-chloro-
Ethane, 1,1,2,2-tetrachloro-
Ethane, 1,1,1-trichloro-

Ethane, 1,1,2-trichloro-
Ethene, chloro-
Ethene, 2-chloroethoxy-
Ethene, 1,1-dichloro-
Ethene, 1,2-dichloro- (E)
Ethene, tetrachloro-
Ethene, trichloro-
Ethion
Ethylbenzene
Ethylenediamine
Ethylenediamine-tetraacetic acid (EDTA)
Ethylene dibromide
Ethylene dichloride
Ethylidene dichloride
Ferric ammonium citrate
Ferric ammonium oxalate
Ferric chloride
Ferric fluoride
Ferric nitrate
Ferric sulfate
Ferrous ammonium sulfate
Ferrous chloride
Ferrous sulfate
Fluoranthene
Fluorene
Formaldehyde
Formic acid
Fumaric acid
2-Furancarboxaldehyde
2,5-Furandione
Furtural
Guthion
Heptachlor
Heptachlor epoxide
Hexachlorobenzene
Hexachlorobutadiene
HEXACHLOROCYCLOHEXANE (all isomers)
Hexachlorocyclohexane (gamma isomer)
Hexachlorocyclopentadiene
Hexachloroethane
Hydrazine, 1,2-diphenyl-
Hydrochloric acid
Hydrocyanic acid
Hydrofluoric acid
Hydrogen chloride
Hydrogen cyanide
Hydrogen fluoride
Hydrogen sulfide
Hydrogen sulfide H2S
Indeno(1,2,3-cd)pyrene
Isophorone
Isoprene
Isopropanolamine dodecylbenzenesulfonate
Kepone

Lead
Lead acetate
Lead arsenate
Lead chloride
Lead fluoborate
Lead fluoride
Lead iodide
Lead nitrate
Lead stearate
Lead sulfate
Lead sulfide
Lead thiocyanate
Lindane
Lithium chromate
Malathion
Maleic acid
Maleic anhydride
Mercaptodimethur
Mercuric cyanide
Mercuric nitrate
Mercuric sulfate
Mercuric thiocyanate
Mercurous nitrate
Mercury
Methanamine, N-methyl-
Methanamine, N-methyl-N-nitroso-
Methane, bromo-
Methane, chloro-
Methane, dichloro-
Methane, tetrachloro-
Methane, tribromo-
Methane, trichloro-
Methanethiol
Methoxychlor
Methyl bromide
Methyl chloride
Methyl chloroform
Methylene chloride
2-Methyllactonitrile
Methylmercaptan
Methyl methacrylate
Methyl parathion
Mevinphos
Mexacarbate
Monoethylamine
Naled
Naphthalene
Naphthalene, 2-chloro-
Naphthenic acid
Nickel
Nickel ammonium sulfate
Nickel chloride
Nickel hydroxide
Nickel nitrate

Nickel sulfate
Nitric acid
Nitrobenzene
Nitrogen dioxide
Nitrogen oxide NO2
Nitrophenol (mixed)
o-Nitrophenol
p-Nitrophenol
2-Nitrophenol
4-Nitrophenol
N-Nitrosodimethylamine
N-Nitrosodiphenylamine
Nitrotoluene
Oxirane, (chloromethyl)-
Paraformaldehyde
Parathion
Pentachlorophenol
Perchloroethylene
Phenanthrene
Phenol
Phenol, 2-chloro-
Phenol, 4-chloro-3-methyl-
Phenol, 2,4-dichloro-
Phenol, 2,4-dimethyl-
Phenol, 2,4-dinitro-
Phenol, methyl-
Phenol, 2-methyl-4,6-dinitro-
Phenol, 4-nitro-
Phenol, pentachloro-
Phenol, 2,4,5-trichloro-
Phenol, 2,4,6-trichloro-
Phosgene
Phosphoric acid
Phosphorothioic acid, O,O-dimethyl O-(4-nitrophenyl) ester
Phosphorus
Phosphorus oxycloride
Phosphorus pentasulfide
Phosphorus sulfide
Phosphorus trichloride
Plumbane, tetraethyl-
Potassium arsenate
Potassium arsenite
Potassium bichromate
Potassium chromate
Potassium cyanide
Potassium cyanide (K(CN)
Potassium hydroxide
potassium permanganate
1-Propanamine, N-nitroso-N-propyl-
Propane, 1,2-dichloro-
Propanenitrile, 2-hydroxy-2-methyl-
Propane, 2,2'-oxybis[2-chloro-
Propargite

2-Propenal
1-Propene, 1,3-dichloro-
2-Propenenitrile
2-Propenoic acid, 2-methyl-, methyl ester
2-Propen-1-o1
Propionic acid
Propionic anhydride
Propylene dichloride
Propylene oxide
Pyrene
Pyrethrins
Quinoline
Resorcinol
Selenium
Selenium dioxide
Selenium oxide
Silver
Silver nitrate
Silvex (2,4,5-TP)
Sodium
Sodium arsenate
Sodium arsenite
Sodium bichromate
Sodium bifluoride
Sodium bisulfite
Sodium chromate
Sodium cyanide
Sodium cyanide Na (CN)
Sodium dodecylbenzenesulfonate
Sodium fluoride
Sodium hydrosulfide
Sodium hydroxide
Sodium hypochlorite
Sodium methylate
Sodium nitrite
Sodium phosphate, dibasic
Sodium phosphate, tribasic
Sodium selenite
Strontium chromate
Strychnidin-10-one
Strychnine, & salts
Styrene
Sulfur monochloride
Sulfur phosphide
Sulfuric acid
Sulfuric acid, dithallium (1+) salt
2,4,5-T acid
2,4,5-T amines
2,4,5-T esters
2,4,5-T salts
2,4,5-T
TDE
Tetraethyl lead
Tetraethyl pyrophosphate

Thallium
Thallium (1) sulfate
Thiomethanol
Toluene
Toxaphene
2,4,5-TP acid
2,4,5-TP esters
Trichlorfon
1,2,4-Trichlorobenzene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethene
Trichloroethylene
Trichlorophenol
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
Triethanolamine dodecylbenzenesulfonate
Triethylamine
Trimethylamine
Uranyl acetate
Uranyl nitrate
Vanadium oxide V205
Vanadium pentoxide
Vanadyl sulfate
Vinyl chloride
Vinyl acetate
Vinyl acetate monomer
Vinylidene chloride
Xylene (mixed)
Xylenol
Zinc
Zinc acetate
Zinc ammonium chloride
Zinc borate
Zinc bromide
Zinc carbonate
Zinc chloride
Zinc cyanide
Zinc cyanide Zn(CN)2
Zinc fluoride
Zinc formate
Zinc hydrosulfite
Zinc nitrate
Zinc phenosulfonate
Zinc phosphide
Zinc silicofluoride
Zinc sulfate
Zirconium nitrate
Zirconium potassium fluoride
Zirconium sulfate
Zirconium tetrachloride

Table 20. Industry Categories of 40 CFR Part 122, Appendix A

Industrial Category	40 CFR part
Aluminum Forming	467
Asbestos Manufacturing	427
Battery Manufacturing	461
Builder’s Paper and Board Mills	431
Carbon Black Manufacturing	458
Centralized Waste Treatment	437
Coil Coating and Canmaking	465
Copper Forming	468
Electrical and Electronic Components	469
Electroplating	413
Feedlots	412
Ferroalloy Manufacturing	424
Fertilizer Manufacturing	418
Glass Manufacturing	426
Grain Mills	406
Ink Formulation	447
Industrial Laundries	441
Inorganic Chemicals	415
Iron and Steel Manufacturing	420
Landfills and Incinerators	437
Leather Tanning and Finishing	425
Metal Finishing	433
Metal Molding and Casting	464
Metal Products and Machinery Phase 1	438
Metal Products and Machinery Phase 2	438
Nonferrous Metal Forming and Metal Powders	471
Nonferrous Metals Manufacturing	421
Organic Chemicals, Plastics, and Synthetic Fibers	414
Paint Formulation	446
Paving and Roofing Material	443
Pesticide Formulation, Packaging and Repacking	455
Petroleum Refining	419
Pharmaceutical Manufacturing	439
Porcelain Enameling	466
Pulp, Paper and Paperboard	430/431
Rubber Manufacturing	428
Soap and Detergent Manufacturing	417
Steam Electric Power Generating	423
Sugar Processing	409
Timber Products Processing	429
Transportation Equipment Cleaning	442

6. Stormwater

[STILL UNDER DEVELOPMENT. This section will be revised prior to the next manual release]

The *Technical Support Document for Water Quality-Based Toxics Control* (*(TSD)* EPA 1991) forms the basis for much of Ecology's approach to deriving water quality-based effluent limits (WQBELs) for toxics. When permitting uncontrolled, intermittent stormwater discharges, the permit writer should evaluate the tools available for limit development. TSD does has provisions in Chapter 4, Section 4.5.2 for using dynamic modeling techniques rather the steady state models that form the basis of Ecology's PermitCalc tool. For context, an uncontrolled, intermittent discharge is episodic in nature, non-continuous and unpredictable in volume and pollutant concentration. The majority of stormwater discharge falls into this category.

Stormwater is a product of precipitation. Rain drops form around particulate matter and, when rain falls, so does that particle and any pollutants that adhere to that particle. Rainfall runoff also collects pollutants as water flows overland, via interflow, and through the pipe and other features of a stormwater drainage system. Because of this, untreated stormwater is highly variable in pollutant concentration and discharge volume. The duration and frequency of localized storms are also highly variable. Other storm characteristics also differ substantially between eastern and western Washington. Even after treatment, stormwater remains highly variable in both quality and quantity. This occurs when flow exceed the treatment facility design storm or when influent concentrations are lower or higher than anticipated.

Water quality criteria for toxics that affect both human health and aquatic life are expressed as a magnitude similar to a numeric concentration (e.g. 1 µg/L). Criteria expressed as a magnitude pair specific durations of exposure and a limited allowed frequency of exceedance. WQBELs translate the criteria into a term that is expressed as a concentration over a specific averaging period such as average month or maximum day. The concentrations of pollutants in the discharge must be limited to levels that will not cause a water quality criteria excursion for the specified duration of exposure and frequency of exceedance that are applied to the individual criterion. Permit writers can find durations of exposure and allowed frequencies of exceedance that accompany the numeric toxic substances criteria concentrations in WAC 173-201A-240, and also summarized in Table C-2 of Appendix C of this manual.

The TSD-based standard approach for deriving WQBELs for continuous, controlled discharges outlined in other sections of this manual provides a clear method for evaluating reasonable potential to exceed water quality criteria. After evaluating and finding reasonable potential, the TSD approach results in calculating maximum and average pollutant concentrations (i.e., WQBELs) that will ensure that the water quality standards are met. The TSD-based standard approach depends on three core assumptions about the discharge and the receiving water quality and quantity:

- A continuous, predictable discharge
- A lognormal distribution of pollutant concentrations in treated effluent (e.g., parametric distribution)

- Predictable discharge flow volumes during know receiving water critical low flows

For continuous discharges like a municipal wastewater facility, one can assume continuous exposure for days, months, and years. For a continuous treated discharge these types of assumptions are generally reasonable for the exposure periods that the toxics criteria are based on: instantaneous maximum, one hour up to 96 hour durations (aquatic life criteria), and to the long multi-year averages assumed in the human health criteria (70 years for carcinogens, and variable up to 30 years for non-carcinogens – see page 88 of EPA 1991). PermitCalc and other tools and methods presented in this manual are based on the standard TSD approach and assume a continuous discharge in a low flow, high discharge concentration, worst case scenario. However, it may not be appropriate or reasonable to assume a continuous discharge for uncontrolled, intermittent stormwater discharges because of (1) variability of precipitation events and volumes over days, weeks, seasons, and years, as well as the (2) varying and attenuating pollutant concentration over the duration of a storm event, and, (3) the changes in the ability of the soils and underlying geology of a catchment basin to absorb and moderate flow (e.g., increasing soil saturation over seasons or storm events), which could further decrease the predictability of flow volumes entering treatment basins.

In the event of a highly controlled, intermittent stormwater discharge with predictable quantifiable discharge rates and pollutant loadings, the standard TSD approach should be considered using some adjustment for flow. This adjustment accounts for equivalent flows over the duration of exposure based on site specific information. You must evaluate your stormwater discharge and clearly document the applicability of the TSD approach in your fact sheet in these highly controlled stormwater discharge situations.

Chapter 7. Deriving Water Quality-Based Effluent Limits for Protection of Human Health

NOTE: *Ecology submitted a standards revision for 192 new human health criteria for 97 pollutants to EPA on August 1, 2016. EPA partially approved and partially disapproved these standards revisions. This partial approval/disapproval resulted in both federally promulgated human health criteria (40 CFR 131.45) for use in Clean Water Act permits and also state specific human health criteria found in WAC 173-201A-240. Further modifications to this chapter are needed following adoption of the rule revision. Please contact the permitting technical lead for rule implementation information and other guidance until the next manual update.*

Our water quality standards now include 91 numeric human health-based criteria that permit writers must consider when drafting an NPDES permit. These criteria were promulgated for the state by the U.S.EPA in its' National Toxics Rule (40 CFR 131.36). Permit writers must consider whether a discharge has a reasonable potential to violate these criteria. In some cases a TMDL may be present for human health-based criteria and permit limits must reflect the allocation in the TMDL. The human health criteria are listed in PermitCalc.

This section outlines the process of conducting an initial screening and conducting a reasonable potential determination for these chemicals, as well as how to determine monitoring requirements and compliance schedules. This guidance complies with the NTR. The process of determining a reasonable potential for human health-based criteria exceedances parallels the procedure currently used for aquatic life-based criteria (Chapter 6). The decision path for human health-based permitting is illustrated in Figure 28.

1. Water Quality Criteria - Background

The human health-based water quality criteria incorporate several exposure and risk assumptions. These include:

- A 70-year lifetime of daily exposures.
- An ingestion rate for fish or shellfish in kg/day.
- 2.4 liters/day ingestion rate for drinking water, and a one-in-one-million excess cancer risk for carcinogenic chemicals.

In general, these exposure assumptions will provide a safe level of protection for most individuals. On the other hand, the criteria do not account for additive or synergistic effects of multiple contaminants on human health, and they contain the assumption that 100% of exposures come from ingesting fish, shellfish, or waters from surface water sources, thus no account is taken of exposures resulting from air, other foodstuffs, or groundwater-derived or public drinking water supplies.

Human health criteria are derived by equations that reflect both technical information and policy decisions. Many issues associated with establishing human health criteria are complex and controversial, but the basic equation and concepts used to derive the criteria are simple. EPA changed the methodology for calculating human health criteria in 2000. This resulted in changes to some human health criteria. However, EPA did not revise the National Toxic Rule based on the new methodology. The following text is from the EPA fact sheet on the revised methodology.

Revised Methodology for Deriving Health-Based Ambient Water Quality Criteria (2000)

Fact Sheet; October 2000

We have published revisions to the 1980 Ambient Water Quality Criteria National Guidelines to better protect human health. The 1980 Ambient Water Quality Criteria National Guidelines outline the methodology used by states and tribes to develop human health water quality criteria. Revisions to the 1980 guidelines incorporate significant scientific advances in key areas such as cancer and non-cancer risk assessments, exposure assessments, and bioaccumulation in fish. The revised methodology will provide more flexibility for decision-making at the state, tribal and EPA regional levels. It is most likely that the methodology will result in more stringent criteria for bioaccumulatives and generally similar values of nonbioaccumulatives.

Human Health Water Quality Criteria

Human health ambient water quality criteria (AWQC) are numeric values limiting the amount of chemicals present in our nation's waters. Human health criteria are developed under Section 304(a) of the Clean Water Act of 1972 and are designed to protect human health. Water quality criteria are developed by assessing the relationship between pollutants and their effect on human health and the environment. These criteria are used by states and Indian tribes to establish water quality standards and ultimately provide a basis for controlling discharges or releases of pollutants.

The Clean Water Act (CWA) requires EPA to develop, publish and revise ambient water quality criteria (AWQC). In 1980, EPA published AWQC for 64 pollutants/pollutant classes and provided a methodology for deriving the criteria. These national guidelines addressed three types of endpoints: noncancer, cancer and organoleptic (taste and odor) effects.

The states and tribes use these criteria to develop water quality standards for each water body. EPA is required to review periodically criteria adopted by states and tribes. The revisions to the EPA's 1980 methodology will help states and tribes establish water quality criteria and standards that protect human health. They provide detailed means for developing water quality criteria, including systematic procedures for evaluating cancer risk, noncancer health effects, human exposure, and bioaccumulation potential in fish.

EPA Methodology for Deriving Criteria

States and tribes must develop water quality standards that include designated uses and water quality criteria necessary to support those uses. The Methodology is the guidance for states and tribes to help them establish water quality criteria and standards to protect human health. It provides detailed means for developing the water quality criteria, including systematic procedures for evaluating cancer risk, noncancer health effects, human exposure, and bioaccumulation potential in fish.

Risk assessment practices have evolved significantly since 1980, particularly in the areas of cancer and noncancer risk assessments (with new information, procedures, and numerous published Agency guidelines), exposure assessments (with new studies on human intake and exposure patterns, and new science policy guidelines) and methodologies on accounting for bioaccumulation in fish.

General Background and Revision Process

Revisions began with a national workshop in 1992, where participants discussed critical issues. Based on individual expertise, attendees were assigned to technical workgroups including cancer risk, noncancer risk, exposure, and bioaccumulation in fish.

EPA submitted recommendations from the workshop for review and comment by the EPA Science Advisory Board. EPA created a workgroup in 1994, including program office and regional participants, to revise the methodology. Numerous stakeholder participation activities were conducted between 1995 and 1998, including presentations to the Federal-State Toxicology and Risk Analysis Committee and several multi-regional water quality coordinator's meetings in 1996 and 1997, which included participants from EPA regions, states, tribes and some industry.

Following publication of the draft Methodology revisions, written public comments were accepted. Further presentations included the 1998 Annual Meeting of the Society For Risk Analysis and the 1999 Annual Meeting of the Society of Toxicology. In May 1999, a peer review workshop was held. A public stakeholders meeting was also held then. EPA received extensive input on the Methodology from each of these groups. EPA considered all comments and incorporated a substantial portion of them into the final AWQC Methodology Revisions.

Major Methodology Revisions

Publication of final revisions satisfies the requirements of the CWA that EPA periodically revise criteria for water quality to reflect accurately the latest scientific knowledge on the kind and extent of all identifiable effects on health and welfare that may be expected from the presence of pollutants in any body of water. These Final AWQC Methodology Revisions to the 1980 AWQC National Guidelines are necessitated by the many significant scientific advances made during the past 20 years in the key areas of cancer and noncancer assessments, exposure assessments, and bioaccumulation in fish.

The major revisions are in four assessment areas: cancer, non-cancer, exposure, and bioaccumulation.

For carcinogen (cancer) risk assessment:

- Recommend more sophisticated methods to comprehensively determine the likely mechanism of human carcinogenicity.
- Recommend a mode of action (MOA) approach to determine the most appropriate low-dose extrapolation for carcinogenic agents.

For noncarcinogens:

- Use EPA guidance on assessing noncarcinogenic effects of chemicals and for the Reference Dose (RfD) derivation.
- Recommend consideration of other issues related to the RfD process including: integrating reproductive/ developmental, immunotoxicity, and neurotoxicity data into the calculation.
- Recommend the use of quantitative dose-response modeling for the derivation of RfDs.
- Provide guidance for states and tribes on the use of an alternative value from the RfD point estimate, within a limited range, to reflect the inherent imprecision of the RfD.

For exposure assessment:

- Encourage states and tribes to use local studies on fish consumption that better reflect local intake patterns and choices.
- Recommend default fish consumption values for the general population, recreational fishers and subsistence fishers.
- Account for other sources of exposure, such as food and air, when deriving AWQC for noncarcinogens and nonlinear carcinogens.

For bioaccumulation:

- Focus on the use of bioaccumulation factors (BAFs), instead of bioconcentration factors (BCFs) for estimating potential human exposure to contaminants via the consumption of contaminated fish and shellfish.
- Use high quality field data over laboratory or model-derived estimates for deriving BAFs, since field data best reflect factors which can affect the extent of bioaccumlation (e.g., chemical metabolism, food web structure).

EPA does not plan to completely revise all of the criteria developed in 1980 or those updated as part of the 1992 National Toxics Rule. Partial updates of all criteria may be necessary. EPA will continue to develop and update toxicology and exposure data needed in the derivation of AWQC that may be impractical for the states and regions to obtain.

Methodology Revisions Implementation by EPA/States

EPA's future role in developing AWQC for the protection of human health will include:

- The development of revised criteria for chemicals of high priority and national importance (including, but not limited to, chemicals that bioaccumulate, such as PCBs, dioxin, and mercury).
- The development or revision of AWQC for some additional priority chemicals.
- Technical assistance to states and tribes on the toxicology, exposure and bioaccumulation methods, and review of state/tribal water quality standards.

EPA encourages states and tribes to use the revised methodology to develop or revise AWQC to reflect local conditions appropriately. EPA believes that AWQC inherently require several risk management decisions that are, in many cases, better made at the state and regional level (e.g., fish consumption rates, target risk levels).

Effect on State and EPA Regional Offices

The revised methodology will provide more flexibility for decision-making at state, tribal and EPA regional levels. EPA believes the AWQC require several risk management decisions that are often better made at the state, tribal and regional level. The methodology will probably result in more stringent criteria for bioaccumulatives (due to the use of BAFs instead of BCFs) and generally similar, or less stringent, values of nonbioaccumulatives.

The formulas for calculating human health criteria are presented below.

The generalized equations for deriving AWQC based on noncancer effects are:

Noncancer Effects[2]

$$AWQC = RfD \bullet RSC \bullet \left[\frac{BW}{DI + \sum_{i=2}^{4} \left(FI_i \bullet BAF_i \right)} \right]$$

2. Although appearing in this equation as a factor to be multiplied, the RSC can also be an amount subtracted. Refer to the explanation key below.

Cancer Effects: Nonlinear Low-Dose Extrapolation

$$AWQC = \frac{POD}{UF} \bullet RSC \bullet \left[\frac{BW}{DI + \sum_{i=2}^{4} \left(FI_i \bullet BAF_i \right)} \right]$$

Cancer Effects: Linear Low-Dose Extrapolation

$$AWQC = RfD \bullet \left[\frac{BW}{DI + \sum_{i=2}^{4} \left(FI_i \bullet BAF_i \right)} \right]$$

where:

AWQC = Ambient Water Quality Criterion (mg/L)

RfD = Reference dose for noncancer effects (mg/kg-day)

POD = Point of departure for carcinogens based on a nonlinear low-dose extrapolation (mg/kg-day), usually a LOAEL, NOAEL, or LED10

UF = Uncertainty Factor for carcinogens based on a nonlinear low-dose extrapolation (unitless)

RSD = Risk-specific dose for carcinogens based on a linear low-dose extrapolation (mg/kg-day) (dose associated with a target risk, such as 10^{-6}) (Note: The RSD for Washington State is 10^{-6})

RSC = Relative source contribution factor to account for non-water sources of exposure. (Not used for linear carcinogens.) May be either a percentage (multiplied) or amount subtracted, depending on whether multiple criteria are relevant to the chemical.

BW = Human body weight (default = 70 kg for adults)

DI = Drinking water intake (default = 2.4 L/day for adults)

FIi = Fish intake at trophic level (TL) I (I = 2, 3, and 4) (defaults for total intake = 0.0175 kg/day for general adult population and sport anglers, and 0.1424 kg/day for subsistence fishers). Trophic level breakouts for the general adult population and sport anglers are:

TL2 = 0.0038 kg/day; TL3 = 0.0080 kg/day; and TL4 = 0.0057 kg/day.

BAFi = Bioaccumulation factor at trophic level I (I=2, 3 and 4), lipid normalized (L/kg)

2. Implementation - Overview

The process for developing an effluent limit based on human health (Figure 28) parallels the existing process for developing aquatic life-based limits. However, there are some differences in the procedures used to determine whether a discharge will have a reasonable potential determination made for the human health-based criteria. These include two steps where the discharge is evaluated for (1) likelihood of discharging chemicals of concern, and (2) an evaluation by the agency of whether that discharge is a high priority in the permitting scheme or not.

The process of performing a reasonable potential determination is similar to that used for evaluating aquatic impacts as indicated by chronic aquatic life-based criteria. The differences between the two are the model inputs used to represent the critical flow conditions, the criterion values, and the probability values. Other input data, such as the default value for the coefficient of variation of effluent variability and statistical confidence level remain the same.

3. Screening and Prioritization

Screening and prioritizing discharges to determine whether a reasonable potential determination should be made is a two-step process. If a TMDL exists for a parameter with human health-based criteria, the permit writer will need to establish permit limits consistent with the TMDL WLAs.

Step 1.
After receipt of an NPDES application, the application should be screened to determine if it is a "low risk" discharge or a discharge undergoing modification. *These discharges will be omitted from implementation at the present time.* "Low risk" discharges include non-process cooling waters without biocides, gravel mining operations without asphalt processes, or other facilities where the permit writer has data or process knowledge to indicate that chemicals regulated under the human health criteria are absent. This determination must be made based on data or process information pointing to absence of chemicals, and cannot be based on a lack of data indicating the presence of chemicals. Discharges undergoing technology-based upgrades or improvements that are required by an Ecology order or permit (as specified below) will be omitted in order to allow the effluent to stabilize under the new treatment regime.

These discharges will be considered for human health-based limits after their upgrades are completed. These discharges include all industrial stormwater dischargers covered under the department's general industrial stormwater permit and all municipal stormwater discharges. If a discharger is in the planning phase of upgrades in response to an Ecology requirement, the discharger should be told that the effluent will be evaluated for impacts to human health after the upgrades are completed. This will allow the discharger to make plans for more extensive upgrades or process changes earlier on, if desired, and may result in cost savings. After a discharge has been evaluated based on the above criteria, the applicant will either be given no further consideration for human health-based permitting at the present time, or will go on to a second prioritization step.

Step 2.
If the screening step results in a "likelihood" finding, the application should be reviewed to determine whether the discharge is a high priority in agency permitting. Those discharges termed "high priority" will go on to have a full reasonable potential determination made on them. The following discharges are classed as high priorities:

1. All major dischargers.
2. Discharges for which existing data or knowledge of processes indicates the known or probable presence of chemicals with human health-based criteria.
3. Facilities discharging to a receiving water that is 303(d)-listed for a chemical with human health-based criteria, and that chemical is expected to be in the effluent.

If a discharge fits into any of the three groups described above, a reasonable potential determination must be conducted for that discharge. If a discharge does not fit into the groups described above, the application should not be considered further for human health-based effluent limits, but the permit writer should consider requiring submittal of a priority pollutant scan with the next permit application.

4. The Reasonable Potential Determination

The following section reviews the design criteria for making a determination of reasonable potential of a violation of the water quality criteria for human health. A summary of these is presented in Table 21.

4.1 Which Criteria?

A reasonable potential determination is conducted for each chemical in a discharge that (1) has an associated human health-based criterion, and (2) has been found (or is known to exist) in the discharge during the last permit cycle or upon application.

4.2 Effluent and Background Concentration

Use the 50th percentile effluent concentration for reasonable potential analysis. If there are less than 10 effluent data points use a multiplier on the highest effluent concentration to estimate the 50th percentile concentration. If there are more than 10 values use the cumulative percentile calculation at a 95% confidence to derive the 50th percentile (Excel).

For background concentration(s), use 0 for measured value(s) below the MDL and use the MDL for values between the MDL and the QL. For multiple data points use the geometric mean

4.3 Mixing Zones

The NTR allows states to use mixing zones already placed in state standards, or to default to an application of the criteria at the "end-of-pipe"(40 CFR 131.36(c)(2)(i)).

Washington's Water Quality Standards (Chapter 173-201A WAC) specifies mixing zone sizes for acute and chronic criteria. The mixing zone specified for chronic aquatic life-based criteria will be used for the human health-based criteria. This mixing zone allows for some dilution when calculating effluent limits, but is still protective of human health. See Appendix C for guidance on conducting a mixing zone analysis.

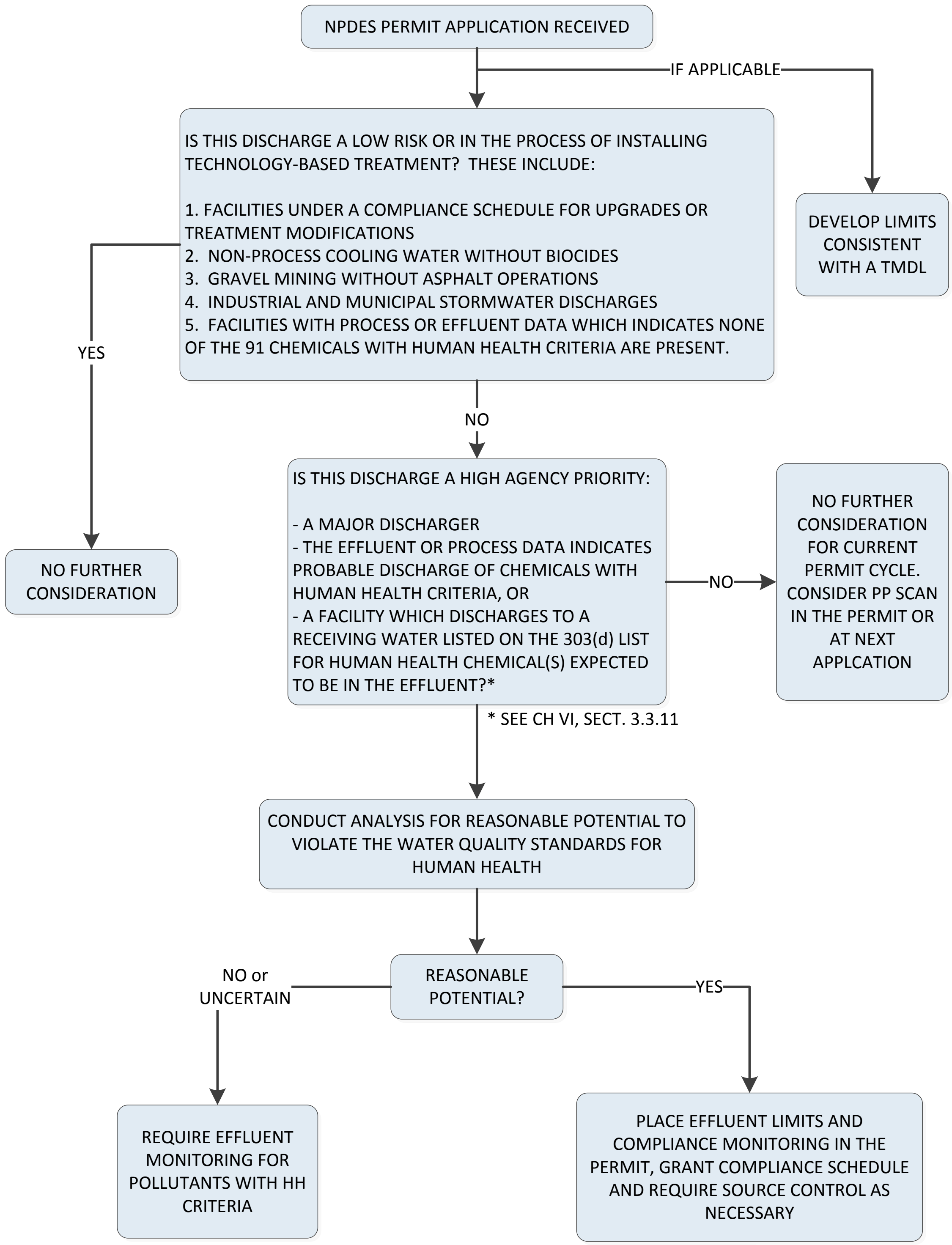


Figure 28. Process for implementing Human Health Criteria

4.4 Plant Design Flows

The following plant design flows should be used when conducting a human health-based reasonable potential determination. Note that the flows differ depending on whether the criterion is based on cancer or non-cancer effects (see Table 21 to determine this). See *Appendix C, Section 6.1 Critical Effluent Flow*, for more detail.

Carcinogens

- *Municipal Effluent* - Use the annual average design flow as specified in the engineering report, permit application, or a projection of the average annual flow over the life of the permit.
- *Industrial Effluents* - Use the annual average flow based on the permit application or DMR analysis.
- *Intermittent Discharges* - Use equivalent annual flow (highest total volume of all discharge events in one year divided by 365 days).

Non-carcinogens

- *Municipal Effluent* - Use the dry weather design flow if the facility flows are within 15% of design capacity. If the facility is operating well below design during the critical receiving water period, and there is no substantial projected increase in flows for the period of the next permit, then use the historical flow as defined by the highest monthly average flow for the past three years during the time of year when the critical receiving water period is likely to occur.
- *Industrial Effluents* - Use the historical flow as defined by the highest monthly average flow for the past three years during the period when the critical receiving water flow is most likely to occur. If flows are expected to increase during the life of the permit the highest average monthly flow must be estimated.
- *Intermittent Discharges* - Use equivalent monthly average flow (highest total volume of all discharge events in a month divided by 30 days).

4.5 Critical Receiving Water Flow Conditions

The NTR specifies that critical receiving water flow conditions in a state's standards may be used to determine effluent limits for human health criteria. WAC 173-201A-020 allows the state flexibility when determining the critical condition for riverine systems ("...may be assumed equal to the 7Q10 flow event unless determined otherwise by the department") and contains a narrative statement that can be used to determine a marine critical condition.

The flows used to conduct a reasonable potential determination are specified below, and follow the guidance in the NTR as closely as possible. Note that different flows are specified for criteria based on cancer effects and non-cancer effects.

Carcinogens

- *Freshwater Critical Condition* - Use the harmonic mean flow for the representative period of record. The representative period is the period that best represents flows as they now exist. For instance, if a dam was constructed that modified flows, use data from the time after the dam was constructed to determine the critical flow.
- *Marine/Estuarine Critical Condition* - Use the median velocity taken over one tidal cycle or from as many tidal cycles as are available in the period of record.

Non-carcinogens

- *Freshwater Critical Condition* - Use the 30Q5 if available or use the 7Q10 as an estimate of the 30Q5.
- *Marine/Estuarine Critical Condition* - Use the median velocity taken over one tidal cycle or from as many tidal cycles as are available in the period of record.

4.6 Coefficient of Variation of Effluent Concentration

Use 0.6, as is used for aquatic life-based permitting, or best available estimate (see Chapter 6).

4.7 Dilution Factor

Use a value derived from a reliable model (as is used for aquatic life-based permitting) or from an ambient dilution study or use percent of flow if that is more stringent (see Appendix C). If reliable values are not available, estimate flows or use percent of flow to determine reasonable potential and then insert a requirement in the permit for the discharger to provide a reliable dilution value to the department no later than the next permit reapplication (see Chapter 13, Monitoring).

4.8 Statistical Confidence Level

Use an alpha equal to 0.05 when calculating reasonable potential.

4.9 Background Data on Chemical Concentrations

Use available background data on chemical concentrations in the water column, or use zero as a default value if reliable data are not available.

Table 21. Design Conditions for Water Quality-Based Permitting of Human Health Criteria

<table>
<tr><th colspan="3">DESIGN CONDITIONS FOR MIXING ZONE/RATIO ANALYSIS - HUMAN HEALTH CRITERIA</th></tr>
<tr><th>Parameter</th><th>Pollutant</th><th>Critical Design Condition</th></tr>
<tr><td rowspan="2">Facility Effluent (Flow)</td><td>Carcinogen</td><td>The design effluent flow is defined as the annual average flow based on the engineering report, permit application or DMR analysis.
Use equivalent annual flow for intermittent discharges.</td></tr>
<tr><td>Non-carcinogen</td><td>The design effluent flow is defined as the highest monthly average plant effluent flow for the past three years during the critical flow or when critical condition is likely to occur. If plant effluent flows are expected to increase during the life of the permit, the highest average monthly flow must be estimated.
Use equivalent monthly average flow for intermittent discharges.</td></tr>
<tr><td rowspan="4">Receiving Water (Characteristics)</td><td>Carcinogen - Freshwater</td><td>The design receiving water current velocity is defined as the current velocity at the harmonic mean flow for the representative period of record.
The diffuser depth is defined as the depth at the harmonic mean flow.</td></tr>
<tr><td>Non-carcinogen - Freshwater</td><td>The design receiving water current velocity is defined as the current velocity at the 30-day low flow period with a recurrence interval of 5 years (30Q5) if available or at 7Q10.
The diffuser depth is defined as the depth at the 30Q5 or 7Q10 low flow period.</td></tr>
<tr><td>Carcinogen - Marine</td><td>The design receiving water current velocity is defined as the 50th percentile current velocity derived from a cumulative frequency distribution analysis. The current velocity frequently distribution analysis should be conducted, at minimum, over one tidal cycle.
The design ambient density profile is defined as the density profile that results in average mixing.
The diffuser depth is defined as the depth at MLLW. For tidally influenced rivers, the diffuser depth is defined as the depth at MLLW at 30Q5.</td></tr>
<tr><td>Non-carcinogen - Marine</td><td>The design receiving water current velocity is defined as the 50th percentile current velocity derived from a cumulative frequency distribution analysis. The current velocity frequency distribution analysis should be conducted, at minimum, over one tidal cycle.
The design ambient density profile is defined as the density profile that results in average mixing.
The diffuser depth is defined as the depth at MLLW. For tidally influenced rivers, the diffuser depth is defined as the depth at MLLW at the harmonic mean flow</td></tr>
</table>

Miscellaneous Design Conditions for Mixing Zone/Ratio Analysis		
Parameter	**No. of Data Points**	**Methodology**
Receiving Water Background Concentration (Human Health)	N/A	The geometric mean of receiving water concentrations is used to determine reasonable potential. If background is between the MDL and the QL use the MDL. If the background concentration is below the MDL, use 0. If no background data is available use 0.
Effluent Concentration (Human Health)	N/A	Use the 50th percentile effluent concentration. If there are less than 10 effluent data points use the following multipliers (see box following) on the highest effluent concentration to estimate the 50th percentile concentration. If there are more than 10 values use the cumulative percentile calculation at a 95% confidence to derive the 50th percentile (Excel).
Dilution Ratio Unidirectional flow (freshwater)	N/A	Flux average
Dilution Ratio Multidirectional flow (marine)	N/A	Flux average
Reflux	N/A	Assume reflux reduces the dilution factor by 1/2 or use site-specific data.

The point of compliance with the human health criteria is the boundary of the chronic mixing zone. Chronic design conditions are used for both the initial mixing and the far-field mixing calculations.

Number Of Effluent Samples For Determining Reasonable Potential For Human Health Criteria	Factors By Which To Multiply The Highest Effluent Concentration Value To Estimate The 50th Percentile Value (Cv = 0.6, 95% Confidence)
1	2.5
2	1.5
3	1.2
4	1.0
5	0.9
6	0.9
7	0.8
8	0.8
9	0.7
10	0.7

The values in this table were calculated using EPA's method (TSD, Section 3.3.2) of estimating quantile values from a limited data set presumed to be log normally distributed.

5. Results of the Reasonable Potential Determination

The reasonable potential determination will result in three possible outcomes. These are "yes", "no", or "can't determine". The following paragraphs explain how to set up permit requirements for the three possible results.

5.1 Yes, a Reasonable Potential Exists to Exceed Water Quality Standards

If a TMDL is in place, or if the reasonable potential determination shows that there is a potential for one or more water quality criteria to be exceeded, then effluent limits should be placed in the permit for the constituent(s) of concern (PermitCalc). The effluent limits are calculated by setting the average monthly limit equal to the WLA and using Table 5-3 of the TSD (99^{th} and 95^{th} percentile) to calculate the maximum daily limit. The Input 2 – Reasonable Potential spreadsheet in PermitCalc will perform a determination of reasonable potential and calculate limits if there is a reasonable potential.

The permit should also contain a compliance schedule if one is needed. The length of the compliance schedule should be evaluated individually for each facility. The permit should also contain source control requirements in order to ensure that efforts to comply with the permit limits in a timely manner are being made. These source control requirements should be set out in a phased approach. For instance, initial requirements should be to evaluate sources of pollutants, and examine ways to control those sources. That phase should be followed by requirements to implement methods of control.

The timing of the requirements will differ from facility to facility. In some cases, where sources are already known and may be easily controllable, short compliance schedules may be appropriate. In other cases, unknown sources or reduction issues may make a longer compliance schedule appropriate. Source reduction requirements should be aimed at pollution prevention, and, if possible, not be aimed at treatment methods that would involve large capital expenditures by dischargers. Compliance schedules should be shorter if fishing, shellfishing, or drinking water uses of the receiving water body are known or suspected to be impaired.

Stormwater and satellite CSO treatment plant discharges are highly intermittent and highly variable in discharge volumes, durations, and pollutant concentrations, both between storms and during a single storm event. Therefore, deriving numeric effluent limits for human health criteria is infeasible. Based on the authority of 40 CFR 122.44(k)(3), the permit should require the implementation of best management practices (BMPs) to control or abate human health pollutants from these discharges.

5.1.1. Compliance Monitoring

Permits with effluent limits should also contain requirements for priority pollutant scan monitoring during wet and dry seasons of years three and four of the permit. Effluent limits must be monitored at least once yearly. The recommended frequency is one/month.

5.2 No, a Reasonable Potential Does Not Exist to Exceed Water Quality Standards

If the results of the reasonable potential indicate that an exceedance of water quality standards is unlikely to occur, the permit should not contain effluent limits. The permit should, however, contain requirements for priority pollutant scan monitoring once during the wet and once during the dry seasons of year three of the permit. This information should be submitted with the next permit application. In addition, other information may be needed to more clearly make a reasonable potential determination at the next permit reissuance. These will be factors that are acceptable for decision making at this time, but about which valid biological or engineering issues still need to be addressed. For instance, using a river model program to estimate dilution is frequently acceptable, but in some cases the physical characteristics of the river (e.g., river bottom topography, curvature of river) make a field dilution study desirable to validate the model. In this case, although a reasonable potential determination can be made with the available data, the permit should contain requirements for a field dilution study to calibrate or verify modeling work.

5.3 The Result of the Reasonable Potential Determination is Ambiguous, or, "Can't Determine".

The result "can't determine" will likely result from poor or incomplete effluent data, background data or unreliable dilution estimates. If this outcome occurs the permit should be issued with requirements to conduct two priority pollutant scans during year three of the permit, one during the wet season and one during the dry season. These data should be submitted with the appropriate DMRs. In addition, the permit should contain requirements to provide data to clarify any other factors leading to the "can't determine" finding. For instance, if the reasonable potential determination does not yield a reliable "yes" or "no" result because of unreliable dilution information, the permit should require that a dilution study be performed during the permit cycle, with data available, at latest, with the next permit application.

6. Analytical Methods

See Table 14 for a discussion of the analytical methods that should be used for general priority pollutant scans. In general, it is not effective to require an individual and different method for each chemical in a priority pollutant scan. Instead, the usual default will be to require the most sensitive analytical method for a particular chemical analysis that will measure a suite of chemicals (e.g., Method 608 for pesticides).

7. Intake Credits

On September 1, 2016, the rule adding Chapter 173-201A-460 WAC became effective, providing for the consideration and use of intake credits in evaluating the need for water quality based effluent limits (WQBELs). On November 15, 2016, EPA affirmed Ecology’s ability to use intake credits in permitting decisions with the following statement in their partial approval/partial disapproval of the human health criteria and implementation tools. “The EPA is not taking action on the following because they are not WQS reviewable under CWA section 303(c): …New intake credit rule at WAC 173-201A-460.”

An intake credit is defined in Chapter 173-201A-020 WAC as:

- **Intake credit –** a procedure for establishing effluent limits that takes into account the amount of pollutant that is present in waters of the state, at the time water is removed from the body of water by the discharger or other facility supplying the discharger with intake water.

Intake credits are available for determining reasonable potential and establishing WQBELs for both aquatic life and human health-based criteria. They are described here in Chapter 7 for convenience. Technology-based intake credits are discussed in Chapter 4, Section 5.

7.1 General Provisions

An intake credit applies to consideration of an intake pollutant, defined in Chapter 173-201A-460 WAC as:

- An **intake pollutant** is the amount of a pollutant that is present in waters of the state at the time water is removed from the same body of water by the discharger or other facility supplying the discharger with intake water.

A discharger requesting use of an intake credit should expect to provide the permit writer with much of the information required for consideration. This may include additional monitoring and documentation not required in a typical permit application (e.g. water distribution information).

A permit writer evaluating use of an intake credit should expect to gather required information, perform additional reasonable potential calculations, consider the need for additional permit requirements, and provide thorough documentation of findings in the permit fact sheet.

7.2 Consideration of Intake Pollutants

Figure 29 below provides an overview of the process for considering intake credits. One endpoint is a no reasonable potential determination. The other is the establishment of water quality-based effluent limits. Permit writers should carefully consult rule language when considering intake credits.

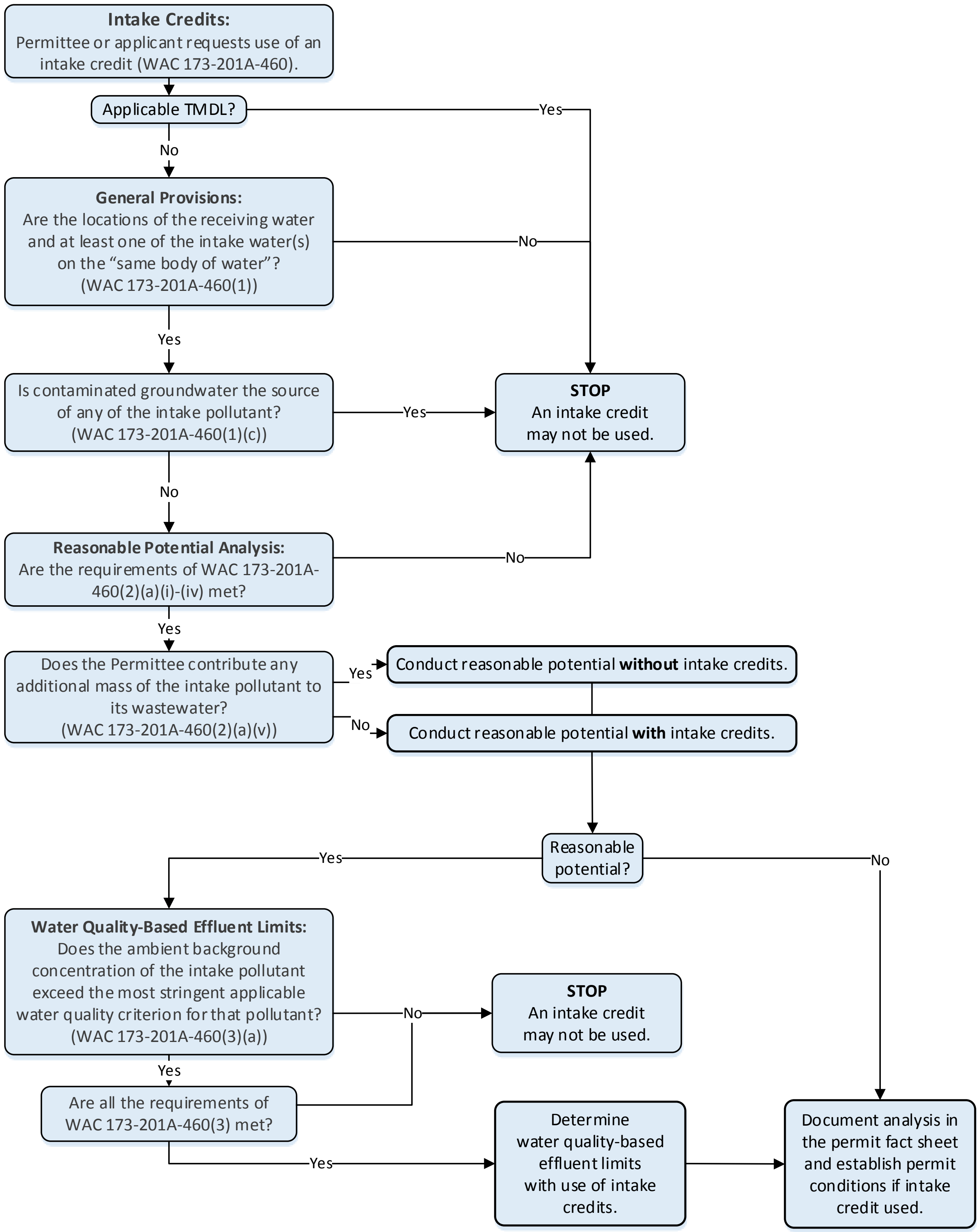


Figure 29. Consideration of Intake Pollutants

Step 1.
Gather available data on the discharge and the ambient background concentration of the pollutant and evaluate the overall situation. See Chapter 6, Section 3.3.6 for more on acquiring background data. At least two situations exist where an intake credit cannot be used. First is when an applicable TMDL exists. In this case, permit limits must be consistent with any TMDL wasteload allocation. See Chapter 6, Section 3.3.11 and Appendix E for more on TMDLs and discharges to impaired waters.

The second situation where use of an intake credit is not allowed is when at least a portion of the intake pollutant in groundwater is present due to human activity. This could include pollutants originating from groundwater cleanup sites or sites not officially identified as a cleanup site. Applying an intake credit to a discharge resulting from a groundwater cleanup action would be counter to cleanup objectives.

Step 2.
The permit writer must determine if the intake pollutant is from the same body of water as the receiving water into which the discharge occurs. You may need to collect additional data, as described in Step 3, to evaluate rule requirements. To establish a “same body of water” finding, all of the following conditions must be met:

- The intake pollutant would have reached the vicinity of the outfall point in the receiving water within a reasonable period had it not been removed by the permittee.
- The background concentration of the pollutant in the receiving water (excluding any amount of the pollutant in the facility’s discharge) must be similar to that in the intake water.
- A direct hydrological connection must exist from the intake to the discharge.
- Site-specific factors: The permit writer may also consider site-specific factors relevant to transport and fate of the pollutant in a “same body of water” determination.

The rule does not require that all the intake water come from the same body of water as the receiving water into which the discharge occurs. For example, you may have a groundwater withdrawal and surface water discharge. Intake water may be provided by a municipal supply system, or come from multiple sources. Only those portions of intake water that come from the same body of water as the receiving water into which the discharge occurs are eligible for intake credit.

It may be helpful to have a map or diagram showing the locations of the receiving water, the discharge outfall, and the intake locations(s). When evaluating multiple intake sources, include eligible (from the same body of water) sources in a flow-weighted intake concentration calculation as follows:

$$\mathbf{I_{total} = [(I_1*Q_1)+(I_2*Q_2)+(\ldots)+(I_n*Q_n)]/Q_{total}}$$

Where: I_{total} = the total intake concentration from eligible sources
I_n = the pollutant concentration from eligible intake source n
Q_n = the flow rate from eligible intake source n
Q_{total} = the flow rate from all eligible intake sources

If none of the intakes containing the pollutant are from the same body of water as the discharge, STOP – use of an intake credit is not permitted.

Step 3.
If the conditions in Steps 1 and 2 are met (or additional data is needed for Step 2), the discharger will need to provide additional data on the quality of the facility's intake water and effluent.

Data on the mass and concentration of the intake pollutant(s) in the intake water(s) and the effluent during the same period of time will be required for analysis. While some of these data may be available, particularly for the effluent, it will likely require sampling and analysis specific to the purpose of evaluating compliance with the rule at Chapter 173-201A-460(2)(a) WAC:

(i) The facility removes the intake water containing the pollutant from the same body of water into which the discharge is made;
(ii) The facility does not alter the identified intake pollutant chemically or physically in a manner that would cause adverse water quality impacts to occur that would not occur if the pollutant had not been removed from the body of water;
(iii) The timing and location of the discharge would not cause adverse water quality impacts to occur that would not occur if the identified intake pollutant had not been removed from the body of water; and
(iv) The facility does not increase the identified intake pollutant concentration at the edge of the mixing zone, or at the point of discharge if a mixing zone is not allowed, as compared to the pollutant concentration in the intake water, unless the increased concentration does not cause or contribute to an excursion above an applicable water quality standard; and
(v) The facility does not contribute any additional mass of the identified intake pollutant to its wastewater; [NOTE: Contributing mass may mean the pollutant is a raw material or contained in a raw material, is created in a chemical reaction in an industrial process, or is added in the treatment process. This requirement applies only when determining reasonable potential. However, mass must still be evaluated if limits are established.]

The permit writer should require the discharger to prepare a quality assurance project plan (QAPP) with Ecology review and approval prior to sample collection to assure the work will provide all the data needed to evaluate use of the intake credit in both the reasonable potential analysis and in determining water quality-based effluent limits.
Sampling would typically include paired monitoring of the intake waters and effluent. Flow rates will be needed along with concentration. Time of travel in the system (industrial process and

wastewater treatment process) should be considered. If intake water is pretreated (e.g. by a municipal water supplier), monitoring must be conducted after initial treatment to reflect the quality of the facility's actual intake water.

The discharger should prepare the QAPP in accordance with the guidelines given in *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies*, Ecology Publication 04-03-030. This document is available at: https://fortress.wa.gov/ecy/publications/SummaryPages/0403030.html. The EAP or WQ PDS may provide support in reviewing the QAPP.

Step 4.
Next, the permit writer will need to evaluate the data gathered in Step 3 to identify any potential changes in pollutant speciation or water chemistry that may result in increased pollutant toxicity, mobility, or bio-availability (WAC 173-201A-460(2)(a)(ii)). If the intake pollutant is altered by use at the facility in a way that causes adverse water quality impacts, STOP – use of an intake credit is not permitted.

Also evaluate any effects from changes in the timing and location of discharge of the intake pollutants (WAC 173-201A-460(2)(a)(iii)). This would be of particular concern in effluent-dominated waterbodies with low base flows. If adverse water quality impacts occur as a result of changes in the timing and location of discharge of the intake pollutant, STOP – use of an intake credit is not permitted.

Step 5.
Next, use the data gathered in Step 3 to evaluate use of an intake credit for reasonable potential.

Chapter 172-201A-460(2)(a)(i) – (v) WAC requirements for determining reasonable potential are listed in Steps 2 and 3 above. In evaluating (2)(a)(v) for reasonable potential, the permit writer must determine if there is a potential for contributions of the pollutant from the facility. Review the production process description, raw materials used, toxic release inventory (TRI) reports (See TRI Explorer at http://iaspub.epa.gov/triexplorer/tri_release.chemical), hazardous waste records (See TurboWaste.Net (internal staff only) at: http://ecyapps7/Turbowaste/Forms/SiteSearch.aspx), inspection reports and facility history.

For domestic wastewater facilities, use information from the pretreatment program if present. POTWs without a pretreatment program may be submitting *Industrial User Surveys* which will list industries discharging to the POTW. If no pretreatment program exists, check Ecology-issued permits discharging to the facility. You can create a list of permits that discharge to a POTW using the *Related Permits Report* in PARIS. Additional monitoring may be required.

If the facility contributes additional mass of the pollutant to its wastewater, even if that mass is removed through treatment, don't use intake credit when evaluating reasonable potential. Note, however that contribution of additional mass doesn't disqualify the use of an intake credit for calculating water quality-based effluent limits (see Step 6).

If the facility doesn't contribute additional mass of the pollutant, and satisfies other rule eligibility criteria, adjust reasonable potential values using the intake credit as described below. Either of these adjustments could result in a negative number. That's OK.

For aquatic life criteria:

1. Calculate the appropriate effluent concentration for analysis. See Chapter 6, Table 12 (95^{th} percentile or single highest effluent concentration based on number of data points).
2. Calculate the influent concentration using the same guidance from Chapter 6, Table 12.
3. Subtract the influent concentration from the effluent concentration.
4. Use this number in place of the effluent value in PermitCalc.

For human health-based criteria:

1. Calculate the appropriate effluent concentration for analysis. See Chapter 7, Table 21 (50^{th} percentile or as calculated).
2. Calculate the influent concentration using the same guidance from Chapter 7, Table 21.
3. Subtract the influent concentration from the effluent concentration.
4. Use this number in place of the effluent value in PermitCalc.

If no reasonable potential exists, document the analysis in the fact sheet and see Section 7.3 of this chapter for additional permit conditions to consider.

If reasonable potential exists, continue to Step 6.

Step 6.

When a discharge is eligible for consideration of an intake credit in the determination of water quality-based effluent limits, the permit writer will next need to establish appropriate effluent limits using that intake credit and specify how compliance with those limits will be assessed.

Note that if data entry from Step 5 above resulted in **Reasonable Potential? = YES** in PermitCalc, the spreadsheet will automatically calculate effluent limits adjusted by the use of the intake credit. However, if the facility contributes additional mass of the identified intake pollutant and then removes that mass through treatment, the spreadsheet may show **Reasonable Potential? = NO**. In this case, the permit writer will need to override the spreadsheet by typing **YES** in place of **NO**. PermitCalc will then calculate effluent limits. These calculated limits may or may not be sufficient for evaluating compliance when an intake credit is used.

One possible expression of an effluent limit based on an intake credit is:

1. Place a water quality-based limit calculated **without** use of the intake credit in the permit.
2. Determine compliance using the following calculated value:
   Effluent concentration – influent concentration

The permittee would remain in compliance provided the calculated value is below the limit. Using this approach requires careful setup of the permit limits in PARIS. The permittee should be reporting the influent concentration on the intake monitoring point, the effluent concentration on the effluent monitoring point, and the net value on an additional and appropriately labeled monitoring point where the limit resides. Consult the PARIS business lead as to how these limits should be set up.

Other expressions of an effluent limit may be considered, provided they are sufficient for determining compliance and accounting for variability in the influent and effluent. More complex situations (e.g. multiple intake sources and pollutants) will require more consideration when developing limits.

7.3 Additional Permit Conditions for Intake Credits

Any permit where intake credits are used will require additional permit conditions. Even if a no reasonable potential determination is made, sufficient monitoring should be included in the permit to assure the identification of any changing conditions that may make the use of the intake credit inappropriate. Intakes should be identified on the permit application and entered into PARIS and included in the permit similarly to outfalls.

The permit writer should document in the permit fact sheet how intake credits were considered and, if applicable, used in the permit.

Permit required monitoring and reporting must be sufficient to consistently evaluate use of an intake credit. This will likely require monitoring intake(s) and effluent in tandem at sufficient frequency. See Chapter 13 for more on monitoring frequency.

Chapter 8. Deriving Water Quality-Based Effluent Limitations for the Protection of Ground Water Quality

In Washington State, any commercial or industrial operation discharging wastewater to ground water must have a discharge permit. The permit writer, in developing that permit, must consider the effect of the discharge on the quality of ground water.

1. Ground Water Criteria and Standards

The Water Quality Standards for Ground Waters of the State of Washington (Chapter 173-200 WAC) are similar to the water quality standards for surface waters. They define the beneficial uses to be protected, they specify the concentrations of chemicals to protect the beneficial uses, they have an antidegradation section, and they generally define the point of compliance.

The implementation process for the ground water standards is found in *Implementation Guidance for the Ground Water Quality Standards,* Ecology Publication 96-02.

1.1 Numeric Criteria

The numeric criteria within the ground water standards are divided into I. Primary and Secondary Contaminants and Radionuclides and II. Carcinogens.

2. De Minimis Application of Food Process Wastewater

General

De minimis application of food process wastewater to land via irrigation for the purpose of treatment is an application that occurs infrequently (e.g., once per year), on a limited area (e.g., one-time applications to a specific field), and/or at a nutrient loading rate that is well below the crop requirement. If managed properly, de minimis applications of food process wastewater benefits both the discharger and the environment by prolonging the viability of wastewater disposal sites, and providing nutrient benefit for crops. To qualify as a de minimis discharge, the permittee must clearly demonstrate in an Engineering Report that the discharge will have minimal potential to impact ground water. All de minimis discharges will be authorized by conditions set forth in a state waste discharge permit. To make this type of operation viable, a process and permit language was developed to allow these types of applications.

Review Process

If a food processing facility intends to propose a de minimis discharge at the time it submits a discharge permit application, an Engineering Report, as per Chapter 173-240 WAC, or an addendum to an existing approved engineering report must accompany the permit application.

At a minimum the engineering report must include a description of soil and crop types, depth to ground water, distance to any surface water, proposed wastewater irrigation schedule, percent of nutrient crop need per year provided by the wastewater, and a statement that the proposed de minimis application will be protective of the existing and future beneficial uses of the ground water. This is similar to the requirements for submission of an "Abbreviated Engineering Report" detailed in Chapter 3 of *Guidelines for Preparation of Engineering Reports for Industrial Wastewater Land Application Systems (Ecology Publication 93-36).* An addendum to an existing engineering report must give details of the proposed de minimis application and evaluate hydrogeologic conditions at the proposed sites. The facility manager, in coordination with the project proponent, will determine if additional evaluation is required for a proposal for de minimis application.

Adequate guidance currently exists (*Implementation Guidance for the Ground Water Quality Standards (Ecology Publication 96-02), Guidance for Submission of an Engineering Report for Industrial Wastewater Land Treatment Systems*, and the *Irrigation Management Practices Manual*, etc.) that allows Ecology to evaluate de minimis application proposals from food processors. These manuals provide enough flexibility for Ecology to evaluate the need for additional hydrogeologic information and to determine what type of monitoring is needed.

Review of the Engineering Report will help determine if additional hydrogeologic evaluation is needed and what type of monitoring (e.g., effluent quality, application monitoring, farm plan evaluation, etc.) is needed to insure the protection of the state's ground water resource. After Ecology's approval of the Engineering Report or addendum, permit language should be included to condition the application of wastewater in accordance with that described in the Engineering Report or addendum and to address monitoring needs. Ecology permit writers can access permit shell language from SharePoint.

Facilities that decide to make de minimis applications while their current permit is in effect must request a permit modification and submit the same type of engineering report or addendum discussed above. Approval of the engineering report will result in the permit being modified to include new de minimis permit language. Ecology permit writers can access permit shell language from SharePoint.

3. Discharges to Double-lined Evaporative Lagoons with Leak Detection

General

Chapter 3, Section 1 of this manual presents a discussion of who needs water quality permit coverage. It states that all lagoons containing wastewater, lined and unlined, require state wastewater discharge permits. However, there are limited cases where Ecology can be reasonably assured that no discharge to waters of the state will occur, and therefore no permit is required.

Weather patterns in some regions of Washington promote significant evaporation of wastewater in lagoons while also producing limited rainfall. This may allow generators of wastewater to design non-discharging lagoons capable of evaporating all wastewater to the atmosphere with no reasonable potential for discharge to waters of the state.

Ecology's *Implementation Guidance for Ground Water Quality Standards* (Ecology Publication 96-02), discusses lagoons in *4.2.1.4.2 Impoundments*. All liners leak to some extent. But impoundments with double synthetic membrane liners with a leak detection system are not considered to have a potential to contaminate ground water. If all wastewater is evaporated, there is also no potential to contaminate surface water.

Review Process

If a facility intends to use a double-lined evaporative lagoon for wastewater disposal, they must submit engineering reports, plans, and specifications in accordance with Chapter 173-240 WAC. At a minimum, the engineering report must be consistent with the criteria in G3-3.5 Ponds and Aerated Lagoons, of the Criteria for Sewage Works Design (Ecology Publication 98-37). The operation and maintenance manual must include a leak detection plan to monitor or test for the structural integrity of the lagoon liner.

In addition to standard review, Ecology will evaluate the submittal for consistency with the Criteria for Sewage Works Design, including lagoon sizing criteria, adequacy of operations and maintenance, and leak detection plans. If the facility adequately demonstrates no potential discharge to waters of the state, Ecology will not require application for state wastewater discharge permit coverage. This does not apply to any lagoons, including double-lined lagoons, used for wastewater storage prior to a disposal method that results in a discharge to waters of the state. If any discharge at a facility triggers permit coverage, the permit should include requirements for any double-lined evaporative lagoons to ensure proper operation and maintenance and leak detection monitoring or testing.

Chapter 9. Deriving Effluent Limits for the Protection of Aquatic Sediments

NOTE: This chapter has not been substantially updated since Ecology revised Chapter 173-204 WAC, *Sediment Management Standards*. Permit writers should consult the SMU and the rule until this chapter is updated to reflect revisions.

Permit managers must consider the effect of a proposed discharge to surface waters on the quality of aquatic sediments and limit the concentrations of pollutants that cause an exceedance of the sediment quality standards (SQS).

This chapter acquaints the permit writer with the basis of the sediment quality standards and defines the permit writer's initial tasks of implementing the standards. This chapter is derived from a more comprehensive document called the *Sediment Source Control Standards User Manual* (Ecology 1993). Permit managers who become involved in authorizing sediment impact zones (SIZ) or deriving effluent limits based on the sediment quality standards should read the *Sediment Source Control Standards User Manual* to understand those procedures.

This chapter outlines the permit writers tasks for implementing the sediment management standards, discusses the sediment quality standards, presents the overall approach for implementing the sediment source control standards including the authorization of the SIZ and then discusses in more detail the narrative and technical screening conducted by permit writers. Sediment monitoring guidance is located in Section 7 of Chapter 13 Monitoring Guidelines.

Permit writers should realize that the processes described here are only for assessment and control of sediment contamination near the point of discharge. A TMDL may be in-place to protect sediments potentially affected by the discharge, and in that case, permit limitations are needed to implement the TMDL WLAs. Otherwise, protection from farfield contamination relies on customary technology-based and surface water quality-based pollutant controls.

1. Permit Writer's Tasks

1.1 For Permits to Puget Sound

Complete the narrative evaluation sheet and the technical evaluation sheets, send a copy of the completed sheets when submitting the draft permit for QA review, and discuss the results in the fact sheet. Require baseline monitoring or monitoring for model runs if indicated by the evaluation. Consult with the Sediment Management Unit (SMU) on the specifics of the monitoring requirements. Compare monitoring results with the sediment quality standards.

1.2 For Permits to Other Marine Waters

Complete the narrative evaluation sheets and the technical evaluation sheets, attach copies of the completed sheets to the draft permit for QA review, and discuss the results in the fact sheet.

Require baseline monitoring or monitoring for model runs if indicated by the evaluation. Consult with the Sediment Management Unit on the specifics of the monitoring requirements. Compare sediment quality data with the sediment quality standards on a case-by-case basis.

1.3 For Permits to Low Saline Waters

Complete the narrative and technical evaluation sheets and send a copy of the completed sheets with the draft permit for QA review. Require sediment-related monitoring or other sediment requirements only after consultation with the SMU.

1.4 For Permits to Fresh Water

Evaluate the possibility of sediment contamination on a pollutant-specific and facility-specific basis. Contact the SMU before placing any sediment-related requirements in permits.

2. The Sediment Management Standards

Several state laws provide Ecology with the authority to address sediment contamination issues in Washington State waters. The most important of these laws, for purposes of implementing the Sediment Management Standards, is the Water Pollution Control Act, Chapter 90.48 of the Revised Code of Washington (RCW). The Water Pollution Control Act provides Ecology with the authority to regulate point and nonpoint source discharges in order to limit discharge-related impacts to sediment quality. The Sediment Management Standards rule (Chapter 173-204 WAC) was developed by Ecology to:

- Establish chemical, biological, and other criteria as standards for the quality of sediments to protect beneficial uses and human health. These specific criteria values within the Sediment Management Standards are called the Sediment Quality Standards (SQS). The SQS are equivalent to the numerical criteria in the surface water quality standards.
- Apply the sediment quality standards (SQS) as the basis for the management and reduction of pollutant discharges.
- Provide a management and decision process for the cleanup of contaminated sediments.

Additional background information on the development of and rationale for the Sediment Management Standards is available in the *Final Environmental Impact Statement for the Washington State Sediment Management Standards* (Ecology 1990).

The Sediment Management Standards address three main issues:

First:
The rule establishes a narrative sediment quality goal defined as no acute or chronic adverse effects on biological resources and no significant health risk to humans caused by sediment contamination. The SQS establish the long-term management goal for the quality of sediments throughout the state. The SQS are defined by:

- Numerical chemical concentration criteria (chemical concentration criteria for Puget Sound marine sediment quality are provided in WAC 173-204-320(2))
- Biological effects criteria (biological effects criteria for Puget Sound marine sediment quality are provided in WAC 173-204-320(3))
- Human health criteria **(currently under development)**; WAC 173-204-320(4) and (5)).

Sediments that exceed the SQS criteria are predicted to have adverse effects on biological resources or to pose significant human health risks. The SQS criteria may be revised as new data are developed regarding the toxicity of contaminants in sediments to human health and the environment.

A significant difference between the SQS and the surface water quality standards is that the SQS can be superseded by a demonstration that no significant biological effects are occurring. A discharger who finds that the SQS are exceeded at the point of discharge may elect to let the results stand as an exceedance of the criteria or, alternatively, to conduct biological testing to show compliance with the standards.

Table 22. Marine Sediment Quality Standards and Sediment Impact Zone Maximum Allowable Contamination Levels for Puget Sound[a]

Chemical Parameter	SQS	SIZ_{max}
Metals (mg/kg dry weight)		
Arsenic	57	93
Cadmium	5.1	6.7
Chromium	260	270
Copper	390	390
Lead	450	530
Mercury	0.41	0.59
Silver	6.1	6.1
Zinc	410	960
Nonionizable Organic Compounds (mg/kg organic carbon[b])		
Aromatic Hydrocarbons		
Total LPAH[c]	370	780
Naphthalene	99	170
Acenaphthylene	66	66
Acenaphthene	16	57
Fluorene	23	79
Phenanthrene	100	480
Anthracene	220	1,200
2-Methylnaphthalene	38	64
Total HPAH[d]	960	5,300
Fluoranthene	160	1,200
Pyrene	1,000	1,400
Benz[a]anthracene	110	270
Chrysene	110	460
Total benzofluoranthenes[e]	230	450
Benzo[a]pyrene	99	210
Indeno[1,2,3-c,d]pyrene	34	88
Dibenzo[a,h]anthracene	12	33
Benzo[g,h,i]perylene	31	78
Chlorinated Benzenes		
1,2-Dichlorobenzene	2.3	2.3
1,4-Dichlorobenzene	3.1	9

1,2,4-Trichlorobenzene	0.81	1.8
Hexachlorobenzene	0.38	2.3
Phthalate Esters		
Dimethyl phthalate	53	53
Diethyl phthalate	61	110
Di-*n*-butyl phthalate	220	1,700
Butyl benzyl phthalate	4.9	64
Bis[2-ethylhexyl]phthalate	47	78
Di-*n*-octyl phthalate	58	4,500
Miscellaneous		
Dibenzofuran	15	58
Hexachlorobutadiene	3.9	6.2
N-nitrosodiphenylamine	11	11
PCBs	12	65
Ionizable Organic Compounds (□g/kg dry weight; parts per billion)		
Phenol	420	1,200
2-Methylphenol	63	63
4-Methylphenol	670	670
2,4-Dimethylphenol	29	29
Pentachlorophenol	360	690
Benzyl alcohol	57	73
Benzoic acid	650	650

HPAH - high molecular weight polycyclic aromatic hydrocarbon
LPAH - low molecular weight polycyclic aromatic hydrocarbon
PCB - polychlorinated biphenyl
SIZ_{max} - Sediment Impact Zone maximum allowable contamination level (WAC 173-204-420)
SQS - Sediment Quality Standards (WAC 173-204-320)

[a] Where laboratory analysis indicates a chemical is not detected in a sediment sample, the detection limit should be reported. Where chemical criteria in this table represent the sums of individual compounds (e.g., total LPAHs and total HPAHs) or groups of isomers (e.g., total PCBs), and a chemical analysis identifies an undetected value for one or more individual compounds or groups of isomers, the detection limit should be used for calculating the sum of the respective compounds or groups of isomers.

[b] The listed values represent concentrations in parts per million "normalized" on a total organic carbon basis. To normalize to total organic carbon, the dry-weight concentration for each parameter is divided by the decimal fraction representing the percent total organic carbon content of the sediment.

[c] The total LPAH criteria are to be compared to the sum of the concentrations of the following LPAH compounds: naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene. 2-Methylnaphthalene is not included in the LPAH definition. The total LPAH criteria are not the sums of the corresponding criteria listed for the individual LPAH compounds.

[d] The total HPAH criteria are to be compared to the sum of the concentrations of the following HPAH compounds: fluoranthene, pyrene, benz[a]anthracene, chrysene, total benzofluoranthenes, benzo[a]pyrene, indeno[1,2,3-c,d]pyrene, dibenzo[a,h]anthracene,

and benzo[g,h,i]perylene. The total HPAH criteria are not the sums of the corresponding criteria listed for the individual HPAH compounds.

[e] The total benzofluoranthenes criteria are to be compared to the sums of the concentrations of the b, j, and k isomers of benzofluoranthene.

The numerical chemical concentration criteria and biological effects criteria presently contained in the rule (WAC 173-204-320(2) and (3)) apply only to marine sediments in Puget Sound. Similar criteria for other marine sediments and for freshwater and low-salinity sediments of Washington State are **currently being developed** by Ecology (WAC 173-204-320(1)(c), 173-204-330, and 173-204-340). Until such criteria are adopted into the Sediment Management Standards, rule compliance with the narrative standard for other marine, freshwater, and low-salinity sediments will be determined on a case-by-case basis. This document presents a process for such case-by-case determinations in Part 4.4.

Second:

The Sediment Management Standards set forth a process for managing sources of sediment contamination (WAC 173-204-400 through 173-204-420). The SSCS specifically address the following aspects of this process:

- A requirement that discharges with the potential to impact receiving sediments have received all known, available, and reasonable methods of prevention, control, and treatment (AKART) prior to discharge, and/or the application of best management practices (BMPs), as appropriate
- Monitoring procedures for evaluating the potential for a discharge to impact the receiving sediments
- Procedures for determining whether a discharge is eligible for a sediment impact zone (SIZ), which would allow contamination in the receiving sediments to exceed the SQS
- If a SIZ is to be authorized, methods for determining appropriate restrictions (e.g., on the allowable areal extent or level of contamination and biological effects)
- SIZ renewal, maintenance, and closure requirements.

Although the SSCS allow eligible discharges to cause receiving sediments to exceed the SQS, the SSCS also set forth specific chemical and biological criteria (WAC 173-204-420) that define the maximum level of chemical contamination or biological effects above the SQS that will be allowed within an authorized SIZ. This ceiling on chemical contamination and biological effects is referred to as the SIZ maximum allowable contamination level, or SIZ_{max}.

Third:

The Sediment Management Standards set forth a decision process for identifying contaminated sediment sites and determining appropriate cleanup responses (WAC 173-204-500 through 173-204-590). Natural recovery is recognized as a viable response option for sediments that are expected to recover unaided to at least the minimum cleanup level within a 10-year time frame. Natural recovery to the SQS may take more than 10 years.

There should be consistency in the levels of sediment contamination and biological effects that will be allowed to remain in the environment following source control measures and cleanup at contaminated sediment sites. For this reason, the same numerical chemical concentration criteria and biological effects criteria have been established for the maximum level of chemical contamination or biological effects allowable within an authorized SIZ (i.e., SIZ_{max}; WAC 173-204-420) and the maximum level of chemical contamination or biological effects allowable once cleanup is complete (i.e., MCUL; WAC 173-204-520). These standards have been set at chemical concentrations or biological effects levels established by the narrative sediment quality regulatory goals that correspond to a “minor adverse effects level” (equal to or higher than the SQS).

The narrative goal of the Sediment Management Standards has also been formulated to be consistent and compatible with the sediment quality goals of the Puget Sound Dredged Disposal Analysis (PSDDA) program, which addresses the management and disposal of sediments dredged as part of navigational maintenance or construction activities. Consistency is established by setting the SIZ_{max}, CSL, and MCUL at chemical concentrations and biological effects levels that are as similar as possible to the PSDDA guidelines for unconfined, open-water disposal of dredged material (i.e., PSDDA Site Condition II). Exact correspondence is currently not possible because slightly different sets of biological tests and test interpretation guidelines are used for the two programs. For the purpose of testing sediments under the various sediment management programs, the Puget Sound Estuary Program protocols (PSEP 1991c) provide consistent procedures for sediment sampling, chemical analyses, and biological testing, but the interpretation of the results is program-specific.

3. Overview of the Process

Figure 29 provides an overview of the permitting process and authorization of a SIZ. For the sake of simplicity, the process depicted in Figure 29 is linear. However, the actual decision-making process followed by permit managers and SMU staff has multiple decision points and pathways, which are described in greater detail in subsequent sections of this chapter and in the *Sediment Source Control Standards User Manual*. In addition, some of the steps illustrated in Figure 29 are actually implemented in a phased or iterative manner, which is not easily represented in this linear flowchart (e.g., the evaluation of the potential for sediment impacts may include both generalized and site-specific computer model runs, which are conducted before and after, respectively, the request for a SIZ application). This section only discusses in detail the part of the process up to the application of the SIZ.

In the following sections, the primary provisions and requirements of the SSCS with respect to the sediment source control standards permitting process are described. This process generally follows the 10-step process outlined in WAC 173-204-400(1)(a)–(j), but the order of discussion in the following sections have been modified slightly to correspond to the permitting process as implemented by the WQP. The subsections of the rule corresponding to each step are indicated. When appropriate, reference is made to subsequent chapters of this manual for implementation guidance.

3.1 Evaluation of the Potential for a Discharge to Impact Receiving Sediments (WAC 173-204-400(1)(a))

A screening-level evaluation of the potential for a discharge to cause sediment impact is conducted when a permit application is accepted for a new or existing discharge. The screening-level evaluation, which consists of both narrative and technical evaluations, is described in Section 4.

If the screening-level evaluation indicates that it is unlikely that the discharge would adversely impact the receiving sediments, the permit is issued or renewed without sediment monitoring, a SIZ authorization, or sediment quality-based effluent limits. The evaluation sheets are sent to the SMU.

If the screening-level evaluation indicates a potential for a discharge to adversely impact receiving sediments the sediment-related information is forwarded to the SMU with the evaluation sheets. The SMU then runs a generalized SIZ computer model(s) (such as the Cornell Mixing Zone Expert System [CORMIX], or Water Quality Analysis Simulation Program [WASP]) using readily available information. The purpose of this generalized model run is to determine whether the discharge has the potential to cause an exceedance of the SQS numerical criteria (Table 22) within a 10-year period from the date of Ecology's evaluation of the ongoing discharge or the starting date of the proposed discharge, whichever is later (WAC 173-204-415(2)).

If there is evidence of an SQS violation, if sufficient data are available, and if the discharge is from a priority facility (see Figure 30), a site-specific model run will also be performed. Additional data required for either the generalized or site-specific model runs may be requested from the discharger. The results of these model runs and application of the SMU's best professional judgment provide the basis for predicting the potential for a discharge to result in sediment impacts. The generalized and site-specific model runs are described in the *Sediment Source Control User Manual*. In some cases, a compliance schedule may be established during the period required for collection of additional data to support application of the models.

In addition to the modeling data, monitoring data may be used to evaluate the potential for a discharge to cause an exceedance of the SQS. Guidance on the use of monitoring data for this purpose is provided in Chapter 13 Section 7.

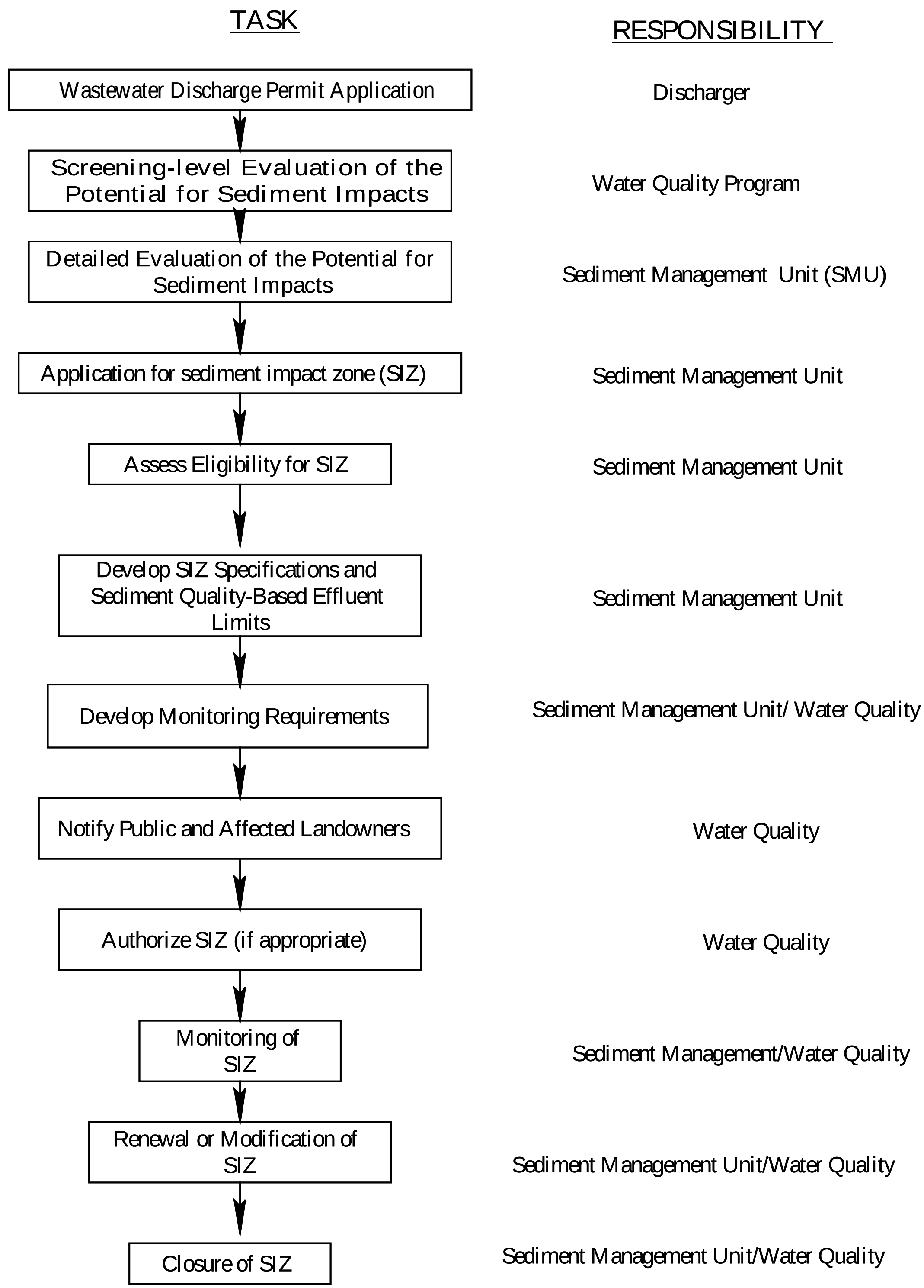


Figure 30. Overview of Process and Responsibilities for the Protection of Aquatic Sediments

3.2 Application for a SIZ (WAC 173-204-400(1)(b))

If the results of the generalized SIZ computer model run indicate that the discharge has the potential to impact sediments, Ecology will require an application for a SIZ. WAC 173-204-200(22) defines a SIZ as:

> ...an area where the applicable sediment quality standards of WAC 173-204-320 through 173-204-340 are exceeded due to ongoing permitted or otherwise authorized wastewater, stormwater, or nonpoint source discharges, and authorized by the department within a federal or state wastewater or stormwater discharge permit, or other formal department authorization.

By the authority of WAC 173-204-415(4)(a), Ecology may require a discharger to submit any information needed to run the SIZ models (simulating sediment contamination over a 10-year period) to determine whether a SIZ is necessary and to determine the areal extent and location of the SIZ associated with the discharge. The SMU is responsible for requesting and evaluating applications for SIZs. SIZ application procedures are described in the *Sediment Source Control Standards Users Manual*. When an application is received, the SMU will notify the Washington Department of Natural Resources (DNR) Division of Aquatic Lands, U.S. Army Corps of Engineers (Corps), and any port districts whose aquatic lands may be included within the proposed SIZ (WAC 173-204-415(2)(f)).

3.3 SIZ Eligibility Requirements (WAC 173-204-400(1)(c) and (f))

Once a SIZ application is received, the discharge must be evaluated to determine whether it is eligible for a SIZ. The SMU is responsible for the eligibility evaluation.

All discharges are required to be operating with AKART and/or BMPs in place, as appropriate, or to be on a compliance schedule to meet these requirements, as a condition of a discharge authorization (Chapters 90.48, 90.52, and 90.54 RCW). This issue will, therefore, be addressed early in the discharge permitting process, regardless of the potential for the discharge to cause an impact to receiving sediments. However, to determine whether a new discharge or one not yet operating with AKART/BMPs in place will adversely impact receiving sediments, AKART/BMPs must be identified and assessed in the initial screening evaluation. Chapter 4 of this manual should be consulted for guidance on the process of determining AKART/BMPs for a given discharge. This evaluation will be conducted before a permit application is forwarded to the SMU for SIZ evaluation.

WAC 173-204-415(3) requires the discharger to submit to Ecology information concerning the location of the proposed SIZ. This section also requires that SIZs authorized by Ecology avoid whenever possible, and minimize adverse impacts to, areas of special importance. A SIZ must also be authorized in a manner consistent with the antidegradation policy of the state, as set forth in WAC 173-204-120.

The areal extent of a SIZ will be determined based on the results of the modeling and the application of the SMU's best professional judgment. When the model results indicate that a SIZ may impact an area of special importance or property owned by someone other than the discharger, it may be necessary to alter the discharge characteristics (e.g., by relocating the discharge, reducing effluent loading) to avoid impacting such areas.

3.4 Development of SIZ Specifications (WAC 173-204-400(1)(d),(e), and (g))

After determining that the discharge is eligible for a SIZ, detailed model simulations are run using site-specific information provided in the SIZ application. The CORMIX and WASP models, or other SIZ model(s) can be used. The SMU is responsible for application of contaminant fate and transport modeling to the discharge.

The site-specific model run is used to reduce the uncertainty associated with the generalized model run, develop SIZ specifications, and evaluate the potential for the discharge to exceed the SIZ_{max} numerical criteria over a 10-year period from the date of Ecology's evaluation of an ongoing discharge or the start date of a proposed discharge, whichever is later (WAC 173-204-415(4)). The site-specific model may also be used to establish sediment quality-based effluent limits necessary to achieve acceptable levels of sediment quality. WAC 173-204-415(4) specifies that the models be run by Ecology or by the discharger, as required by Ecology.

In addition to the modeling data, monitoring data may be used to evaluate the potential for a discharge to cause an exceedance of the SIZ_{max} numerical criteria. Guidance on the use of monitoring data for this purpose is provided in Chapter 13 Section 7.

As stated in WAC 173-204-415(1)(e), SIZs authorized by Ecology shall include the minimum practicable surface area, not to exceed the surface area allowed by WAC 173-204-415(4). WAC 173-204-415(4) in turn requires that the location of the SIZ, its areal extent, and the degree of allowable effects within the SIZ be determined by applying the SIZ models (CORMIX, WASP, and/or other SIZ model[s] approved by Ecology) as limited by the standards of that section, and by application of best professional judgment.

Any overlap of the SIZs for two or more discharges predicted through the use of the SIZ models or based on best professional judgment will be authorized only in the event that the SIZ_{max} chemical and biological criteria are not exceeded as a result of the overlap. If multiple discharges would result in sediment contamination above the SIZ_{max}, a wasteload allocation process would be necessary (WAC 173-204-415(4)(b)(ii)). The SMU is responsible for running the SIZ models for this purpose and will work with Ecology's Environmental Assessment Program and the WQP in developing wasteload allocations.

WAC 173-204-415(1)(f) also requires that the chemical concentrations and biological effects levels within an authorized SIZ be maintained at the lowest levels possible. Ecology is required to consider the relationship between environmental effects, technical feasibility, and cost in determining the minimum practicable chemical concentration and biological effects levels, within the range of contamination that will be allowed in an authorized SIZ. In no case should the adverse effects to biological resources within an authorized SIZ exceed the minor adverse effects level as a result of the discharge, as determined by the procedures set forth in WAC 173-204-415(5). This activity is the responsibility of the SMU.

3.5 SIZ Monitoring and Maintenance Requirements (WAC 173-204-400(1)(i))

All SIZ authorizations should include monitoring and maintenance requirements designed to ensure that the specifications included in the authorization are not violated. Such requirements should include sediment and effluent monitoring and procedures for maintenance restoration of sediments (i.e., if the discharge results in sediment contamination or biological effects that exceed the maximum levels allowed in the SIZ authorization, capping or dredging of the contaminated sediments may be required). Permit managers and SMU staff jointly develop monitoring and maintenance requirements.

3.6 Public Notice and Landowner Notification Procedures (WAC 173-204-400(1)(h))

In accordance with WAC 173-204-415(1)(j), all proposed SIZ authorizations are subject to public notice, comment, and hearing procedures as required by the state laws and regulations applicable to the specific discharge. When determining the need for, location, and/or design of the SIZ, Ecology is required to consider all comments received during public review of the application. The permit manager is responsible for public notice and landowner notifications. However, as discussed above, the SMU will also notify DNR, the Corps, and affected port districts early in the process of reviewing a SIZ application. The discharger should also be encouraged to make an early effort to identify and coordinate with the potentially affected landowner(s).

In some cases, an authorized SIZ will be located on property owned or used by someone other than the source discharger. Recognizing that the potential sediment impact resulting from the discharge may be of concern to the other individual(s), WAC 173-204-415(2)(e) requires that Ecology and the discharger make a reasonable effort to identify and notify all landowners, adjacent landowners, and lessees potentially affected by the proposed SIZ. Under the authority of WAC 173-204-415(2)(e)(viii), affected landowners, adjacent landowners, and lessees may comment on a proposed SIZ. Any such comments are to be submitted in writing to Ecology within 30 days from the date of receipt of the notification letter, or by an extended due date approved by Ecology. WAC 173-204-415(5)(e) also requires that affected landowners be given the opportunity to review all SIZ maintenance action plans before the action is implemented.

3.7 Renewal, Modification, and Elimination of Authorized SIZs (WAC 173-204-400(1)(j))

The goal of Ecology is to manage source control activities to reduce and ultimately eliminate adverse effects on biological resources and significant threats to human health resulting from sediment contamination (WAC 173-204-410(1)(a)). In support of that goal, it is Ecology's policy to minimize the number, areal extent, and adverse effects of all authorized SIZs, with the intent to eliminate the existence of all SIZs whenever practicable (WAC 173-204-410(1)(b)). This goal will be achieved through modification of existing SIZ specifications and by limiting the renewal of SIZs when possible. However, the rule addresses exceptions to this general policy by requiring that Ecology consider environmental effects, technical feasibility, and cost in determining when it is practicable to minimize or eliminate a SIZ.

WAC 173-204-415(8) sets forth the conditions under which a SIZ authorization may be renewed. These conditions include:

- When the discharge is operating with AKART/BMPs in place
- When the discharger demonstrates that the discharge activities comply with the SSCS and with the existing SIZ authorization
- When the discharger demonstrates that a reduction in the areal extent of the SIZ and/or the level of contamination within the SIZ is not practicable, and therefore the SIZ cannot be reduced or eliminated.

WAC 173-204-415(7) specifically authorizes Ecology to modify a SIZ authorization under the following conditions:

- When the nature of the discharge activity has changed
- When new information indicates that a modification of the SIZ authorization is appropriate
- When the standards or regulations upon which the permit was based have changed
- When there is advancement in technology that applies to the discharge under consideration.

This section should be interpreted to provide Ecology with the authority to both restrict and relax SIZ specifications, as appropriate, based on a consideration of environmental effects, technical feasibility, and cost, consistent with the requirements of the SSCS.

Guidance for determining whether it is practicable to modify or eliminate a SIZ, whether SIZ maintenance activities should be required, or whether a SIZ should be renewed at the end of the permit cycle without modification is provided in the *Sediment Source Control Standards User Manual*. SMU staff and permit managers share the responsibility for this determination. Permit managers will conduct an initial screening of the renewal application. If it appears that a SIZ authorization should be modified, the renewal application will be forwarded to the SMU for a detailed evaluation.

3.8 Closure and Restoration of SIZs (WAC 173-204-400(1)(I))

WAC 173-204-415(6) requires that all SIZ authorizations include a SIZ closure plan. The purpose of this plan is to identify the method or methods of cleanup that the discharger will implement upon closure of the SIZ. The responsibility for overseeing SIZ closure and restoration activities will be determined by Ecology on a case-by-case basis.

4. Screening-Level Evaluation of Potential for Sediment Impacts

The general process for determining whether a SIZ is needed and for developing SIZ specifications is illustrated in Figure 31. The first step in this process is for the permit manager to perform a screening-level evaluation of whether the discharge has the potential to impact sediment quality. This chapter describes the screening-level evaluation, which includes both narrative and technical evaluations. The WQ Program has determined that all major dischargers to Puget Sound will conduct sediment sampling.

Screening-level evaluations are required for all marine surface water discharges to determine their potential to cause an exceedance of the SQS numerical criteria.

4.1 Initiation of Activities

In the initial stages of the permitting process, three general categories of activities that relate to sediment quality impacts are initiated by the permit manager:

- **Assess Status of Source Control.** The status of source control activities is routinely assessed to determine whether AKART and BMPs are in place. If the facility has not yet achieved AKART/BMPs, a compliance schedule should be developed, and estimates should be made of effluent characteristics (including contaminant concentrations) to be achieved with AKART/BMPs.

- **Perform Screening-Level Evaluation of the Potential for Sediment Impacts.** Existing information on the qualitative and quantitative characteristics of the facility, discharge, and receiving environment is reviewed to determine whether there is a potential for a discharge to cause sediment quality impacts.

- **Evaluate Baseline Monitoring Data.** Available baseline monitoring data for sediments and receiving water in the vicinity of the discharge should be identified and reviewed. If the screening-level evaluation indicates the potential for a discharge to cause sediment impacts, and if available baseline data are inadequate, additional baseline monitoring may be necessary. Monitoring data and other local sediment data (e.g., data in the SMU SEDQUAL database) will also be used at a number of decision points in the SIZ development process.

These activities are discussed on the following page.

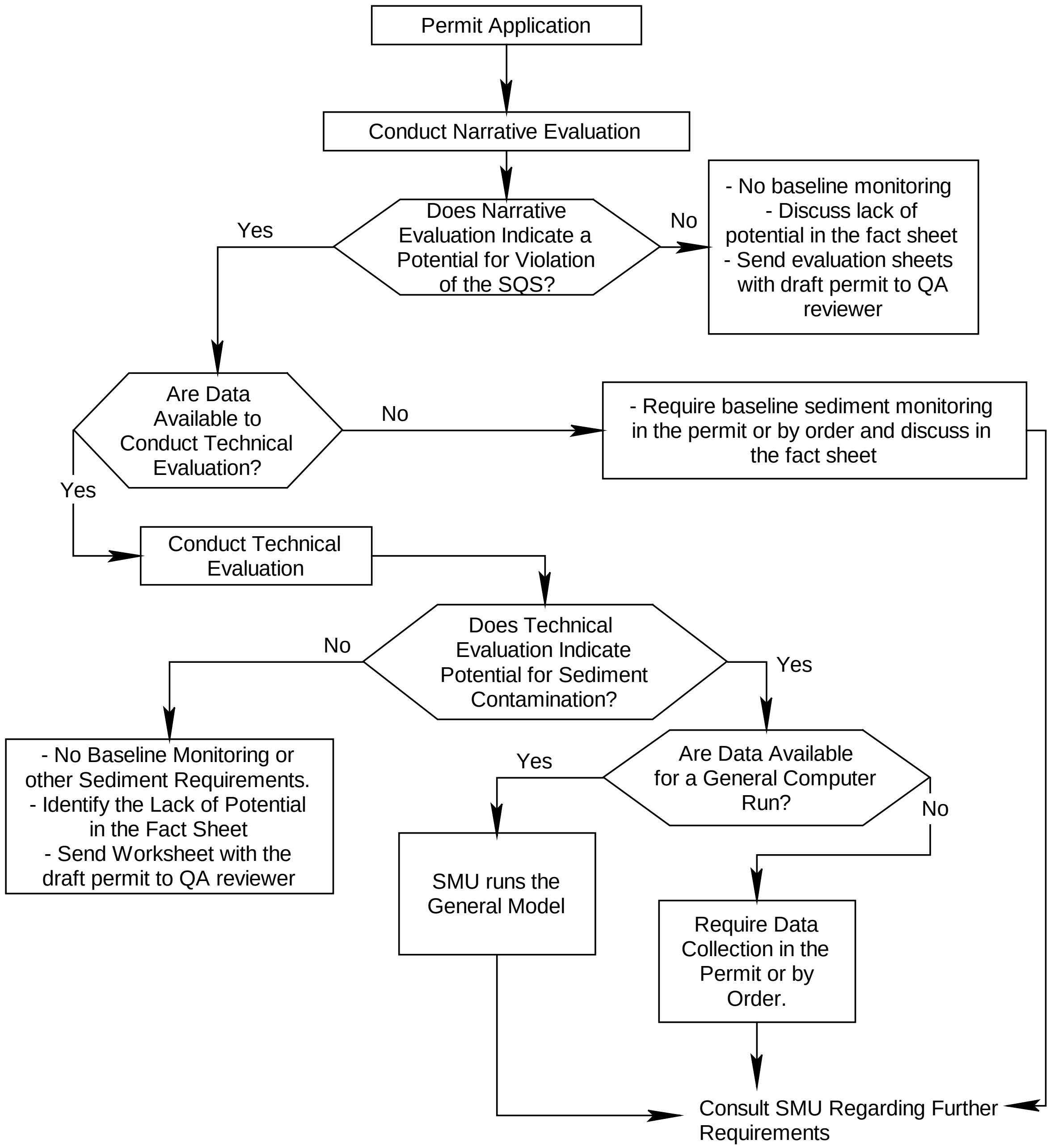


Figure 31. Screening-level Evaluation of Potential for Sediment Impacts

4.1.1 Assess Status of Source Control

WAC 173-204-400(2) requires all permits or other authorizations for wastewater, stormwater, and nonpoint source discharges to surface waters of the state to be conditioned so that the discharger is operating with AKART and/or BMPs prior to discharge, as required by Chapters 90.48, 90.52, and 90.54 RCW. Thus, all regulatory actions taken under the Sediment Management Standards are based on the assumption that the discharger either is operating with AKART and/or BMPs in place, or is on a compliance schedule to meet these requirements. Chapter 4 should be consulted for guidance on the process of identifying AKART/BMPs for the various types of discharges.

Ecology recognizes that it may take some time for an existing discharge to come into compliance with the requirements of AKART. If a discharge of this type has the potential to impact receiving sediments before coming into compliance with AKART, a SIZ may be authorized while a compliance schedule is being implemented. If receiving sediments become contaminated above the level allowed within the SIZ before AKART is in place, Ecology may require the discharger to conduct maintenance restoration of the impacted sediments before or as part of the SIZ authorization.

The permit manager should also document recent changes in treatment processes and assess time trends in discharge loading characteristics. If a compliance schedule is to be implemented for the achievement of AKART/BMPs, it will be necessary to estimate effluent characteristics (including contaminant concentrations) to be achieved with AKART/BMPs for SIZ modeling and authorization.

In addition to the AKART/BMP requirement, WAC 173-204-415(1)(d) requires that the discharger adequately addresses alternative waste reduction, recycling, and disposal options. The permit manager is responsible for verifying this requirement, which would normally be addressed in the discharger's solid waste plan, spill plan, and/or pollution prevention plan.

4.1.2. Perform Screening-Level Evaluation of the Potential for Sediment Impacts

The initial screening-level evaluation of the potential for a discharge to impact receiving sediments is based primarily on readily available qualitative and quantitative information. The evaluation consists of two parts, a narrative evaluation and a technical evaluation.

In general, facilities handling or producing known contaminants that are commonly associated with pollution problems are considered to have a potential for causing sediment contamination and will generally undergo a detailed evaluation by the SMU. If relevant contaminant loading data are available for the discharge, screening equations can be applied as part of the technical evaluation, and a preliminary assessment of the potential for sediment impacts can be made.

Facilities that have been in place and discharging wastewater at a steady rate for several years can also be evaluated through direct measurement of chemical concentrations or biological effects in the receiving sediments. If no sediment contamination or biological effects are found, it may be assumed that there is little potential for sediment contamination to occur in the future unless the loading rate is expected to increase. Alternatively, if a discharger is being granted an increase in permitted contaminant loading rates, evaluation of existing sediment conditions may not be sufficient, and the detailed evaluation may be necessary.

Once the screening-level evaluation is complete, the worksheets should be filed with the permit application and a copy of the worksheets forwarded to the SMU. If the screening-level evaluation indicates that there is little or no potential for sediment impacts, the permit manager may determine that no specific sediment-related provisions need to be included in the discharge permit. If there is considered to be a potential for sediment impacts, the permit manager should evaluate available baseline monitoring data, or, if available baseline monitoring data are inadequate, the discharger should be required to collect the necessary baseline monitoring data (see Part 4.1.3).

The narrative and technical evaluation steps are described in detail in Sections 4.2 and 4.3, which include worksheets that can be used in the evaluation.

4.1.3. Evaluate Baseline Monitoring Data

The results of any baseline sediment quality monitoring, if available, should be reviewed by the permit manager to establish baseline sediment quality conditions. These monitoring data, as well as available regional monitoring data from other programs (e.g., data in the SMU SEDQUAL database), should be reviewed early in the permitting process to identify any additional monitoring that may be required and to identify data that may be used to evaluate the need for a SIZ.

In the sediment source control process, early evaluation of available baseline monitoring data is important because it assists in identifying sediment contaminants that may have been contributed by other permitted or unpermitted (and possibly historical) discharges. In addition, this evaluation may enable Ecology to identify the single or multiple ongoing discharges contributing to sediment contamination in a given area, and thus to regulate these discharges as appropriate.

In cases where no baseline monitoring has previously been conducted and the result of the screening-level evaluation is a judgment that the discharge has the potential to cause sediment impacts, a requirement for baseline monitoring should be included in the permit. The permit manager is responsible for developing baseline monitoring requirements, where appropriate, with assistance of the SMU. In cases where there are also insufficient data available to run even the generalized SIZ model, additional monitoring requirements should be included in the permit for the collection of the necessary data. Guidance on the development of monitoring requirements to support use of the models is also provided in Chapter 13.

In cases where there is a potential for sediment impacts and the needed monitoring data have not yet been collected, the permit may be issued or renewed without a SIZ authorization, but with the requirement for appropriate monitoring to be conducted early in the permit cycle. Once the necessary monitoring has been completed, the data can be used to complete the detailed evaluation of the potential to cause sediment impacts. If the result of the detailed evaluation is that a SIZ is needed, the permit can then be modified to authorize a SIZ.

4.2 Narrative Evaluation of the Potential for Sediment Impacts

The narrative evaluation may be used to identify facilities that have a low potential for sediment impacts, based on the general characteristics of the facility and the nature of the discharge. Facilities identified as having a low potential for sediment impacts by the narrative evaluation need not be evaluated using the more detailed technical evaluation. The permit manager should conduct the narrative evaluation by filling out the narrative evaluation worksheet (Section 4.3.1, Part A). If the facility has any of the characteristics identified in Item 1 of the worksheet, its discharge is considered to have the potential for causing adverse sediment impacts. If the discharge is one of the types identified in Item 2 of the worksheet, or if the facility has none of the characteristics identified in Item 1 of the worksheet, the discharge is not considered to have a potential for causing adverse sediment impacts. The permit manager should indicate in response to Item 3 whether or not the discharge is considered to have the potential to cause adverse sediment impacts.

Although a definitive assessment of a discharge's eligibility for a SIZ can only be made after the development of SIZ specifications, it is appropriate as part of the narrative evaluation to provide a preliminary indication of whether the discharge would be eligible for a SIZ. One of the criteria for authorization of a SIZ is that it not adversely affect an area of special importance and that it be in the public interest. The permit manager should make this determination during the narrative evaluation and indicate to the SMU if the discharge is eligible for a SIZ.

4.3 Technical Evaluation of the Potential for Sediment Impacts

If the narrative evaluation identified the facility as having the potential for sediment impacts and if the necessary data are available, the screening-level evaluation should also include a technical evaluation, as described below. This evaluation uses readily available information on the discharge, along with any baseline monitoring data, to determine whether there is a potential for the SQS numerical criteria to be exceeded in the receiving sediments. If there are insufficient data to conduct the technical evaluation, the discharger will be required to provide the data necessary to further evaluate the need for a SIZ (see Chapter 13, Section 7).

To date, SQS numerical criteria have only been promulgated for marine sediments within Puget Sound. Hence, the technical evaluation procedures described in this section currently apply only to discharges to Puget Sound marine environments. Use of these procedures for evaluating discharges to non-Puget Sound marine environments may be appropriate based on the case-by-case application of best professional judgment by the permit manager, with guidance from the SMU. Until SQS numerical criteria for sediments in freshwater and low-salinity environments are developed, other evaluation procedures will have to be used for discharges to those environments (see Section 3.4).

If there are chemicals of concern in a marine discharge that have SQS numerical criteria (see Table 22), the permit manager should complete the technical evaluation worksheets and attach them to the narrative evaluation. If the discharge is of concern, but not enough data are available to complete the technical evaluation or the chemicals of concern do not have SQS numerical criteria, the permit application should be forwarded to the SMU for a case-by-case evaluation.

4.3.1 Methods of Evaluation

Sediment contaminant concentrations can be measured directly or can be estimated using a variety of sampling methods. These methods include sampling particles or sediments in sumps, drains, or the receiving environment, or sampling suspended particulate matter in the water column or suspended solids in an effluent entering the receiving water. In addition, the results of biological tests may be used to evaluate the potential for impacts to sediments. Alternatively, data on the total chemical concentrations in an effluent can be used to estimate the chemical concentrations associated with discharged particles. Once sediment or particle chemistry has been determined, the concentrations can be compared directly to the SQS numerical criteria to evaluate whether a discharge has the potential to cause an exceedance of the standards. Methods for sampling sediment and suspended particulate matter are described in greater detail in Chapter 13.

Worksheets for completing the technical evaluation are below. In addition to information provided in the permit application, existing effluent monitoring data and baseline monitoring data should be reviewed and used in the evaluation. The following four types of data may be used (see Sections 1–4 of the technical evaluation worksheet):

- **Chemical Concentrations in Source Sediments and Effluent Suspended Solids.** These data include the concentrations of chemicals in sediments that may accumulate at points within the facility downstream of any treatment processes (e.g., ditch, outfall, sump) or the concentrations of chemicals associated with suspended solids in the effluent. Because these data are most closely related to source characteristics, this section of the worksheet should always be completed if such data are available.

- **Chemical Concentrations in Receiving Sediments and Settling Particulate Matter in the Water Column.** Baseline monitoring data or other data on receiving sediments near the point of discharge are most useful in evaluating potential impacts from a source that has been ongoing at a similar level of discharge for 5 years or more. If such data are available near existing outfalls, this section of the worksheet should be completed, unless there is sufficient reason to believe that receiving sediments would only be contaminated due to historical or ongoing sources unrelated to the discharge. This section of the worksheet should also be completed if there are data available on the chemistry of settling particulate matter obtained from sediment traps in the receiving water column, and if there is sufficient reason to believe that the material obtained from those sediment traps is associated with the discharge.

- **Biological Test Data for Receiving Sediments.** These data include baseline monitoring data or other biological tests performed on sediments collected near the outfall. This section of the worksheet should be completed if the appropriate types of biological tests have been conducted, unless there is sufficient reason to believe that receiving sediments would only be contaminated due to historical or ongoing sources unrelated to the discharge.

- **Effluent Monitoring Data.** Effluent monitoring data (i.e., total chemical concentrations in the effluent) can also be used to estimate the potential for sediment impacts, although the relationship between these data and the potential for sediment impacts is less direct than for the types of data described above. This section of the worksheet should be completed if representative effluent data are available, and may be especially useful if the discharger proposes a new or substantially different type of discharge than has been present in the past.

Each of the sections of the worksheet is independent, and any one of the sections alone may indicate the potential for sediment contamination. However, if more than one type of data is available, each applicable section of the worksheet should be completed. This additional information will assist the SMU in performing the subsequent detailed evaluation.

Screening-Level Evaluation of the Potential for Sediment Impacts Worksheet, sections include:

- Part A. Narrative Evaluation.
- Part B. Technical Evaluation. Summary Sheet.
- Section 1. Chemical Concentration in Source Sediments and Effluent Suspended Solids.
- Section 2. Chemical Concentrations in Receiving Sediments and Settling Particulate Matter in the Water Column.
- Section 3. Biological Test Data for Receiving Sediments.
- Section 4. Effluent Monitoring Data.

Screening-Level Evaluation
of the Potential for Sediment Impacts

Part A. Narrative Evaluation

Applicant:____

Waste Discharge Permit No.:____

Location:____

1. A discharge is generally considered **not** to have a risk for causing adverse sediment impacts if the facility has **all** of the following three characteristics:
   - ☐ a freshwater discharge to marine water, and
   - ☐ has secondary wastewater treatment or equivalent and
   - ☐ discharges to an area with an average tidal velocity of 1 cm/sec or greater.

   If any one of these three factors is not applicable proceed to 2.

2. A discharge is generally considered to have a risk for causing adverse sediment impacts if the facility meets any of the following criteria (check any that apply and attach a brief explanation):
   - ☐ Uses, stores, produces as a product or waste, or transfers any hazardous substance listed in 40 CFR 302.4, with a statutory code of 1 or 2, [referring to Sections 311(b)(4) or 307(a) of the Clean Water Act] unless:
     - o The facility is designed and managed so that these substances are kept fully physically separated at all times, including spills or any other accidental release, from any part of the wastewater collection, treatment, or discharge system or stormwater system; or
     - o The amount of any hazardous substance at the facility is never more than the statutory reportable quantity listed in 40 CFR 302.4.
   - ☐ Discharges any chemical pollutant listed in Appendix D of 40 CFR Part 122, Table II, in its effluent *(attach a list of any such pollutants known to be discharged)*.
   - ☐ Has a reasonable potential to violate water quality standards for any pollutant in Appendix D of 40 CFR Part 122, Table III *(attach a list of any such pollutant known to be discharged)*.
   - ☐ Discharges other potentially deleterious substances, such as any of the following *(check any that apply)*:

     _____ Solid inorganic materials (e.g., paint chips, slag)
     _____ Radionuclides
     _____ Other *(describe)*
   - ☐ Belongs to any industry category identified in 40 CRF Part 122, Appendix A.
   - ☐ Is a municipal facility that receives a discharge from any industry category identified in 40 CFR Part 403, Appendix C.
   - ☐ Any facility with whole effluent toxicity detected during the last five years based on:
     - ☐ Less than 80 percent survival in 100 percent effluent; or

- ☐ The no observed effects concentration for chronic toxicity being less than or equal to the acute critical effluent concentration; and
- ☐ Not attributable to a known chemical

☐ Any facility with suspected sediment toxicity because of apparent damage to aquatic biota in the immediate vicinity of the discharge.

☐ Any other discharge that Ecology determines has the potential to include toxic substances that may accumulate in the sediment.

3. The following types of discharges **(check if applicable)** are generally not believed to have a potential for causing adverse sediment impacts unless one of the above factors, in item 2, applies:

   ☐ Once-through noncontact cooling water without biocides

   ☐ Municipal plants discharging less than one-half million gallons per day of effluent that are regulated only for conventional pollutants

   ☐ Drinking water treatment plants

   ☐ Sand and gravel mining operations

   ☐ Sump pump discharges of ground water or rainwater

   ☐ Construction dewatering

   ☐ Fish hatcheries and other aquaculture

   ☐ Boiler blowdown

   ☐ Any other discharger that Ecology determines does not have the potential to discharge toxic pollutants

3. Based on the narrative evaluation above, is there a potential for sediment impacts from this discharge?

   ☐ Yes. If yes, answer the following question.

   ☐ No

4. Is there a preliminary indication that the discharge would be eligible for a SIZ?

   ☐ Yes

   ☐ No. If no, describe the reason(s) the discharge may be ineligible.

Permit Manager: ____
(print name) *(Signature)*

Date:________________________________

Screening-Level Evaluation of the Potential for Sediment Impacts

Part B. Technical Evaluation

Applicant:____

Waste Discharge Permit No.:____

Location:____

SUMMARY

	Potential for Sediment Impact?		No Available Data
Worksheets Attached:	YES	NO	
☐ Section 1. Source Sediments	☐	☐	☐
☐ Section 2. Sediment Chemistry	☐	☐	☐
☐ Section 3. Sediment Biological Tests	☐	☐	☐
☐ Section 4. Effluent Chemistry	☐	☐	☐

Permit Manager: ____
(print name) *(Signature)*

Date:______________________________

Section 1

Chemical Concentrations in Source Sediments and Effluent Suspended Solids

Types of Data:

☐ Ditch Sediments

☐ Sump Sediments

☐ Outfall Sediments

☐ Effluent Suspended Solids

Number of Samples:________________________________

Analyte Groups:

Detected Analytes	Maximum Concentration (mg/kg)[a]	SQS (mg/kg)[a]	Exceeds SQS? YES	NO	Number of Samples Exceeding SQS
1.			☐	☐	
2.			☐	☐	
3.			☐	☐	
4.			☐	☐	
5.			☐	☐	
6.			☐	☐	
7.			☐	☐	
8.			☐	☐	
9.			☐	☐	
10.			☐	☐	
11.			☐	☐	
12.			☐	☐	
13.			☐	☐	
14.			☐	☐	
15.			☐	☐	
16.			☐	☐	
17.			☐	☐	
18.			☐	☐	
19.			☐	☐	
20.			☐	☐	

[a] *mg/kg dry weight or organic carbon normalized, as appropriate (see Section 3.3.3).*

Section 2

Chemical Concentrations in Receiving Sediments and Settling Particulate Matter in the Water Column

Types of Data: Number of Samples:________________________________

☐ Receiving Sediments Analyte Groups:

☐ Settling Particulate Matter in the Water Column

Detected Analytes	Maximum Concentration (mg/kg)[a]	SQS (mg/kg)[a]	Exceeds SQS? YES	NO	Number of Samples Exceeding SQS
1.			☐	☐	
2.			☐	☐	
3.			☐	☐	
4.			☐	☐	
5.			☐	☐	
6.			☐	☐	
7.			☐	☐	
8.			☐	☐	
9.			☐	☐	
10.			☐	☐	
11.			☐	☐	
12.			☐	☐	
13.			☐	☐	
14.			☐	☐	
15.			☐	☐	
16.			☐	☐	
17.			☐	☐	
18.			☐	☐	
19.			☐	☐	
20.			☐	☐	

Is there reason to believe that historical or other ongoing sources of contamination unrelated to the discharge may have contributed to the exceedances of SQS shown? If so, explain below:

[a] *mg/kg dry weight or organic carbon normalized, as appropriate (see Section 3.3.3).*

Section 3

Biological Test Data
for Receiving Sediments

Type of Test			Total Number of Stations	Exceeds SQS? YES NO	Number of Stations Exceeding SQS
☐ Amphipod Bioassay				☐ ☐	
☐ Larval Bioassay					
Type				☐ ☐	
				☐ ☐	
				☐ ☐	
				☐ ☐	
☐ Benthic Infauna				☐ ☐	
☐ Neanthes Bioassay				☐ ☐	
☐ Microtox® Bioassay				☐ ☐	

Is there reason to believe that historical or other ongoing sources of contamination unrelated to the discharge may have contributed to the exceedances of SQS shown? If so, explain below:

Section 4

Effluent Monitoring Data

Number of Samples:___________________

Average TSS (mg/L):__________________

Analyte Groups:______________________

Detected Analytes	Average Concentration (μg/L)	C_p (mg/kg)[a]	SQS (mg/kg)[a]	Exceeds SQS? YES	Exceeds SQS? NO
1.				☐	☐
2.				☐	☐
3.				☐	☐
4.				☐	☐
5.				☐	☐
6.				☐	☐
7.				☐	☐
8.				☐	☐
9.				☐	☐
10.				☐	☐
11.				☐	☐
12.				☐	☐
13.				☐	☐
14.				☐	☐
15.				☐	☐
16.				☐	☐
17.				☐	☐
18.				☐	☐
19.				☐	☐
20.				☐	☐

C_p Concentration of a contaminant associated with suspended solids in the effluent

[a] *mg/kg dry weight or organic carbon normalized, as appropriate (see Section 3.3.3).*

4.3.2. Instructions for the Technical Evaluation Worksheet

The following sections provide further explanations and instructions for completing each section of the technical evaluation worksheet. This worksheet should be completed along with the narrative evaluation worksheet and filed with the permit application. A copy of the worksheet should be forwarded to the SMU. Any data used in the screening-level evaluation should also be forwarded to the SMU with the worksheet; these data will be used in the subsequent detailed evaluation. The permit manager should also provide the SMU with electronic and hard copies of water quality dilution zone model runs, spreadsheets, and any other data and information used to assess compliance with water quality and sediment quality standards.

If neither the narrative nor the technical evaluations indicate that a discharge has the potential to cause sediment impacts, the permit should be issued or renewed by the permit manager without a SIZ authorization or sediment quality-based effluent limits. No sediment monitoring should be required in the permit. The permit manager should identify the lack of potential for sediment impacts in the fact sheet accompanying the permit.

Because the screening-level evaluation (including the narrative and technical evaluations) is highly conservative, it may indicate the potential for impacts for certain facilities where no actual impact would occur. Therefore, if either the narrative or technical evaluation indicates that a discharge has a potential for sediment impacts, the discharge will be further evaluated by the SMU.

Summary Page

The summary page is shown in Part A. To complete the summary page, the permit manager should perform the following steps:

- In the space provided, fill in the name of the applicant, the waste discharge permit number, and the location of the existing or proposed discharge (e.g., latitude and longitude or state plane coordinates; attach a map showing the discharge, if available) or attach those from the fact sheet.
    - Review available data for the permit, including data provided in the permit application, existing effluent monitoring data, and baseline monitoring data, to determine what types of data are available for the evaluation. Check the appropriate boxes to indicate which types of data are used in the evaluation.
    - Fill out and attach the appropriate worksheets.
    - Summarize the results of the evaluation on the summary sheet by checking the “yes,” “no,” or “no available data” box for each worksheet used.
    - Sign and date the worksheet.
    - Attach all data used in the evaluation and forward the worksheet to the SMU. Include a copy of the worksheet in the permit file for the applicant.

Section 1. Chemical Concentrations in Source Sediments and Effluent Suspended Solids

The potential for a discharge to cause an exceedance of the SQS in adjacent sediments can be evaluated by directly comparing SQS numerical criteria with concentrations of contaminants in sediments that may accumulate at points within the facility downstream of any treatment processes (e.g., ditch, sump, outfall). Sediments collected from such locations are likely to be more indicative of source characteristics than are receiving sediments in the immediate vicinity of the point of discharge, because the latter may be affected by other factors, including historical contamination, contributions from other sources, and burial by and mixing with natural sediments.

If there are no sediments present in ditches, sumps, or outfalls, or if these sediments have not been sampled, it may be possible to collect suspended solids in the effluent and determine their chemical concentrations. Methods for the collection of suspended solids in the effluent are discussed in Chapter 13, Section 7. Care must be taken to collect a sample that is representative of the effluent.

The worksheet for Section 1 is shown above. To complete the worksheet for Section 1, the permit manager should perform the following steps:

1. Indicate the type of data available and the number of samples collected. Also note the analyte groups (e.g., metals, semi-volatile organic compounds) that were analyzed. If source sediments were analyzed, any available information (qualitative or quantitative) on the grain size of the sediments sampled should be appended to the worksheet.

    - In the first column, list the detected analytes for which SQS numerical criteria are available (Table 22).

        - List the maximum concentration measured for each analyte. If the SQS numerical criteria for the contaminants measured are listed in mg/kg organic carbon, the organic carbon normalization procedure described in Part 4.3.3 must be completed before comparing the data to the criteria. Otherwise, concentrations should be listed in mg/kg dry weight.

        - Compare the maximum concentrations detected to the SQS numerical criteria listed in Table 22. Check the appropriate boxes to indicate whether the criteria are exceeded. For each contaminant, also indicate the number of samples for which the contaminant exceeds the criteria. If any of the sample concentrations exceed the SQS numerical criteria, there is a potential for sediment impacts from the discharge.

        - Attach the completed worksheet to the summary page.

Section 2. Chemical Concentrations in Receiving Sediments and Suspended Particulate Matter in the Water Column

If there are no sediments associated with the source pathway (e.g., sediments do not accumulate at points within the facility downstream of any treatment processes), surface sediments near the point of discharge can be collected and analyzed. If surface sediment sampling is used to assess contaminant concentrations, only the uppermost sediment horizon (i.e., 0–2 cm), reflecting the most recently deposited sediments, should be collected. Because receiving sediments respond relatively slowly to changes in source characteristics, receiving sediment data should not be used unless the discharge being evaluated is an existing source that has been discharging at a similar rate for at least five years.

Because bottom sediments respond slowly to changes in source characteristics, sampling of suspended particulate matter in the water column may provide a more reliable method for verifying the effects of a discharge on receiving sediments. However, suspended particulate matter in the water column (receiving environment) may also be mixed with particles from other sources or facilities (potentially including resuspended bottom sediments). Sampling of suspended particulate matter in the water column can be performed over a period of time using a sediment trap. Because sediment traps collect only settling particles in the water column, use of sediment traps is the most appropriate sampling method for evaluating the impact on sediment quality of particulate matter settling out of the water column. This sampling technique is discussed in greater detail in Chapter 13, Section 7.

The worksheet for Section 2 is shown above. To complete the worksheet for Section 2, the permit manager should perform the following steps:

1. Indicate the type of data available and the number of stations at which samples were collected. Also note the analyte groups (e.g., metals, semivolatile organic compounds) that were analyzed.

2. In the first column, list the detected analytes for which SQS numerical criteria are available (Table 22).

    - List the maximum concentration measured for each analyte. If the SQS numerical criteria for the contaminants measured are listed in mg/kg organic carbon, the organic carbon normalization procedure described in Part 4.3.3 must be completed before comparing the data to the criteria. Otherwise, concentrations should be listed in mg/kg dry weight.

    - Compare the maximum concentrations detected to the SQS numerical criteria listed in Table 22. Check the appropriate boxes to indicate whether the criteria are exceeded. For each contaminant, also indicate the number of stations at which the contaminant exceeds the criteria. If any of the sample concentrations exceed the SQS numerical criteria, there is a potential for sediment impacts from the discharge.

    - Explain in the space provided whether there is any reason to believe that historical contamination and/or the presence of other ongoing sources may have contributed to the SQS exceedances listed.

    - Attach the completed worksheet to the summary page.

Section 3. Biological Test Data for Receiving Sediments

Use of biological test data for receiving sediments is the most direct way of evaluating whether sediment impacts are occurring, because such tests directly measure adverse effects on organisms of interest. However, because receiving sediments respond relatively slowly to changes in source characteristics, this section of the worksheet should only be used if the discharge being evaluated is an existing source that has been discharging at a similar rate for at least five years.

SQS biological effects criteria for Puget Sound have been established for the following types of tests (WAC 173-204-315):

- Amphipod bioassay (*Rhepoxynius abronius*)
- Larval bioassays:
    - Pacific oyster (*Crassostrea gigas*)
    - Blue mussel (*Mytilus edulis*)
    - Purple sea urchin (*Strongylocentrotus purpuratus*)
    - Sand dollar (*Dendraster excentricus*)
- Benthic infauna
- Juvenile polychaete bioassay (*Neanthes arenaceodentata*)
- Microtox® bioassay (*Photobacterium phosphoreum*)

Therefore, only these types of biological data can be used in the screening-level evaluation.

The worksheet for Section 3 is shown above. To complete the worksheet for Section 3, the permit manager should perform the following steps:

1. Indicate the type(s) of biological tests for which data are available. List the number of stations at which samples were collected for each test.

    - Compare the results of each test to the SQS biological effects criteria for that test listed in Table 22. To compare observed adverse effects to the SQS biological effects criteria, it must first be determined whether the effects observed are statistically significant. The permit applicant should perform this test. If this information is not provided, contact the SMU for instructions or assistance in interpreting the results of biological tests.

        - Check the appropriate boxes to indicate whether the SQS biological effects criteria are exceeded. For each test, also indicate the number of stations that exceed the SQS biological effects criteria. If the sediments exceed the SQS biological effects criteria for one or more of the tests, there is a potential for sediment quality impacts.

        - Explain in the space provided whether there is any reason to believe that historical contamination and/or the presence of other ongoing sources may have contributed to the SQS exceedances listed.

        - Attach the completed worksheet to the summary page.

Section 4. Effluent Monitoring Data

If appropriate data are not available to conduct the evaluations in worksheet Sections 1–3, the results of effluent chemical analyses can be used as an indicator of whether that discharge has the potential to result in exceedance of the SQS numerical criteria near the outfall.

Because effluent sampling and analysis is a standard part of NPDES permit requirements, such data may be available when sediment quality data are not. To use effluent data as an indicator of potential contamination in sediments, a relationship must be derived between effluent and sediment quality.

This part of the evaluation uses effluent monitoring data to provide an estimate of potential sediment quality near a point of discharge. The equation used in the evaluation is based on the assumption that for contaminants likely to accumulate in the sediments, and for which there are SQS numerical criteria, most of the total contaminant concentration in an effluent (or in the receiving water) will be found on the suspended solids fraction. This assumption may not be applicable to certain classes of contaminants (i.e., highly soluble contaminants). Furthermore, this equation does not directly predict the impact of the effluent on sediments around the point of discharge, and it does not account for dilution of the effluent by ambient water during initial mixing or for dilution of effluent suspended solids by particles from other sediment sources.

However, the concentration of a contaminant associated with suspended solids in the effluent (C_p) derived using this equation can be directly compared with the SQS numerical criterion for that contaminant. For chemicals with SQS numerical criteria that are normalized to organic carbon (i.e., nonpolar, nonionizable organic compounds), the additional normalization for organic carbon (i.e., dividing the dry-weight contaminant concentration for the suspended solids fraction by the organic carbon content of the suspended solids fraction) should be applied (see Part 4.3.3.).

C_p can be estimated from effluent monitoring data as follows:

$$C_p = \frac{C_t}{TSS} \times 10^6$$

where:

C_p = concentration of contaminant associated with suspended solids in the effluent (mg/kg dry weight)
C_t = total concentration of contaminant in the effluent (mg/L)
TSS = total suspended solids in the effluent (mg/L)
10^6 = conversion factor (mg/kg).

If all contaminant concentrations on the suspended solids in the effluent are less than or equal to the SQS numerical criteria, the screening criterion is passed.

This equation incorporates the assumption that all contaminants are associated with suspended solids (or particulate organic carbon) in the effluent. This is a conservative assumption intended to provide an environmentally protective analysis; therefore, it may be possible using this equation to screen out a number of discharges with very little expenditure of time and resources.

There are two scenarios in which this equation may be overly conservative. First, if most of the contaminants are expected to be in the dissolved form, this equation could greatly overestimate the concentration of a contaminant associated with suspended solids. Second, if the concentration of TSS is very low, the concentrations of contaminants associated with the suspended solids may appear to be very high, and the screening criterion may be failed. However, in the latter scenario there may or may not be significant loading of contaminants to the sediments in the immediate vicinity of the point of discharge. In either of these two scenarios, the permit manager should contact the SMU for guidance on the appropriate course of action.

It should be noted that this equation may be of only limited applicability for effluents that have very low TSS concentrations (e.g., biological treatment of municipal wastewater may yield a TSS concentration of only 10–30 mg/L). Depending on the magnitude of the SQS numerical criteria for individual contaminants, the total contaminant concentration in the effluent necessary to cause an exceedance of the criteria may be at or below commonly achievable detection limits in cases of low TSS concentrations (e.g., at a TSS concentration of 30 mg/L, a total arsenic concentration of greater than 1.7 μg/L would cause exceedance of the SQS numerical criterion for arsenic). For contaminants with higher SQS numerical criteria, use of the equation may still be valuable for effluents with low TSS concentrations.

The worksheet Section 4 is shown above. To complete the worksheet Section 4, the permit manager should perform the following steps:

1. Indicate the number of samples collected and the analyte groups (e.g., metals, semivolatile organic compounds) that were analyzed. The WQP typically recommends that 10 samples be collected over a period of time to adequately characterize the nature and variability of a discharge's effluent quality. For the purposes of this screening-level evaluation, the results of the analysis of at least 10 samples should be evaluated. If fewer samples are available, they should still be evaluated, although the conclusion should be qualified.

2. Determine the average concentration of TSS in the effluent and note it in the space provided.

3. In the first column, list the detected analytes for which SQS numerical criteria are available (Table 22).

4. Determine the average concentration of each contaminant in the effluent samples and write the averages in the space provided.

5. For each contaminant, divide the average concentration by the average TSS to get C_p. For contaminants whose SQS numerical criteria are in mg/kg organic carbon, convert C_p from mg/kg dry weight to mg/kg organic carbon, as described in Part 3.3.3. Fill in the C_p values in the space provided.

6. Compare C_p values to the SQS numerical criteria listed in Table 22. Check the appropriate box for any contaminants for which C_p exceeds the criteria. If any of the contaminants exceed SQS numerical criteria, there is a potential for sediment quality impacts.

7. Attach the completed worksheet to the summary page.

4.3.3. Organic Carbon Normalization

The SQS numerical criteria for nonpolar, nonionizable, organic contaminants are listed in units of mg/kg organic carbon. However, sediment data are often reported in mg/kg dry weight. C_p is also derived in units of mg/kg dry weight. To convert chemical concentrations expressed as mg/kg dry weight to mg/kg organic carbon for comparison to SQS, the following equation is used:

$$\text{mg/kg organic carbon} = \frac{\text{mg/kg dry weight}}{\text{TOC}}$$

where:

TOC = percent total organic carbon of sediments or suspended solids (expressed as a decimal; i.e., 1% TOC = 0.01).

For this screening-level analysis, a total organic carbon (TOC) value of 1 percent may be assumed in the absence of discharge-specific TOC data. In Puget Sound reference area sediments, TOC values range from 0 to 6.1 percent, with a median of 1.4 percent (Pastorok et al. 1989).

4.4 Alternative Procedures for the Technical Evaluation of the Potential for Sediment Impacts in Freshwater, low Salinity, and Non-Puget Sound Marine Environments

As described in Section 3.3, the current absence of promulgated SQS numerical criteria for sediments in freshwater, low-salinity, and non-Puget Sound marine environments necessitates the use of alternative procedures for the technical evaluation of the potential for sediment impacts. This section describes technical evaluation procedures for discharges into each of those environments. After SQS numerical criteria are promulgated for those environments, other evaluation procedures will be developed by Ecology.

4.4.1. Technical Evaluation Procedures for Discharges to Freshwater Environments

Currently, the Sediment Management Standards have neither SQS numerical criteria nor biological effects criteria for freshwater sediments. However, sediment quality values are available from other sources (e.g., Ecology's FSEDCRIT report, Appendix D of the *Sediment Source Control Standards User Manual*), and Ecology has two recommended freshwater sediment bioassays for evaluating sediment impacts around existing discharges to freshwater environments. Therefore, there are tools available for use, on a case-by-case basis using best professional judgment, in evaluating the potential for sediment impacts in the vicinity of discharges to freshwater environments. These tools require sediment monitoring data from the depositional environment in the vicinity of the discharge.

Ecology's FSEDCRIT report includes numerical sediment quality values for a number of metals and organic compounds in freshwater sediments. These values were assembled from several sources, including the U.S. Environmental Protection Agency (EPA), other states, and Canadian agencies. While not directly applicable to Washington State freshwater sediments, they can be used, with supporting documentation, on a case-by-case basis using best professional judgment with the assistance of the SMU for identifying sediments likely to exhibit adverse effects.

Ecology currently recommends the following sediment bioassays for identifying biological impacts in freshwater sediments (Bennett and Cubbage, 1992):

- Amphipod bioassay (*Hyalella azteca*)
- Microtox® bioassay (*Photobacterium phosphoreum*).

The protocols for these bioassays (ASTM 1990; PSEP 1991a) do not include test sediment interpretation values. For the amphipod bioassay, the SMU recommends that to be considered indicative of a potential sediment impact, the test sediment should exhibit mortality that is significantly higher (t-test, $P \leq 0.05$) than the reference sediment and the test sediment mortality should exceed 25 percent (on an absolute basis). For the Microtox® bioassay, to be considered indicative of a potential sediment impact, the mean light output of the highest concentration of the test sediment should be less than 80 percent of the mean light output of the reference sediment, and the two means should be significantly different (t-test, $P \leq 0.05$).

In cases where there are existing sediment data (either sediment concentrations of chemicals for which there are sediment quality values in the FSEDCRIT report, or the results of sediment bioassays), the permit manager has the option of conducting the technical evaluation on a case-by-case basis using best professional judgment or forwarding the permit application materials to the SMU for them to perform the technical evaluation. If the permit manager elects to conduct the technical evaluation, the concentrations of sediment contaminants (if available) can be compared with the appropriate FSEDCRIT sediment quality values (selected with guidance from the SMU) using the worksheet Section 2, modified accordingly. If the results of one or both sediment bioassays are available, they can be reported on the worksheet Section 3 (Figure IX-6), modified accordingly. The permit applicant should generally perform the tests of statistical significance for these bioassays. If this information is not provided, the permit manager should contact the SMU for instructions or assistance in interpreting the results.

In the absence of existing sediment data from the vicinity of a discharge to a freshwater environment, there are no technical procedures (equivalent to those used for screening Puget Sound marine sediments) for evaluating the potential for sediment impacts based only on chemical concentrations in source sediments and particles (i.e., worksheet Section 1) or on effluent monitoring data (i.e., worksheet Section 4). If the narrative evaluation indicated the potential for sediment impacts, and if only those data types are available (or if no data at all are available), the permit manager should issue or renew the permit with a requirement for the collection of baseline monitoring data (including sediment chemistry and sediment bioassays) so that an evaluation of sediment impacts can be made at a later date.

After the baseline monitoring data become available, the technical evaluation can be completed by the permit manager or by the SMU. This may occur during the next permit review cycle or at an earlier date, at the discretion of the permit manager.

4.4.2. Technical Evaluation Procedures for Discharges to Low-Salinity Environments

Currently, the Sediment Management Standards have neither SQS numerical criteria nor biological effects criteria for low-salinity sediments. Unlike the situation for freshwater sediments, however, there are no sediment quality values currently available from other sources. Application of the SQS numerical criteria for Puget Sound marine sediments to low-salinity sediments may be inappropriate. Similarly, the biological effects tests applicable to Puget Sound marine sediments may not be applicable to low-salinity sediments. Therefore, there are currently no technical evaluation procedures applicable to low-salinity sediments that can be performed by the permit manager. Hence, all permit applications received for discharges to such environments should be forwarded to the SMU for further evaluation, until such time as appropriate criteria and technical evaluation procedures are developed. On a case-by-case basis using best professional judgment, the SMU may choose to apply the Puget Sound marine sediment chemical criteria or biological effects tests to low-salinity sediments.

4.4.3. Technical Evaluation Procedures for Discharges to Non-Puget Sound Marine Environments

Currently, the Sediment Management Standards have neither SQS numerical criteria nor biological effects criteria for non-Puget Sound marine sediments. As in the case of low-salinity sediments, there are also no sediment quality values currently available from other sources. However, the SMU is of the opinion that, until such time as criteria are developed specifically for non-Puget Sound marine sediments, the corresponding criteria developed for Puget Sound marine sediments can be used, on a case-by-case basis using best professional judgment, for evaluating the potential for sediment impacts in those environments. Hence, the technical evaluation for discharges to non-Puget Sound marine environments can in the interim be conducted by the permit manager using the same procedures as developed for Puget Sound marine sediments (see Section 4.3).

Chapter 10. Pretreatment Program

1. Overview

Cities have long recognized the need to control tributary industries to keep them from harming their sewer systems. After passage of the Clean Water Act, EPA standardized these controls and set "categorical" limits for pollution from specific processes of certain types of major industries. Both municipal and industrial permit writers implement the pretreatment program. Municipal permit writers must add appropriate pretreatment related conditions in permits for Publicly Owned Treatment Works (POTWs) and other Treatment Works Treating Domestic Sewage (TWTDS). These conditions compel the participation of sewerage agencies in carrying out this program. Ecology may require sewerage agencies to develop a program, properly run their approved program, or do things to support and reinforce Ecology's control of their tributary industries. Industrial to POTW permit writers must know how to apply categorical standards and other applicable pretreatment standards and requirements. The following sections provide an overview of pretreatment specific concerns for permit writer in both cases.

1.1 Federal Pretreatment Rules

Pretreatment Requirements: Federal Regulations describing appropriate controls for non-domestic wastewater are found at 40 CFR§403. These regulations are intended to prevent non-domestic wastewater from having undesirable effects at a POTW. These rules prohibit discharges that cause "Pass Through" or "Interference" at the POTW, explosion, vapor toxicity, emergency conditions, and sludge contamination. You can find definitions of pretreatment related terms at 40 CFR §403.3, and these prohibitions at 40 CFR §403.5. The rules at §403.8 require POTWs that have a design flow capacity of over 5.0 MGD to develop programs to prevent such undesirable effects if they have any industries.

The rules at §403.8 describe (in general) the required components of an approvable program. EPA guidance (See EPA's Pretreatment Website) significantly augments and refines the brief descriptions found there. EPA's manual "Introduction to the National Pretreatment Program" summarizes some of the most important guidance. Staff seeking to run a pretreatment program must be conversant with much of this.

The rules beginning at §403.9 describe the process of delegating a pretreatment program. Rules at §403.10(e) allow states to take responsibility for the POTW's program and issue permits to control discharges from Industrial Users.

Categorical Pretreatment Standards: Under the Clean Water Act (CWA), EPA established uniform national standards for some specific industry categories. These are found in sections §405 to §471. Where these standards specify Pretreatment Standards for Existing Sources (PSES) or Pretreatment Standards for New Sources (PSNS) for processes conducted by the industry, and the industry is connected to a POTW, the industry is considered a "Categorical Industrial User" (CIU). Where PSNS or PSES standards merely require compliance with the general pretreatment regulations (formerly 40 CFR §128, now 40 CFR §403), the industry is not considered to be subject to categorical standards or a CIU.

EPA publishes each categorical pretreatment standard as a separate regulation. The standards contain limitations for pollutants commonly discharged within each specific industrial category. All industries regulated by a particular category are required to comply with these standards, no matter where they are located in the United States. Facilities covered by categorical standards must comply with any more stringent local limits, state standards, or prohibitive standards.

Local Limits: EPA has constructed the Pretreatment Regulation to recognize technically based local limits as pretreatment standards under Section 307(c) of the Clean Water Act. EPA's pretreatment regulations also reinforce that pretreatment permits must require compliance with any more stringent state or local requirement.

Pretreatment Streamlining: EPA revised several sections of the pretreatment rules in November 2005 in what they termed "streamlining". The preamble to the rule change, which can be found on EPA's pretreatment web site, provides the best source of information on the scope and EPA's intentions for those changes. EPA has produced nine "fact sheets" that describe the various required changes, options allowed, and particulars of each change or new allowance. Permit writers should familiarize themselves with this rule change. They should understand the need to carefully document, in fact sheets, decisions with respect to the sample type (grab or composite), requirements for a slug discharge control plan, and best management practices (BMPs). Permits need to include, as enforceable provisions, requirements to develop and follow a slug discharge control plan, keep records that show compliance with BMPs, and provide any periodic certifications or characterizations.

1.2 Washington State's Rules for Non-Domestic Wastewater

EPA delegated Ecology the authority to issue NPDES permits in 1973 and to administer the federal pretreatment program in 1986. Ecology derives its authority to include pretreatment related requirements in NPDES permits issued to POTW's through RCW 90.48 and Chapter 173-220 WAC. These rules allow (at 173-220-150(g)) Ecology to give full or partial delegation to POTWs and requires their programs be as stringent as the Department's. Rules allowing delegation of local pretreatment programs are at Chapter 173-208 WAC.

The authority to directly regulate industries discharging to a POTW comes from 90.48 RCW and Chapter 173-216 WAC. Ecology's rules are for permit writers to include all relevant state and federal requirements in such permits. In addition to reinforcing EPA requirements, Washington State rules require industries to:

- Obtain approval for plans for construction of wastewater facilities (as described in Chapter 173-240 WAC).
- Provide All Known, Available, and Reasonable means of Treatment (AKART).
  [Note: Ecology determined that AKART prohibits approval of removal credits (described at 40 CFR §403.7)].
- Use an Ecology-accredited laboratory for their monitoring.

- Comply with Dangerous Waste (DW) rules (found at Chapter 173-303 WAC). These rules (173-303-071 WAC) exempt discharges to the sewer from DW rules if they identify the waste streams that would otherwise be DW in their permit application, and their pretreatment permit includes certain language.

1.3 Philosophy of Washington State's Pretreatment Program

Federal regulations require POTWs with design flows of 5.0 MGD and SIU's to develop a pretreatment program unless the state assumes this responsibility. These rules also allow Ecology to require a smaller POTW to develop a program when they receive wastes that are causing problems such as pass through at the POTW, when their problems are most amenable to local solutions. On a functional level, Ecology may also have to require a local program when the POTW is not providing Ecology the support needed to manage the program for them. Ecology would have to rely on Best Professional Judgment (BPJ) to require other TWTDS to develop a program. Washington State is one of only a handful of states that has a permit program to allow the state to implement the pretreatment program in lieu of a POTW.

Ecology's decision to require a municipality to develop a pretreatment program is a regional one. The decision should weight the benefits of each option. One of the main factors is whether it is less work to permit significant industrial users (SIUs) or to delegate and oversee a local program. Permit writers should describe the rationale for delegation decisions in the permit fact sheet when the municipality's permit (State Waste Discharge for TWTDS, and NPDES for POTWs) is (re)issued.

Where Ecology does not delegate full responsibility to implement the pretreatment program, Ecology will issue permits to SIUs. The POTW may still be required, in its NPDES permit, to do a variety of supporting tasks as described in Section 2.D. (Similarly, Ecology permits writers may place equivalent requirements in TWTDS permits based on BPJ.)

Ecology oversees the approved POTW pretreatment programs of municipalities that have been delegated pretreatment program authority. As of 2010, ten Washington municipalities have approved POTW pretreatment programs and have been delegated pretreatment authority. These include: METRO (Seattle metropolitan area including Renton and Bellevue), Everett, Lynnwood, Pierce County, Spokane, Vancouver, Richland, LOTT (Lacey, Olympia, Tumwater and Thurston County), Tacoma, and Yakima.

2. NPDES Permits For POTWs

Ecology's approved program manual from 1986 describes how Ecology and municipal sewerage agencies are to work in concert to carry out the responsibilities of the pretreatment program. POTWs and TWTDS, with staff at the local level, may be better situated to carry out certain pretreatment related tasks. In such cases, Ecology should assign them the responsibility for doing so as an NPDES permit condition.

The first step in crafting pretreatment-related permit conditions is to evaluate the situation and decide what pretreatment-related needs are. To do this, the permit writer must know what problems are symptomatic of poor pretreatment oversight. These include the observation either at the POTW or at some point in the collection system of certain conditions as listed below.

Symptoms of Uncontrolled Industrial Waste Sources Tributary to a POTW:

1. Corrosion to sewer lines, manholes, pump stations, or the POTW headworks
2. Noxious or chemical odors in the collection or treatment system
3. Oil, grease, fuel, solvents, or explosivity alarms
4. Unusual color
5. Excessive foaming
6. Unexplained reductions in treatment efficiency
7. Toxicity in WET tests, or periodic reduction in the oxygen uptake rate in aeration basins
8. Poor settling sludges
9. High temperatures in sewer lines or at the headworks
10. High or low pH or unusual pH swings
11. Poor UV transmissivity or loss of the effectiveness of UV disinfection
12. High or unusual variation in conventional pollutant loading rates (BOD, TSS, ammonia)
13. High metals concentrations in the influent, effluent, or sludges
14. High levels of total dissolved solids (e.g., from uncontrolled sources of brines)
15. Debris, sand, or unusual sludges in sewer lines or excessive solids at the headworks
16. Unusual levels of priority pollutants in the effluent or biosolids

In revisiting a POTW's NPDES permit, the permit writer should both review the POTW's monitoring reports for these symptoms and ask representatives of the POTW (including staff who oversee the collection system) about such occurrences. If the POTW shows evidence of adverse effects from non-domestic wastes, then the permit writer must decide two things: What actions should be taken in response, and the respective roles of Ecology and the POTW in taking those actions.

The permit writer's challenge will be to develop permit conditions that support and reinforce Ecology's partnership with the POTW. Conditions must compel the POTW to provide the support needed for Ecology to, in turn, properly administer the pretreatment program.

The major divisions of this section describe how permit writers craft permit language that requires a POTW to: Develop a pretreatment program; Implement their previously delegated program; Implement a modified program, or; Support Ecology's pretreatment program. Of these options, the permit writer has the greatest latitude in requiring tasks in support of Ecology's program. Whatever pretreatment related conditions are decided upon, the permit writer will typically need to properly document the basis for the conditions in the fact sheet.

Ecology has developed standard language for requiring a POTW to develop a delegated program, or to implement their previously delegated or modified program. This wording is in the NPDES Permit shell for POTWs. Regional pretreatment specialists are available to help permit managers decide what conditions to impose and evaluate whether the POTW has complied with their permit requirements (Section 4 of this chapter describes regional pretreatment engineer expertise areas).

2.1 Requiring a POTW to Develop a Pretreatment Program:

2.1.1 Resources

Requiring a POTW to develop a pretreatment program is an involved process. If you are not doing it, you can (mercifully) skip to the next section. If you are, it is best to anticipate the level of effort required from the outset (about 0.5 FTE*years). Then you can adjust your work plan accordingly. Permit writers should never require a POTW to develop a pretreatment program without the concurrence of the regional pretreatment engineer and regional manager. Either a POTW or a TWTDS may request authority to administer a permit program for their tributary IU's. Ecology is not obliged to approve such requests, and should ensure that any decision enhances the protection of waters of the state.

2.1.2 Drivers

Most states that administer the NPDES permit program also operate as the "Approval Authority" to require, approve, and oversee local POTW pretreatment programs. EPA rules at 40 CFR 403.8(a) require certain POTWs to develop a pretreatment program. This includes any POTW or group of POTWs owned by the same municipality with a design capacity of 5.0 MGD and receiving wastewater subject to pretreatment standards or requirements. State rules at RCW 90.48.165 and Chapter 173-208 WAC expand on this, empowering Ecology to also delegate **any** municipal body the authority to issue permits for the discharge of wastes into their system provided Ecology finds the program will protect the quality of the state's waters ("Waters of the State" includes both surface and ground water).

Federal rules at 40 CFR 403.10(e) allow states that have developed a permitting program to assume the role of the Control Authority instead of requiring the POTW to develop a pretreatment program. Ecology developed such a program and received EPA approval of it in 1986. Ecology therefore may permit the industries that discharge to a municipal sewerage system (either a POTW or TWTDS) rather than require a local pretreatment program. When Ecology decides to do this, permit writers must document this decision, and clarify which tasks Ecology still expects the municipality to carry out (to facilitate Ecology's permitting program) in the municipality's NPDES or State Waste Discharge permit and fact sheet.

2.1.3 Selection Process

The final responsibility for the selection and scope of a new full or partial program delegation rests with the Regional Section Manager. Ecology regional offices are to notify POTWs when they are required to develop local pretreatment programs (40 CFR 403.10(f)(2)(i)). To support that decision, the regional pretreatment engineer must assess whether:

1. The POTW is willing to assume pretreatment program responsibilities.
2. The POTW is capable of assuming pretreatment program responsibilities.
3. The POTW can overcome challenges posed by the inter-jurisdictional situation.

4. Delegating (in whole or part) the pretreatment program will better achieve the goals of pretreatment (better protect the public, the treatment works, and receiving waters).
5. For full program delegations, whether the review, approval, and oversight of the program will be less work to Ecology than the continued oversight of Industrial Users, or other feasible collaborative options.

Where Ecology decides to require a pretreatment program, Ecology should transmit this requirement by NPDES permit condition (per 403.8(a-e), 122.44(j), and 122.62(a)(9)). Upon approval of a local program, Ecology will provide an approval letter or order delegating authority to the POTW. Ecology then must amend the POTW's NPDES permit (under authority of 403.8(a-e) and 122.63(g) to include the requirement to implement their approved pretreatment program.

2.1.4 How Long Do We Allow to Develop a Program

Federal Regulations at 40 CFR 403.8(b) require municipalities to develop a local program within a year of being notified in writing that they are required to have a program by the Approval Authority (which in Washington State is Ecology). While EPA has not objected to a longer schedule, permit writers should understand that a third party might successfully challenge it. On the other hand, some believe that properly developing a well-considered pretreatment program may take up to three years.

2.1.5 Including a Schedule for Delegation

Where Ecology finds a pretreatment program is necessary, Ecology should include a compliance schedule in the POTW's NPDES permit when it is reissued or modified (403.10(f)(2)(iii)). The compliance schedule outlines milestones and dates for program completion. Federal rules at 40 CFR 403.8(e)(5) also specifically permit Ecology to invoke the authority of section 402(b)(1)(C) of the Act to modify or revoke and reissue a POTW's permit to include a compliance schedule to develop a pretreatment program.

The compliance schedule should require the POTW to develop and document the necessary authorities, information, and procedures to implement its local program. The next two sections describe the typical program elements specified in the compliance schedule for a fully delegated program, and the general process for "partial" delegation.

2.1.6 Contents for Full Delegations

EPA describes the requisite contents for a POTW's submission for approval of their proposed program in 40 CFR 403.9. If the permit writer, in concert with the regional Pretreatment Specialist, determines that the POTW should develop a program, Ecology must require this in the POTW's NPDES permit or an order. All delegated pretreatment programs must have the basic elements required by regulations. Each permit or order to develop a local program must require the POTW to:

1. Develop a list of Users that will be subject to the proposed pretreatment program.
2. Estimate the resources and staff needed to carry out the program and propose a schedule for obtaining resources and qualified staff prior to program approval.

3. Develop technically defensible local limits for all pollutants of concern.
4. Obtain the legal authority to apply and to enforce the requirements of the program C/O:
    a. An Ordinance that provides requisite authorities and codifies the local limits,
    b. Inter-jurisdictional agreements that apply the program to outlying areas, and
    c. An assessment by the POTW's counsel that the POTW's authorities and IJA's allow them to legally defend applying the program throughout their service area.
5. Develop procedures to ensure compliance with the requirements of a pretreatment program. These procedures must include the means to:
    a. Locate all users potentially subject to the program through both periodic efforts and continuous systems,
    b. Properly permit users subject to their program,
    c. Develop a Slug Discharge Control Program,
    d. Develop a system for evaluating compliance with permit conditions,
    e. Provide direct oversight including inspecting and sampling,
    f. Take timely and effective enforcement against violations of the program through the application of an Enforcement Response Plan, and
    g. Provide for public participation and transparency, and
    h. Modify the program to keep pace with Federal and State rule changes.

2.1.7 Stepwise Process for Delegating Programs:

NOTE: The procedures for partial programs will be similar to the procedures developed for fully delegated pretreatment programs with the exception that Ecology will not require and review any functions that Ecology is not delegating. The regional pretreatment engineer will typically be the lead in carrying out these steps:

1. Ecology determines which pretreatment functions to delegate to the POTW and formally notifies the POTW of this determination.
2. Ecology puts the POTW on a compliance schedule to complete development of the procedures or includes the requirements in their NPDES permit.
3. The POTW takes the measures necessary to develop a program as described in Items 1-5 above (or the functions required by the order) and sends three copies to Ecology who has 60 days to review the submittal. Ecology sends one copy to EPA for review.
4. Ecology provides comments back to the POTW on any areas not adequately addressed. The POTW must address all deficiencies to Ecology's satisfaction before going to the next step.
5. Ecology provides public notice of delegation of a pretreatment program. Public notice provisions of the POTW's NPDES permit are adequate for a partial delegation.
6. Ecology notifies IUs of the transfer of responsibilities that result from full or partial delegation.
7. Ecology revises the POTW's NPDES permit to reflect the municipality's delegated status or additional roles and responsibilities.

8. Ecology cancels or the State Waste Discharge Permits of tributary users when a delegated program issues a permit (upon the effective date of that permit).
9. Ecology modifies permits for IU's discharging to POTWs which need to reflect additional reporting or oversight by POTWs with *partial programs*.

2.1.8 EPA Role

EPA oversees program delegations as described in 40 CFR 403.9 through being sent a copy of the proposed program and objecting within 30 days if it does not meet their standards. There is no formal role for the EPA in the selection and delegation of a partial program under the federal pretreatment regulations. There are no regulatory requirements that specify the involvement of the EPA in partial program delegation other than their right to review and comment on permit conditions in NPDES permits issued by Ecology. The municipality is simply acting as Ecology's duly appointed agent as provided for in Chapter 90.48 RCW.

EPA also has the opportunity to comment on any partial delegation when we place the partial program conditions in a municipality's NPDES permit.

2.1.9 Tribal and Federal Treatment Works or Tributary Facilities

Tribal and Federal-Owned Treatment Works: Washington State's delegation of the NPDES permit program in 1973 did not include delegation of the authority to permit tribal or federal facilities. Ecology did not seek such delegated responsibility since Ecology's interpretation of the CWA was that it did not allow delegation of authority commensurate with it. The Clean Water Act, unlike RCRA, does not give States authority over federal facilities. Ecology concluded it may well have less authority to compel compliance with an NPDES permit it issues to a federal facility than to compel compliance with an EPA-issued permit as a third party. Ecology also has the ability to issue 401 certifications, adding state specific requirements.

Federal Facilities Tributary to POTWs: Ecology expects POTWs, as utility providers, to ensure any person using their utility does so in accordance with the rules established to protect the POTW. Where federal facilities are discharging to a POTW, the POTW should condition its services to require compliance with local pretreatment program requirements as a condition of discharge. This must be in an enforceable contract with the tributary facility. Ecology should include language in the NPDES permit for delegated POTWs requiring the POTW to establish such contractual relationships. Where the POTW is not delegated, Ecology has written permits for tributary federal facilities which impose requirements on point sources tributary to a POTW. This can be done by requiring the federal facility to sample and meet appropriate criteria at intermediate discharge points.

Industries on Tribal Lands Tributary to a POTW: Permits for facilities on tribal lands are discussed in Chapter 2, section 13 of Permit Writer's Manual. That section discusses discharges on tribal lands, but not the rules for a discharge from Tribal Lands to a POTW that is not on tribal lands. No law gives tribal activities the right to connect to a POTW without permission of that POTW, or to be exempt from categorical standards for indirect discharges. Since the POTW would have to construct a pipeline that extends to the tribal lands, such discharges can only be initiated with the concurrence of the POTW. POTWs must be very careful about agreeing to accept any such discharges without appropriate safeguards. A POTW may have no authority to enter and inspect such sources of wastewater (which may change over time) unless this right is established as a condition of their service. Ecology has been extremely reluctant to assert its authorities to require tribal activities discharging to a POTW to obtain a State Waste Discharge Permit. Unless and until this changes, Ecology permit writers should be clear with POTWs that this puts the burden squarely on their shoulders.

Problems from Federal and Tribal Industries: Where the POTW doesn't establish the appropriate controls before agreeing to accept the flows from any such activities such discharges may cause damage to the POTW, including its treatment process. When Ecology finds this happening, they should require the POTW to take action to fulfill its obligation to protect the public's interest in the POTW. If the POTW does not have a pretreatment program, and Ecology believes that a pretreatment permit is necessary, Ecology might need to require the POTW to develop one.

2.1.10 Discharges to Ground

Ecology's municipal permit writers also oversee POTWs and other treatment works treating domestic sewage (TWTDS) which discharge to ground. Such facilities and their tributary industries are not subject to the federal pretreatment program at 40 CFR 403. Ecology may, however, require such facilities to essentially do the same things a pretreatment POTWs would do. The pretreatment program provides a number of important safeguards to protect the sewers, treatment process, biosolids, and effluent. These goals are important for discharges to ground as well. The difference is that for a discharge to ground, the standards for discharge of the effluent are not designed to meet our water quality criteria, but rather our groundwater criteria.

2.2 NPDES Permit Conditions for Delegated Programs

For delegated programs, pretreatment requirements in the municipal NPDES permit must include conditions requiring the POTW to properly implement its program, submit an annual report, and do proper oversight, enforcement, and verification. All permit writers should be familiar with the requirements of the pretreatment program because the requirements will become an integral part of some municipal NPDES permits.

The Municipal NPDES permit shell contains standard language for requiring a POTW to carry out the requirements of its approved program and pretreatment rules of EPA and Ecology. These sections were written to be as self-explanatory as possible. However, since each situation is unique, it's best to consult your regional pretreatment engineer when there is any doubt about whether a condition is appropriate or not.

Special conditions that may be applicable to delegated programs include additional tasks supporting single industry campaigns such as dental amalgam or photo processors. Tasks supporting information gathering efforts also may be included.

2.3 Requiring and Recognizing Changes to Delegated Programs

As Federal and State regulations change, delegated pretreatment programs need to be required to change in turn. 40 CFR 403.18 describes when POTWs (control authorities) must submit changes to Ecology (the approval authority) and when they are substantial enough to require approval by Ecology and public notice and opportunity for comment.

Ecology, through its oversight (PCI's and Audits) may also find that some aspects of the program are insufficient or inadequately described. In such cases, POTWs may need to modify their program to correct the deficiencies. POTWs should follow the rules of 40 CFR 403.18 whenever they change their program.

Ecology may also modify pretreatment permits to require monitoring or controls on any pollutant for which criteria have been newly promulgated or revised.

2.4 NPDES Permit Conditions for Non-Delegated Programs

Ecology applies and enforces pretreatment requirements on IUs when Ecology has not delegated the authority to run a local pretreatment program to the municipality. Ecology's program for direct inspection and control of IUs includes processes and procedures for developing local limits, updating and maintaining user inventories, permitting, reviewing reports and plans, compliance tracking and monitoring, inspections, and enforcement.

However, Ecology cannot carry out these tasks without the assistance of the municipalities that run the treatment works and control discharges to the collection system. Permit writers must require domestic treatment works without pretreatment programs to develop and implement policies and procedures to support Ecology's pretreatment program administration as enforceable conditions of their NPDES or State Waste Discharge permit. While Ecology will maintain the NPDES municipal permit shell with the most up-to-date source of these conditions, typically they include the following requirements for each municipality that owns a portion of the collection system to:

- Conduct Industrial User Surveys at a frequency commensurate with the treatment works' design flows. Such surveys must provide Ecology enough information to know whether a potential industrial user requires a permit.
- Prohibit IUs from discharging either without a permit (where an Ecology "IU to POTW" permit is warranted), or in violation of the prohibitions applicable to all discharges;
- Develop local pollutant discharge limits specific to the treatment works where Ecology finds such limits are needed to enable Ecology to, in turn, issue permits with a reasonable assurance they will protect the treatment works;
- Codify a pretreatment ordinance (including local limits where developed) that gives affected users notice and opportunity for comment, gives authorities to the municipality to compel certain actions (such as completing survey forms, obtaining a permit, and meeting local limits).

- Develop a spill prevention program that protects against spills and slug discharges to the treatment works.

Additional tasks which Ecology may require of local POTWs to ensure proper administration of the pretreatment program include to:

- Develop and implement a grease control program for food service establishments.
- Develop and require (through ordinance provisions) best management practices (BMPs) for small flow industries whose combined contribution to the POTW is a significant source of pollutants. These may include photo-processors, dental offices, stormwater sources, car washes, dry cleaners, medical service industries, laboratories, and such.
- Issue control mechanisms for such "Minor Industrial Users" (above) that compel periodic certification they are adhering to the BMPs required by the program.
- Develop "end of process" limits for small flow pretreatment processes such as silver limits from silver recovery units used by photo processors (e.g., 5 mg/l) or mercury from dental amalgam separators to support appropriate maintenance practices and BMP's.
- Develop capacity management strategies and annually report on the flows and loadings allocated to industries as a proportion of the total flow and loading capacity available to the POTW (may be included with the annual waste load assessment report requirement).
- Collect and tabulate data from industries, trunk lines, biosolids, and POTW influent and effluent to show where loadings are coming from and how much reserve capacity is available at the POTW. POTWs may be required to report such data annually, and compile the results of monitoring from tributary users permitted by Ecology.
- Maintain signed IU Survey forms from all businesses with the potential to discharge non-domestic wastewater. Hold IU's accountable for obtaining a permit prior to discharging wastewater that they should reasonable know is subject to State Waste Discharge permit or local BMP's.
- Undertake sampling and inspection of IUs permitted by Ecology.
- Review duplicates of the monitoring reports sent by IU's permitted by Ecology, alert Ecology to non-compliance, help develop a response strategy, and tabulate compliance data annually.
- Review and ensure adequacy of Slug Discharge Control Plans that Ecology requires of IUs.
- Respond to reports of spills or slug discharges at IUs permitted by Ecology.
- Issue permits to industries with compatible pollutants only, or below the flow and loading thresholds which would make them SIUs.

2.5 Pretreatment Related NPDES Permit and Fact Sheet Language for POTWs

The municipal NPDES permit fact sheet shell contains standard language explaining the basis for common pretreatment related POTW conditions. These address the basis for requiring the POTW to run a pretreatment program, or do some of the more common pretreatment tasks. This language should be included in the permit to the extent it is applicable.

When additional pretreatment-related requirements are added to the permit (such as those listed in the section immediately preceding this one), the permit writer must document the basis in the fact sheet. This is important for the POTW, future permit managers, and others seeking to understand the basis and intent of the requirement.

3. State Waste Discharge Permits for Non-Domestic Waste

3.1 Overview of the Permitting Process

Permit writers use State Waste Discharge Permits to control discharges to sewage treatment systems (both POTWs and TWTDS). Where the receiving treatment works is owned by a municipal corporation and discharges to waters of the United States, the system is termed a Publicly Owned Treatment Works (POTW). Federal rules on permit contents found at 40 CFR part 403 apply to permits for industries tributary to POTWs.

When the receiving treatment works discharges to ground or other waters of the state, or is not publicly owned, it may not meet the federal definition of a POTW (found at 40 CFR 403.3(q)). In such cases, the treatment works is termed a Treatment Works Treating Domestic Sewage (TWTDS). Discharges from industries that would be subject to categorical standards if discharging to a POTW, but discharges to a TWTDS are not technically CIUs, or subject to categorical standards. The same logic applies to industries that would be SIUs if discharging to a POTW. While not considered SIUs or CIUs, Ecology can impose equivalent conditions on sources of indirect discharges to a TWTDS to similarly protect receiving treatment works based on the particular situation.

However, state regulations at Chapter 173-216 WAC impose the same requirements for discharge to a domestic sewage system regardless of whether it is a POTW or a TWTDS. Permit writers permitting a sewer customer or "Industrial User" therefore can use the same "IU to POTW" permit shell to issue a permit under the authority of that chapter. A number of the conditions in the permit shell stem from federal pretreatment requirements applicable to discharges to a POTW. Because of this, where discharge is to a TWTDS, the permit writer may have greater latitude in imposing such requirements.

Sources of non-domestic wastewater enter the permitting process through various means. The permit assistance center is one means. Their identification by a POTW or TWTDS is another. That is why it is so important to include (per the prior section) conditions in NPDES permits for

POTWs, and State Waste Discharge Permits for other TWTDS that require municipalities have a system for identifying such sources and (in turn) requiring them to apply for permits before providing sewer service.

Ecology begins the permitting process for a tributary industry when we hear of a source that may be subject to “categorical” standards or may otherwise be an SIU or require a permit. The first step in the permitting process is to gather information. Through review of the permit application and inspection of the User, the permit writer’s second step is to decide how to categorize the User (as a SIU, CIU, or MIU).

After categorizing the User, the third step is for the permit writer to notify the User of their status. The notification letter should document their categorization, the basis, the status of their permit application (if one has been received) and their reporting requirements per 40 CFR 403.12. These reporting requirements vary depending on whether the User is subject to categorical pretreatment standards or not. Both SIUs and CIUs must provide a one-time notification of discharges of any wastes that would otherwise be hazardous (see 403.12(p)). CIUs must be advised that their permit application must satisfy requirements of a baseline monitoring report (403.12(b)) and they will need to provide an initial compliance report (per 403.12(d)) within 90-days after commencing discharge. CIUs should be advised that they lose their right to request a categorical determination from EPA once they commence discharge (per 403.6.(a)(4)) and that this is a requisite step in requesting alternate limits due to fundamentally different factors (per 403.13(g)(3)).

The fourth step is to review the industry’s permit application and collect enough information to write the permit. Chapter 3 of the Permit Writer’s Manual and the flow charts of Figure 5, 6, and 7 describe this process in good detail. Please refer to those areas of this manual. The permit writer will need to include appropriate pretreatment standards (below section 3.B), and requirements (section 3.C).

Section 8 of Chapter 3 of the Permit Writer’s Manual discusses the “Domestic Sewage Exclusion” in good detail, and permit writers need to review this section and Figure 9 before writing a permit for discharge to a POTW of a waste which would otherwise be a hazardous waste. In such cases, the permit writer should ensure that the permit application adequately describes the waste (if a permit is not going to be issued), and should specifically authorize the discharge of the hazardous constituents in the permit, including a mass or concentration limit for the pollutants when feasible. (reference 173-303-070(b)(iii)(G), 173-303-071(3)(a) and 173-303-803(5))

3.2 Pretreatment Standards

The general pretreatment regulations establish three types of pretreatment standards: discharge prohibitions, categorical pretreatment standards, and local limits. The State adds a fourth type of standard known as AKART.

Each is important to properly controlling pollutant discharges into POTW's. Prohibited discharge standards (40 CFR 403.5 and 173-216-060 WAC) apply to all sources of non-domestic wastewater (industrial and commercial establishments) connected to POTW's. Categorical pretreatment standards (40 CFR parts 405 – 471) requiring zero discharge or compliance with concentration or production based limits apply to the users in 37 specific industrial categories.

When tasked to write a permit for an industry conducting an operation covered by categorical standards, permit writers must apply the more stringent of the categorical standards, local limits, or AKART. All permit writers writing industrial permits should be able to recognize industry sectors subject to national categorical standards, and know how to research what specific industrial processes are covered by the standards.

Pollutants subject to categorical limits are not candidates for a "reasonable potential" determination. Federal rules require CIU's to confirm at least semi-annually through self-monitoring they are meeting the limits for all pollutants limited by the categorical standards. Also, a "reasonable potential" determination may not be used to justify removing pollutant limits where treatment reduces pollutant levels to below the "reasonable potential" threshold. In such cases, the application of AKART requires permit writers to continue to apply the pollutant limits. This is necessary to ensure the Permittee continues to provide appropriate treatment (AKART).

Chapter 4, section 1.2 of this manual describes the process for applying categorical standards when permitting a Categorical Industrial User. Permit writers should apply this methodology for indirect dischargers subject to categorical standards as well. Permit writers looking to review development documents should consult their regional pretreatment coordinator. The pretreatment workgroup has compiled references on the "Pot-O-Gold" CD under the folder "Categorical Standards". This compilation includes all published pretreatment standards, a list of early development documents, and subdirectories for each categorical standard. The development documents which EPA has scanned are included as well. Permit writers can probably locate all of these on EPA's internet web site but it may take longer. Ecology's library also includes a substantial number of development documents.

Local limits are considered "pretreatment standards" under the CWA when approved by Ecology. Local limits may be codified such that they only apply to SIU's, apply to all users, apply to the combined discharge, or apply to the discharge from specific processes. Section 2 discusses reasons for Ecology requiring POTWs receiving non-domestic wastewater to codify such limits. After approval, permit writers should use them to write permits that protect the environment, sludge use, and the proper functioning of the collection system and treatment works.

EPA, in 2004 refined their guidance on local limit development, and asks all POTWs which require local limits to develop them for all pollutants of concern, and at least the following pollutants: Arsenic, Cadmium, Chromium, Copper, Cyanide, Lead, Mercury, Molybdenum, Nickel, Selenium, Silver, Zinc, BOD, TSS, and where the POTW is providing nitrification, Ammonia. Technically based local limits must consider the pollutant level that would cause adverse effects to the POTW (or TWTDS) including: its biological processes, sludge processes, sludge use options, and receiving environment (surface waters, groundwater, or air for POTWs which incinerate their sludges). In writing permits for industrial users, permit writers should consider requiring information on "pollutants of concern" in order to facilitate developing or confirming local limits.

3.3 Other Pretreatment Requirements

Permits must include notification of one-time reporting requirements, determination of the User's classification, requirements to submit baseline monitoring and final compliance reports, plans for wastewater facilities, and a complete permit application. Permits must contain requisite contents.

Discharge Prohibitions: Federal rules at 40 CFR 403.5(A) prohibit discharge of any pollutants that cause *pass through* or *interference*, and at 403.5(B) specifically prohibit a number of discharges. These prohibitions are reinforced in Chapter 173-216 WAC under section 173-216-060. Permit writers must be conversant with these prohibitions and therefore should read and understand these sections. Ecology's rules for indirect discharges to POTWs goes beyond the requirements of 40 CFR 403 in prohibiting:

- Clean stormwater, non-contact cooling water in significant volumes, and other clean wastewaters that could significantly affect hydraulic loading.
- Wastes with a pH greater than 11.0.
- Dangerous wastes, as prohibited by Chapter 173-303 WAC.

Local Prohibitions: Local POTWs may, at their discretion, prohibit the discharge of pollutants which they find are not amenable to their treatment process, have a potential to disrupt the POTW or pose a threat, or that have caused or contributed to pass through or interference.

Permit Contents (in general) will cover the following topics:

- **Permittee Rights to:**
  - Discharge the waste streams and pollutants identified in the permit application subject to the pretreatment standards and requirements of the permit.
  - Discharge specific waste streams (identify) at specific outfall locations (describe or show).
- **Pretreatment Requirements to:**
  - Properly treat all wastewater and apply AKART.
  - Meet the specific (listed) effluent limits (flow and pollutant concentration or loading limits) applicable to each outfall.
  - Average monitoring results over specific time frames (e.g., daily, weekly, monthly).
- **Monitoring Requirements to:**
  - Monitor flows and specific pollutants on a specific schedule,
  - Take representative samples (grab(s) or composite) using approved (40 CFR 136) methods and an accredited laboratory.
- **Reporting Requirements to:**
  - Send periodic reports (at least semi-annually) that include all applicable documentation and monitoring results to a specific person and address.

- **Record Keeping Requirements to record for each sample and keep at the facility for at least three years:**
  - Who took the sample, where the sample is from, when it was taken (date and time), and how it was preserved,
  - Who else had control of the sample,
  - Who analyzed the sample, when it was analyzed, and what analysis method they used,
  - What the sample results were, when they were obtained, and when they were reported.
- **Notification Requirements to:**
  - Immediately notify the CA and POTW upon discovering noncompliance (including failure of continuous flow or monitoring equipment),
  - Resample on discovering limits were exceeded and promptly report the results of re-sampling.
  - Notify before any scheduled bypass, or planned changes to production, chemicals, waste streams, water use, and flows.
  - Notify before a new or increased discharge of a substance which would be a dangerous waste if otherwise disposed of.
- **General Permittee Responsibilities to:**
  - Immediately halt any discharge that threatens to harm any person or the POTW.
  - Take actions needed to maintain compliance with permit limits, and act promptly to restore compliance.
  - Comply with the other permit terms and applicable Laws and Statutes.
  - Properly operate and maintain pretreatment systems, follow your approved O&M manual, and keep any checklists or log books it describes on site.
  - Obtain Ecology review and concurrence before making changes to processes creating wastewater or any pretreatment systems.
  - Properly handle and dispose of removed substances, retaining records of any waste characterization and disposal.
  - Provide information relevant to discharges to the control authority or receiving POTW upon request.
  - Reimburse all costs incurred by Ecology and the POTW due to noncompliance including additional monitoring.
  - Support any assertion of an affirmative defense with contemporaneous documentation.
- **Prohibitions Requiring the Permittee to:**
  - Comply with any general and specific discharge prohibitions.
  - Discharge only waste streams from activities or processes identified in this permit.
  - Obtain Ecology approval prior to discharge of any unforeseen wastes (e.g., rinse tanks, resin regeneration, or periodic maintenance).
  - Not use dilution as a substitute for treatment, and not bypass any treatment component except in accordance with an approved O&M Manual.

- **Administrative Requirements Pertaining to:**
  - How reports must be certified and who can sign them.
  - Requirements to pay for sewer use, capacity, and extra strength charges, any costs arising from non-compliance, and penalties assessed under this permit.
  - How to request and how Ecology will process changes to the permit.
  - Requirements to re-apply for the permit a certain length of time before expiration.
  - Rules for transferring the permit to new owner or operator.
  - Rules for appealing a permit term or condition.
  - Notice that permit conditions are severable, property rights are not established by the permit, and enforcement remedies are not exclusive.
- **Control Authority Rights:**
  - To modify the permit in certain situations and cancel it in other specific situations.
  - To enter the facility without delay.
  - To sample any waste stream and copy any records pertaining to wastes.
  - To inspect the facility and take notes and pictures of activities subject to the permit.
  - To apply injunctive relief to halt any discharge that poses a threat.
  - To apply civil penalties for violations.
  - To pursue criminal prosecution for knowing or willful violations.
  - To determine and annually publish Users in Significant Non-Compliance.
  - To require the Permittee to provide any information needed to make permit decisions.
  - To increase the scope and frequency of monitoring in response to changed conditions or noncompliance.
  - To extend an expired permit.
- **Liabilities:** General civil and criminal liabilities apply to noncompliance with the permit.
- **Special Requirements:**
  - To develop and follow a Slug Discharge Control Plan as a requirement of this permit, and promptly modify the plan as changes occur.
  - To report whether compliance schedule milestones have been met when such are established by this permit.
  - To provide any plans developed to comply with other environmental media such as spills, solid waste, dangerous waste, air pollution, and stormwater.

3.4 State Waste Discharge Permit Fact Sheet Contents

The following topics are typical of a pretreatment permit fact sheet.

- Summary of information in the permit application relevant to permit terms and conditions
- Compliance status with the prior permit if this is a permit renewal.
- Processes producing wastewater and their flow volumes and characteristics (pollutants).

- Whether composite samples or grab samples are appropriate for each pollutant and why.
- Observations from the last inspection of the facility.
- Pretreatment systems, the waste streams they treat, their capacities, and approval status of these systems and any O&M manuals per Chapter 173-240 WAC.
- Whether reinforcement of O&M manuals or procedures are needed to ensure compliance.
- Specific processes (if any) subject to categorical standards.
- For CIU's that combine categorical and non-categorical waste streams for treatment before the monitoring point, whether each non-categorical wastestreams is "unregulated" or "dilute" (as defined by EPA for use in the combined wastestream formula)
- Applicable pretreatment standards (categorical, local limits, AKART) and how the most stringent limitations are applied.
- Whether the permittee has identified any wastestreams that would otherwise be dangerous waste and therefore need to be allowed to discharge under the Domestic Sewage Exclusion.
- Whether a compliance schedule is needed for the Permittee to install additional treatment to reasonably meet the limits or other requirements of the permit.
- Prohibitions that the discharger has the potential to violate and safeguards to ensure that they do not occur.
- Whether the Permittee needs a new or updated slug discharge control plan or any other special condition.
- Other permits which the User reasonably needs to obtain in order to comply with NPDES, stormwater, Dangerous Waste, or other Ecology permit programs.
- Public involvement documentation (public notice, comments, responses)
- Process Piping and Site Layout
- Definitions of terms used in the permit

4. Regional Pretreatment Engineer Staff Expertise Areas

Overview

Federal Regulations at section 40 CFR 403.10(f)(2) require Ecology to provide technical and legal assistance to POTWs in developing pretreatment programs. As a functional necessity, Ecology must also provide training and oversight of the non-delegated POTWs that we rely upon to implement parts of the pretreatment program where there is no local program.

Division of Duties

Each region determines how to divide the responsibilities of implementing and overseeing the diverse municipal and industrial components of the pretreatment program between their pretreatment engineer and municipal and industrial permit writers and facility managers.

Training

Ecology provides training and oversight through the pretreatment workgroup, its chairperson, and regional pretreatment engineers. Pretreatment staff support and speak at pretreatment training events such as the Northwest Pretreatment Conference, and more general forums such as PNCWA meetings. The Pretreatment Workgroup chairperson, in conjunction with regional pretreatment engineers, also arranges separate training events that focus on one or more non-delegated POTW areas of responsibility. These are typically one day events held every two or three years at a couple locations.

Delegated Program Oversight

Regional pretreatment engineers support delegated pretreatment programs on both an informal and formal level. Informally, they support POTW requests for engineering assistance in plan review (Engineering Reports, Plans and Specifications, and O&M Manuals). They also help by reviewing permit applications and draft permits when requested. Formal oversight of delegated pretreatment programs is provided by conducting pretreatment compliance inspections (PCIs), audits, and reviewing the POTW's annual pretreatment report. Pretreatment reports are required and reviewed annually from each delegated municipality

EPA Oversight

The Ecology – EPA Performance Partnership Agreement establishes several pretreatment requirements. Ecology performs PCI's and Audits at the frequency described in that document. As of 2010, that document committed Ecology to conducting PCIs every two years and Audits once every five years. Ecology submits copies of PCI's and Audits to EPA. Ecology will also provide the pretreatment related data in EPA's Required ICIS Database Elements (RIDE) when those protocols are established by rule. Ecology will require delegated POTWs to include this information in annual reports then as well.

Non-Delegated Program Oversight

Regional pretreatment engineers provide non-delegated POTWs with oversight, guidance, and assistance as needed to fulfill their role as partners with Ecology carrying out the pretreatment program in their service area. The duties of non-delegated POTWs can vary, but all are charged with locating industry that should be subject to the pretreatment program. They must also all prohibit industrial discharges until properly controlled by Ecology, and control the myriad diffuse sources such as restaurants that collectively pose a threat.

Expanded Responsibilities

Ecology's staffing and resource limitations are severe. Accordingly, some POTWs must do more than just locate industries. Ecology may need the POTW to develop pretreatment standards (local limits) that protect their POTW from adverse effects from non-domestic wastes, codify these limits in an Ordinance, and provide an expanded oversight "presence" to businesses. The regional pretreatment engineers evaluate the situation and recommend POTW responsibilities commensurate with the situation. This may require changes to NPDES permit requirements and activities preparatory to developing a local program.

4.1 Conducting Industrial User Surveys

Local POTWs are ideally situated to identify the sources of non-domestic wastewater potentially subject to pretreatment standards and requirements. They have direct access to water records, utility billing records for water use, planning department staff and records, tax and business license records, and building code enforcement staff.

For this reason, Ecology's permit shell assigns this task to non-delegated POTWs at a frequency commensurate with the threat. Important factors in evaluating the threat include whether the POTW serves an industrial area, if there have been incidents at the POTW that may have been caused by non-domestic discharges, and how much flow the POTW receives.

Part of the information POTWs collect includes the flow and concentrations of pollutants of concern. This allows the POTW to estimate the loadings from all their non-domestic dischargers which is an important part of developing "technically based" local limits (next section).

The POTW's procedures should describe how they keep their survey list updated (through ongoing systems such as applications for new business licenses or approval or plans), and the interval for periodically re-surveying sewer customers to locate new or changed discharges with should be subject to pretreatment requirements.

To assist in this task, Ecology has developed an Industrial User Survey guidance manual. Permit writers and regional pretreatment engineers should provide this to POTWs that need technical assistance.

4.2 Developing "Technically Based" Local Limits

POTWs must develop local limits for all pollutants of concern to protect the POTW, its solids, workers, and the public from harm. To be legally defensible these limits must describe their basis. This is referred to as "technically based".

Local limits for indirect dischargers are analogous to water quality based limits derived by Ecology for direct dischargers. Both types of limits are developed protect the receiving environment (surface water, groundwater, or POTW). Both also intend to ensure healthy water quality in the receiving environment. POTWs must develop Local limits where they have SIU's that are not limited by categorical standards, or when applicable categorical standards do not limit pollutants well enough to protect the POTW. This latter case is increasingly common as categorical industries use more chemicals that were unavailable when such standards were set.

Federal regulations at 40 CFR 403.5(d) state that where specific limits on pollutant parameters are developed by a POTW according to 403.5(c) (which includes notice to affected Users), such limits are deemed Pretreatment Standards for the purposes of section 307(d) of the Clean Water Act. Ecology should require, as an NPDES permit condition, that any new or revised local limits be reviewed and approved by Ecology. This is important as Ecology will have to defend the limits should they ever be challenged by a Permittee.

Categorical standards and local limits are distinct and complementary types of pretreatment standards. Categorical standards provide a nationally uniform degree of water pollution control. Local limits provide an additional degree of control based on site specific requirements. EPA has published guidance on how to develop local limits in their July 2004 manual "Local Limits Development Guidance" Ecology has developed and will provide a spreadsheet for tabulating and analysis of the data collected during the local limits development process. Ecology has also developed a checklist for verifying the completeness of the local limits development document.

Where Permit Writers have questions on how to develop local limits, they should contact their regional pretreatment engineers, who can answer these questions or pass them on to the state pretreatment engineer. See the monitoring chapter of this manual for a discussion of what monitoring requirements should be included in a POTW's NPDES permit for developing and updating local limits.

Some municipalities may elect to develop local pollutant discharge limits without being required by Ecology. Industrial permit writers should always ask knowledgeable POTW staff about local limits when writing a permit for an industry discharging to a POTW. If those local limits satisfy the requirements of 403.5(c) they are applicable to all indirect discharges. Permit writers should document their findings in such cases in the fact sheet of the permit they are writing. Permit writers must apply the most stringent of local limits, categorical standards, BPJ, and AKART.

4.3 Providing Model Pretreatment Ordinance Language

POTWs that have or are developing delegated programs must first develop a Sewer Use Ordinance that allow the POTW to legally apply and enforce the local limits, requirements of the General Pretreatment Regulations and any other federal, state, or local pretreatment standards and requirements needed to control non-domestic dischargers to all tributary users.

POTWs which support Ecology's administration of a pretreatment program also need to have the authorities to carry out the functions which we require of them. See Section 2.D for a fairly comprehensive list of such possible requirements. Where Ecology has approved the technical basis for local limits, the POTW needs to codify these local limits in their ordinance so that Ecology can support and reinforce them in permits issued by Ecology to indirect dischargers.

Ecology has developed a model pretreatment ordinance for delegated POTWs. This has been used in updating pretreatment programs after EPA's streamlining of 2006. This language will be periodically revised when federal and state rules change.

Ecology is working on an adaptation of this Ordinance for non-delegated POTWs. One complication is that the range of responsibilities for non-delegated POTWs may vary. Until such time as that is published, non-delegated POTWs can codify the model ordinance for delegated POTWs, but instead of requiring Users to obtain a permit from the POTW, reinforce the requirement for them to obtain a permit from Ecology for indirect discharge.

4.4 Inspecting and Auditing Delegated Programs

Ecology is obliged to ensure that delegated POTWs implement the Federal Pretreatment Program and State Waste Discharge permit program for tributary users and do so in accordance with their approved program and applicable rules. Two types of inspections of delegated pretreatment programs are the "Pretreatment Compliance Inspection" (PCI) and "Pretreatment Audit". Definitions of these terms, and the current philosophy for their use and scope is found in Chapter 9 "Pretreatment" of EPA's July 2004 NPDES Compliance Inspection Manual. EPA has also published instructions and checklists for both types of inspections.

During an Audit, Ecology reviews whether the POTW's program satisfies all applicable state and federal rules. This including reviewing whether they have adopted provisions that incorporate any revisions to rules since the program was developed. Where Ecology finds that a program is not carrying out its approved program, or it needs to amend its approved program to incorporate changes to rules or a changed situation, Ecology will apply escalating enforcement measures to correct the situation.

During a PCI, Ecology focuses on assessing whether the POTW is properly implementing its approved program. The PCI starts with assessing whether the local program locates all industries potentially subject to the program, notifies them of appropriate pretreatment related requirements, issues appropriate permits, provides proper oversight (frequency and scope of inspections and sampling), properly reviews reports, manages files, and effectively responds to non-compliance. As part of the PCI, Ecology must assess whether the POTW has sufficient staffing to carry out their approved program. Often inspectors will review the annual pretreatment report in preparation for conducting a PCI. This report can reveal problems at the POTW or continuing non-compliance that needs to be addressed during the PCI.

As part of either an Audit or PCI, Ecology may inspect one or more tributary users. There are several purposes for such oversight. First, it allows Ecology to confirm that the IU is properly classified, and that pretreatment controls of its permit are appropriate. It also provides an assessment of the POTW's ability to do inspections. And it allows Ecology to provide some training for local inspectors that may have few opportunities for such training.

For POTWs without a delegated program, Ecology staff responsible for managing compliance with the municipal permit would typically also assess whether the POTW has met the pretreatment related permit requirements. This may be done during POTW compliance inspections, or based on the POTW not meeting the submittal dates of its permit. The regional pretreatment specialist should be asked to assist in this assessment process when the permit manager is unsure of the requirements.

4.5 Reviewing Pretreatment Related Submittals from POTWs

There are two major types of pretreatment related submittals—those we have required under the POTWs permit and those we haven't. Pretreatment related submittals that arrive unsolicited can range from Engineering Reports and O&M Manuals for tributary Users, to program changes that the POTW would like to make.

Most regions have recognized the value of having an engineer oversee implementation of local POTWs so that they can review plans for wastewater facilities.

Processing NPDES Permit Modifications

When a local pretreatment program has been developed or modified, it must be reviewed and approved by Ecology and EPA. Ecology must then issue a public notice of the proposed approval and allow for public involvement (a comment period). Ecology must then modify the municipal NPDES permit so it incorporates the approved program as an enforceable part of the permit. Ecology must also delegate State Waste Discharge permitting authority to the municipality while retaining an oversight function. This is required under RCW 90.48.165. These procedures should happen concurrently.

4.6 Reviewing Pretreatment Permits

Ecology regional pretreatment engineers have different assigned duties in different regions. In some regions they may write all the indirect discharge permits. In others they may provide technical assistance to Ecology permit writers writing indirect discharge permits. Ecology also provides review of draft permits for delegated programs. Delegation rules at Chapter 173-208 WAC specify that delegated programs will send all permits to Ecology upon issuance. While Ecology has developed other means of ensuring consistency of permits, some POTWs choose to continue to use this opportunity to validate their permits.

4.7 Providing Organized Pretreatment Related Training Events

While much training is done “one-on-one” with POTW staff, another important way that Ecology assists POTWs is to provide training events where Ecology staff review our guidance and answer common implementation questions. Ecology, as part of pretreatment training, should periodically review Ecology guidance and tools for carrying out IU surveys, developing local limits, codifying these limits, and should develop instruction around these topic areas.

Ecology pretreatment training should be focused on reviewing the basics of how the program works, how to use available tools, and what references to go to for additional clarifications.

EPA has produced quite a few EPA guidance manuals relating to pretreatment. Ecology’s training should provide an overview of these manuals so POTWs can locate guidance in specific areas. The Pretreatment coordinator will maintain a compilation of these EPA manuals, Ecology manuals, and other referenced materials that form the basis for pretreatment permit condition and program procedures on DVD format. Part of organized training events will include disseminating this compendium, and ensuring that regional coordinators have copies for distribution within their regions.

Chapter 11. Reclaimed Water Use

In 1992, the Washington State Legislature passed the Reclaimed Water Use Act (Chapter 90.46 RCW). This law directs Ecology and the Department of Health (Health) to encourage the beneficial use of reclaimed water.

In February 2018, Ecology adopted Chapter 173-219 WAC: *Reclaimed Water*, providing a single, comprehensive set of rules for reclaimed water generation, distribution, and use. Ecology and Health are currently working with stakeholders to develop new guidance for this rule.

Permit writers should contact the permitting technical lead for rule implementation information until a manual update is complete.

Additional resources, including permit shells, are available on SharePoint (for Ecology and Health staff), and the following:

Chapter 173-219 WAC: Reclaimed Water

Ecology Reclaimed Water Website

Place holders

Figure 32. Reclaimed Water

Table 23. Reclaimed Water

Table 24. Reclaimed Water

Table 25. Reclaimed Water

Table 26. Reclaimed Water

Table 27. Reclaimed Water

Table 28. Reclaimed Water

Table 29. Reclaimed Water

Table 30. Reclaimed Water

Table 31. Reclaimed Water

Table 32. Reclaimed Water

Table 33. Reclaimed Water

Table 34. Reclaimed Water

Table 35. Reclaimed Water

Chapter 12. Alternatives and Additions to Numerical Effluent Limits

There are alternative mechanisms to numerical effluent limits which can be used in permits to regulate the discharge of pollutants. These alternative mechanisms are authorized by federal and state law for use in both NPDES and state permits. These mechanisms include general conditions, special conditions and best management practices.

1. General Conditions

The general conditions, standard conditions, or boilerplate of a permit are those permit conditions that are based on federal or state law or regulation. They delineate the legal, administrative, and procedural requirements of the permit. In many cases they are direct quotes of the regulations. Most of the federal regulations for the General Conditions are found in 40 CFR 122.41 and 122.42.

In the Washington State permit format most of the General Conditions are placed in the back of a permit which is customary. Since Ecology uses standardized permit wording some of the direct regulatory requirements have been placed in Special Conditions S1 through S4.

The General Conditions are the same for every type of individual NPDES permit and are not to be changed by permit writers. The General Conditions and changes to those conditions are reviewed and approved by the AAG. If a General Condition is not applicable to a particular discharger, the permit writer is free to disregard that condition. The General Conditions for state discharge permits are based on state law and regulation.

The importance of the General Conditions should not be underestimated just because they are standardized. The general conditions are very stringent permit conditions. Permit writers can find the latest versions of permit shells containing these conditions on SharePoint.

1.1 The General Conditions for NPDES Permits

Many of the conditions found in Special Conditions S1 though S4 are required by regulation. They were placed in the main body of the permit for consistency. Permit writers should not alter this text in the permit shells. Conditions directly required by regulation include much of the language on discharge limits, monitoring, reporting, and operations and maintenance as found in the permit shells.

The following are general conditions for NPDES individual permits. These are taken directly from federal or state regulation. The text may have been changed slightly to improve clarity.

G1. Signatory requirements

1. All applications submitted to Ecology must be signed and certified.

a. In the case of corporations, by a responsible corporate officer. For the purpose of this section, a responsible corporate officer means:

    - A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions for the corporation, or
    - The manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long-term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

b. In the case of a partnership, by a general partner.

c. In the case of sole proprietorship, by the proprietor.

d. In the case of a municipal, state, or other public facility, by either a principal executive officer or ranking elected official.

Applications for permits for domestic wastewater facilities that are either owned or operated by, or under contract to, a public entity shall be submitted by the public entity.

2. All reports required by this permit and other information requested by Ecology must be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

    a. The authorization is made in writing by a person described above and submitted to Ecology.

    b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)

3. Changes to authorization. If an authorization under paragraph G1.2, above, is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph G1.2, above, must be submitted to Ecology prior to or together with any reports, information, or applications to be signed by an authorized representative.

4. Certification. Any person signing a document under this section must make the following certification:

   "I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

G2. Right of inspection and entry

The Permittee must allow an authorized representative of Ecology, upon the presentation of credentials and such other documents as may be required by law:

1. To enter upon the premises where a discharge is located or where any records must be kept under the terms and conditions of this permit.
2. To have access to and copy, at reasonable times and at reasonable cost, any records required to be kept under the terms and conditions of this permit.
3. To inspect, at reasonable times, any facilities, equipment (including monitoring and control equipment), practices, methods, or operations regulated or required under this permit.
4. To sample or monitor, at reasonable times, any substances or parameters at any location for purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act.

G3. Permit actions

This permit may be modified, revoked and reissued, or terminated either at the request of any interested person (including the permittee) or upon Ecology's initiative. However, the permit may only be modified, revoked and reissued, or terminated for the reasons specified in 40 CFR 122.62, 122.64 or WAC 173-220-150 according to the procedures of 40 CFR 124.5.

1. The following are causes for terminating this permit during its term, or for denying a permit renewal application:
   a. Violation of any permit term or condition.
   b. Obtaining a permit by misrepresentation or failure to disclose all relevant facts.
   c. A material change in quantity or type of waste disposal.
   d. A determination that the permitted activity endangers human health or the environment, or contributes to water quality standards violations and can only be regulated to acceptable levels by permit modification or termination.

e. A change in any condition that requires either a temporary or permanent reduction, or elimination of any discharge or sludge use or disposal practice controlled by the permit.

f. Nonpayment of fees assessed pursuant to RCW 90.48.465.

g. Failure or refusal of the Permittee to allow entry as required in RCW 90.48.090.

2. The following are causes for modification but not revocation and reissuance except when the Permittee requests or agrees:

   a. A material change in the condition of the waters of the state.

   b. New information not available at the time of permit issuance that would have justified the application of different permit conditions.

   c. Material and substantial alterations or additions to the permitted facility or activities which occurred after this permit issuance.

   d. Promulgation of new or amended standards or regulations having a direct bearing upon permit conditions, or requiring permit revision.

   e. The Permittee has requested a modification based on other rationale meeting the criteria of 40 CFR Part 122.62.

   f. Ecology has determined that good cause exists for modification of a compliance schedule, and the modification will not violate statutory deadlines.

   g. Incorporation of an approved local pretreatment program into a municipality's permit.

3. The following are causes for modification or alternatively revocation and reissuance:

   a. When cause exists for termination for reasons listed in 1.a through 1.g of this section, and Ecology determines that modification or revocation and reissuance is appropriate.

   b. When Ecology has received notification of a proposed transfer of the permit. A permit may also be modified to reflect a transfer after the effective date of an automatic transfer (General Condition G7) but will not be revoked and reissued after the effective date of the transfer except upon the request of the new Permittee.

G4. Reporting planned changes

The Permittee must, as soon as possible, but no later than one hundred eighty (180) days prior to the proposed changes, give notice to Ecology of planned physical alterations or additions to the permitted facility, production increases, or process modification which will result in:

1. The permitted facility being determined to be a new source pursuant to 40 CFR 122.29(b).

2. A significant change in the nature or an increase in quantity of pollutants discharged.
3. A significant change in the Permittee's sludge use or disposal practices.

Following such notice, and the submittal of a new application or supplement to the existing application, along with required engineering plans and reports, this permit may be modified, or revoked and reissued pursuant to 40 CFR 122.62(a) to specify and limit any pollutants not previously limited. Until such modification is effective, any new or increased discharge in excess of permit limits or not specifically authorized by this permit constitutes a violation.

G5. Plan review required

Prior to constructing or modifying any wastewater control facilities, an engineering report and detailed plans and specifications must be submitted to Ecology for approval in accordance with chapter 173-240 WAC. Engineering reports, plans, and specifications must be submitted at least one hundred eighty (180) days prior to the planned start of construction unless a shorter time is approved by Ecology. Facilities must be constructed and operated in accordance with the approved plans.

G6. Compliance with other laws and statutes

Nothing in this permit excuses the Permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

G7. Transfer of this permit

In the event of any change in control or ownership of facilities from which the authorized discharge emanate, the Permittee must notify the succeeding owner or controller of the existence of this permit by letter, a copy of which must be forwarded to Ecology.

1. Transfers by Modification
   Except as provided in paragraph (2) below, this permit may be transferred by the Permittee to a new owner or operator only if this permit has been modified or revoked and reissued under 40 CFR 122.62(b)(2), or a minor modification made under 40 CFR 122.63(d), to identify the new Permittee and incorporate such other requirements as may be necessary under the Clean Water Act.
2. Automatic Transfers
   This permit may be automatically transferred to a new Permittee if:
   a. The Permittee notifies Ecology at least thirty (30) days in advance of the proposed transfer date.
   b. The notice includes a written agreement between the existing and new Permittees containing a specific date transfer of permit responsibility, coverage, and liability between them.
   c. Ecology does not notify the existing Permittee and the proposed new Permittee of its intent to modify or revoke and reissue this permit. A modification under this subparagraph may also be minor modification under 40 CFR 122.63. If this

notice is not received, the transfer is effective on the date specified in the written agreement.

G8. Reduced production for compliance

The Permittee, in order to maintain compliance with its permit, must control production and/or all discharges upon reduction, loss, failure, or bypass of the treatment facility until the facility is restored or an alternative method of treatment is provided. This requirement applies in the situation where, among other things, the primary source of power of the treatment facility is reduced, lost, or fails.

G9. Removed substances

Collected screenings, grit, solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters must not be resuspended or reintroduced to the final effluent stream for discharge to state waters.

G10. Duty to provide information

The Permittee must submit to Ecology, within a reasonable time, all information which Ecology may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The Permittee must also submit to Ecology upon request, copies of records required to be kept by this permit.

G11. Other requirements of 40 CFR

All other requirements of 40 CFR 122.41 and 122.42 are incorporated in this permit by reference.

G12. Additional monitoring

Ecology may establish specific monitoring requirements in addition to those contained in this permit by administrative order or permit modification.

G13. Payment of fees

The Permittee must submit payment of fees associated with this permit as assessed by Ecology.

G14. Penalties for violating permit conditions

Any person who is found guilty of willfully violating the terms and conditions of this permit is deemed guilty of a crime, and upon conviction thereof shall be punished by a fine of up to ten thousand dollars ($10,000) and costs of prosecution, or by imprisonment in the discretion of the court. Each day upon which a willful violation occurs may be deemed a separate and additional violation.

Any person who violates the terms and conditions of a waste discharge permit may incur, in addition to any other penalty as provided by law, a civil penalty in the amount of up to ten thousand dollars ($10,000) for every such violation. Each and every such violation is a separate and distinct offense, and in case of a continuing violation, every day's continuance is deemed to be a separate and distinct violation.

G15. Upset

Definition – "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limits because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limits if the requirements of the following paragraph are met.

A Permittee who wishes to establish the affirmative defense of upset must demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

1. An upset occurred and that the Permittee can identify the cause(s) of the upset.
2. The permitted facility was being properly operated at the time of the upset.
3. The Permittee submitted notice of the upset as required in Special Condition S3.F.
4. The Permittee complied with any remedial measures required under S3.F of this permit.

In any enforcement action the Permittee seeking to establish the occurrence of an upset has the burden of proof.

G16. Property rights

This permit does not convey any property rights of any sort, or any exclusive privilege.

G17. Duty to comply

The Permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

G18. Toxic pollutants

The Permittee must comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if this permit has not yet been modified to incorporate the requirement.

G19. Penalties for tampering

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than two (2) years per violation, or by both. If a conviction of a person is for a violation committed after a first conviction of such person under this condition, punishment shall be a fine of not more than $20,000 per day of violation, or by imprisonment of not more than four (4) years, or by both.

G20. Reporting requirements applicable to existing manufacturing, commercial, mining, and silvicultural dischargers *(industrial only)*

The Permittee belonging to the categories of existing manufacturing, commercial, mining, or silviculture must notify Ecology as soon as they know or have reason to believe:

1. That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant which is not limited in this permit, if that discharge will exceed the highest of the following "notification levels:"
   a. One hundred micrograms per liter (100 μg/L).
   b. Two hundred micrograms per liter (200 μg/L) for acrolein and acrylonitrile; five hundred micrograms per liter (500 μg/L) for 2,4-dinitrophenol and for 2-methyl-4,6-dinitrophenol; and one milligram per liter (1 mg/L) for antimony.
   c. Five (5) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7).
   d. The level established by the Director in accordance with 40 CFR 122.44(f).

2. That any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant which is not limited in this permit, if that discharge will exceed the highest of the following "notification levels:"
   a. Five hundred micrograms per liter (500μg/L).
   b. One milligram per liter (1 mg/L) for antimony.
   c. Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7).
   d. The level established by the Director in accordance with 40 CFR 122.44(f).

G21. Compliance schedules

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit must be submitted no later than fourteen (14) days following each schedule date.

G21. Service agreement review *(municipal only)*

The Permittee must submit to Ecology any proposed service agreements and proposed revisions or updates to existing agreements for the operation of any wastewater treatment facility covered by this permit. The review is to ensure consistency with chapters 90.46 and 90.48 RCW as required by RCW 70.150.040(9). In the event that Ecology does not comment within a thirty-day (30) period, the Permittee may assume consistency and proceed with the service agreement or the revised/updated service agreement.

1.2 The General Conditions for State Permits

As with the NPDES permits some required conditions have been moved to other sections of the permit. Permit writers can find these within the Special Conditions of the permit shells on SharePoint. Following are general conditions for state domestic wastewater permits.

G1. Signatory requirements

All applications, reports, or information submitted to Ecology must be signed as follows:

1. All permit applications must be signed by either a principal executive officer or ranking elected official.
2. All reports required by this permit and other information requested by Ecology must be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:
    a. The authorization is made in writing by the person described above and is submitted to Ecology at the time of authorization, and
    b. The authorization specifies either a named individual or any individual occupying a named position.
3. Changes to authorization. If an authorization under paragraph G1.2. above is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization must be submitted to Ecology prior to or together with any reports, information, or applications to be signed by an authorized representative.
4. Certification. Any person signing a document under this section must make the following certification:

    "I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

G2. Right of entry

Representatives of Ecology have the right to enter at all reasonable times in or upon any property, public or private for the purpose of inspecting and investigating conditions relating to the pollution or the possible pollution of any waters of the state. Reasonable times include normal business hours; hours during which production, treatment, or discharge occurs; or times when Ecology suspects a violation requiring immediate inspection. Representatives of Ecology must be allowed to have access to, and copy at reasonable cost, any records required to be kept under terms and conditions of the permit; to inspect any monitoring equipment or method required in the permit; and to sample the discharge, waste treatment processes, or internal waste streams.

G3. Permit actions

This permit is subject to modification, suspension, or termination, in whole or in part by Ecology for any of the following causes:

1. Violation of any permit term or condition;
2. Obtaining a permit by misrepresentation or failure to disclose all relevant facts;
3. A material change in quantity or type of waste disposal;
4. A material change in the condition of the waters of the state; or
5. Nonpayment of fees assessed pursuant to RCW 90.48.465.

Ecology may also modify this permit, including the schedule of compliance or other conditions, if it determines good and valid cause exists, including promulgation or revisions of regulations or new information.

G4. Reporting a cause for modification

The Permittee must submit a new application at least one hundred eighty (180) days before it wants to discharge more of any pollutant, a new pollutant, or more flow than allowed under this permit. The Permittee should use the State Waste Discharge Permit application, and submit required plans at the same time. Required plans include an Engineering Report, Plans and Specifications, and an Operations and Maintenance manual, (see Chapter 173-240 WAC). Ecology may waive these plan requirements for small changes, so contact Ecology if they do not appear necessary. The Permittee must obtain the written concurrence of the receiving POTW on the application before submitting it to Ecology. The Permittee must continue to comply with the existing permit until it is modified or reissued. Submitting a notice of dangerous waste discharge (to comply with Pretreatment or Dangerous Waste rules) triggers this requirement as well.

G5. Plan review required

Prior to constructing or modifying any wastewater control facilities, an engineering report and detailed plans and specifications must be submitted to Ecology for approval in accordance with Chapter 173-240 WAC. Engineering reports, plans, and specifications should be submitted at least 180 days prior to the planned start of construction. Facilities must be constructed and operated in accordance with the approved plans.

G6. Compliance with other laws and statutes

Nothing in this permit excuses the Permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

G7. Transfer of this permit

This permit is automatically transferred to a new owner or operator if:

1. A written agreement between the old and new owner or operator containing a specific date for transfer of permit responsibility, coverage, and liability is submitted to Ecology;
2. A copy of the permit is provided to the new owner and;
3. Ecology does not notify the Permittee of the need to modify the permit.

Unless this permit is automatically transferred according to Section 1. above, this permit may be transferred only if it is modified to identify the new Permittee and to incorporate such other requirements as determined necessary by Ecology.

G8. Payment of fees

The Permittee must submit payment of fees associated with this permit as assessed by Ecology. Ecology may revoke this permit if the permit fees established under Chapter 173-224 WAC are not paid.

G9. Penalties for violating permit conditions

Any person who is found guilty of willfully violating the terms and conditions of this permit is guilty of a crime, and upon conviction thereof shall be punished by a fine of up to ten thousand dollars and costs of prosecution, or by imprisonment in the discretion of the court. Each day upon which a willful violation occurs may be deemed a separate and additional violation.

Any person who violates the terms and conditions of a waste discharge permit incurs, in addition to any other penalty as provided by law, a civil penalty in the amount of up to ten thousand dollars for every such violation. Each and every such violation is a separate and distinct offense, and in case of a continuing violation, every day's continuance is considered a separate and distinct violation.

G10. Duty to provide information

The Permittee must submit to Ecology, within a reasonable time, all information which Ecology may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The Permittee must also submit to Ecology upon request, copies of records required to be kept by this permit.

G11. Duty to comply

The Permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of chapter 90.48 RCW and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

G12. Service agreement review

The Permittee must submit to Ecology any proposed service agreements and proposed revisions or updates to existing agreements for the operation of any wastewater treatment facility covered by this permit. The review is to ensure consistency with chapters 90.46 and 90.48 RCW as required by RCW 70.150.040(9). In the event that Ecology does not comment within a thirty-day (30) period, the Permittee may assume consistency and proceed with the service agreement or the revised/updated service agreement.

2. Special Conditions

Special conditions, aside from those mentioned above such as discharge limits, monitoring, reporting, and operations and maintenance requirements, are requirements placed in permits without limits. They may be similar to Best Management Practices (discussed in Section 3 below) but are generally smaller in scope and may lead to permit limits. Special conditions are enforceable.

Since special conditions are specific to individual permits, it's difficult to define them in general terms. Some examples of special conditions follow.

1. An old complex industrial facility was found on one occasion to be leaking process wastewater under the building which then flowed to a small stream. The plumbing at the facility was old and in need of repair. In one instance at this facility, process wastewater was plumbed to a line carrying and discharging non-contact cooling water. This error occurred because the maintenance people were unsure of which pipes were carrying wastewater. These problems occurred near permit renewal time. The permit writer wrote a special condition in the new permit that required the facility to upgrade the piping in some areas, to produce a pipe routing diagram, and to conduct a weekly inspection for leaky wastewater plumbing to prevent any further discharges.

2. A sawmill discharged yard runoff and non-contact cooling water which went to a ditch and then to a small stream. There was no receiving water data on the temperature or flow for the stream. The permit writer placed a special condition in the permit which required a temperature study in the receiving water during the summer low flow to determine if the discharge was violating water quality standards. The special condition included language to alert the permittee that the new information could be used as a basis to modify the permit and place temperature limits in it if necessary to meet water quality standards. (See also Chapter 13 - Receiving Environment Monitoring)

3. Pollution Prevention and Best Management Practices (BMPs)

This section describes Ecology's process of pollution prevention within the Water Quality Program and how to incorporate best management practices into permits.

3.1 Pollution Prevention

Pollution prevention is a priority for the agency and the Water Quality Program. It is inherent in the goals of the Clean Water Act (zero discharge) and was one of the five goals in the strategic plan the Water Quality Program adopted in 1992.

Pollution prevention has been defined by Ecology as source control of pollutants.

The implementation of pollution prevention into the permit program is based on the premise that pollution prevention makes both environmental and economic sense. People will choose to make their products or provide their services in less polluting ways if they know they have a choice and it appears economical. Permits can be used to nudge people to look at viable alternatives, to provide incentives for prevention over treatment or to provide a legally binding framework for a project of interest to both the department and the permittee. Permits should not be used to mandate expensive studies of impractical alternatives or to mandate zero discharge where it is not required and it is not cost effective. The permit should be used as a tool to drive practical economical preventative approaches.

Implementation measures include:

- **Zero Discharge** - Permit managers should require permittees to consider and investigate options for zero discharge in engineering reports where that option appears viable.
- **Reduced Monitoring** - Reward exemplary performance, especially as a result of source control efforts, by reducing monitoring requirements (see Chapter 13, Section 1.3.2).
- **Cross Media Shift of Pollutants** - Coordinate your actions at facilities with other Ecology and local government actions to prevent cross media shifts of pollutants when feasible.

When developing technology-based effluent limits on a case-by-case basis or when developing water quality-based limits, the permit manager should identify those situations where there is a significant shift of pollutants to some other media such as air or land. These situations should be discussed and documented with the appropriate Ecology media programs to look for a mutual solution.

Watershed Scoping - Include a pollution prevention section in watershed scoping documents and in watershed workshops with Shorelands and Water Resources look for source reduction and water conservation opportunities.

[STILL UNDER DEVELOPMENT – Permit writers should not use the following guidance without consulting the permitting technical lead. Implementation strategies may vary as permits implement and refine these approaches. Future PWM updates will include revisions to these sections as necessary.]

3.1.1 Arsenic Reduction Efforts

On December 28, 2016, EPA's 40 CFR 131.45 became effective. This rule contained inorganic arsenic human health criteria. These arsenic criteria, based on the 1992 National Toxics Rule (NTR), carried over into the new federally adopted rule with a condition that clarifies the arsenic criterion "*refers to the inorganic form of arsenic only.*" These criteria are 0.018µg/L for combined water and organism ingestion for most fresh waters. For marine, estuarine and six freshwater bodies, the criteria of 0.14 µg/L is based on organism-only ingestion.

Effluent limits in NPDES permits for metals must be expressed as the total recoverable metal as specified in 40 CFR 122.45(c). As adopted, the arsenic criteria for the inorganic form creates a difficult situation when evaluating point source discharges for compliance with effluent limitations. Analytical methods that are used for permit compliance are found in 40 CFR 136. At present, a compliance method for inorganic arsenic is unavailable. In addition, a translator has not yet been developed for the ratio of total to inorganic arsenic in effluent. Ecology has not yet developed a procedure for development of a translator. Translators between total recoverable and inorganic arsenic will be very site specific and potentially dynamic. The translators may vary over time given fluctuations in organic loading from the effluent and organics present in the receiving water body. As a result, the calculation of numeric effluent limits for inorganic arsenic remains infeasible.

40 CFR 122.44 does provides direction for State NPDES programs in this situation. Under this section (in addition to other conditions established for State NPDES programs identified in §123.25) each NPDES permit shall include conditions for meeting the following requirements when applicable:

> (k) *Best management practices (BMPs)* to control or abate the discharge of pollutants when:
>
> > (1) Authorized under section 304(e) of the Clean Water Act (CWA) for the control of toxic pollutants and hazardous substances from ancillary industrial activities;
> >
> > (2) Authorized under section 402(p) of the CWA for the control of stormwater discharges;
> >
> > (3) Numeric effluent limitations are infeasible; or
> >
> > (4) The practices are reasonable necessary to achieve effluent limitations and standards or to carryout out he purposes and intent of the CWA.

This regulation provides flexibility in the permitting process given the infeasibility of limit calculation as it applies to the inorganic arsenic criteria. Permit writers need to address the infeasibility of arsenic limit development within the fact sheet. Language for the factsheet discussion can be found on the SharePoint site. Permit writers should include this language when reasonable potential, based on total recoverable arsenic, is found to exceed the inorganic arsenic human health criteria. Permits may contain numeric total recoverable arsenic effluent limitations based on aquatic life criteria only.

While numerical effluent limits may be infeasible at this time, permits must still include monitoring, source control, and BMP implementation requirements for pollutant minimization upon finding a reasonable potential. Permit writers should not use PERMIT CALC for assessment of reasonable potential given the lack of translator from total recoverable to inorganic arsenic. Rather, reasonable potential should be assessed based on a site specific review. If no arsenic is detected in priority pollutant scans or in monitoring from the last permit cycle, and there are no site specific triggers, permit writers may conclude that no reasonable potential exists. In this case, no monitoring (other than priority pollutant scans) and pollutant minimization requirements are necessary. The fact sheet should clearly document the procedure used to evaluate reasonable potential.

Permit writers should require monitoring for total recoverable arsenic, only, when reasonable potential is found. Part of BMP implementation includes regular assessment and application of adaptive management to refine the pollutant minimization process. Section 3.4 describes elements that should be included in an arsenic pollution prevention plan. Each plan should be tailored to the specific discharger and include an implementation schedule for any identified actions to reduce arsenic in wastewater.

Pollutant minimization is especially important when total arsenic concentrations in the effluent exceed a receiving water's background concentration. Data collected for permit development and in previous permit cycles could possibly be used to support the application of an intake credit. See Chapter 7 for guidance on application of intake credits.

3.1.2 Methylmercury Reduction Efforts

The EPA rule that promulgated methylmercury human health criteria for Washington became effective on December 28, 2016. This new criterion applies only to tissue residue values for methylmercury, a bioaccumulative environmental toxicant. The criterion for methylmercury, as measured in fish tissue, is 0.03 mg/kg (ppm) and applies to organism-only ingestion.

The inability to accurately translate tissue residue values into ambient water concentrations prevents the use of Ecology's PERMIT CALC spreadsheet for conducting a reasonable potential analysis (RPA) at this time. Significant research and waterbody modeling is needed to develop the appropriate translator for site specific reasonable potential analyses. The lack of appropriate translators prevents the calculation of numeric total recoverable mercury effluent limits from the new methylmercury criteria. As of May 2018, Ecology does not have a defensible procedure for translator development. EPA also does not have a 40 CFR 136 compliance method for methylmercury, further complicating the feasibility of a numeric effluent limit.

As with arsenic, the approach identified under 40 CFR 144(k) also applies to methylmercury. Until the additional waterbody-specific studies can be developed for the fish tissue translator, permit writers should assess total mercury levels in effluent for the reasonable potential to exceed the chronic aquatic life-based criteria for mercury. For surface waters not on the 303(d) list, the reasonable potential analysis should determine exceedance at the edge of the chronic mixing zone. In the case of a discharge to a listed waterbody, the point of compliance applies at the end of pipe. Chronic aquatic life-based criteria in WAC 173-201A-240 are 0.012µg/L and 0.025µg/L for freshwater and marine water, respectively.

Where reasonable potential exists, permit writers should require permittees to develop and implement BMPs, including source control efforts in permits developed after the effective date of the new methylmercury criteria. Provisions for evaluation, monitoring, and ongoing adaptive management must be a part of the BMP implementation requirement for pollutant minimization. Any required monitoring for BMP and pollutant minimization evaluations should use the EPA-approved compliance method for total mercury.

Active permits as of December 15, 2016 should not be modified to include this approach; rather, permit writers should incorporate these BMP requirements at the time of reissuance after confirming reasonable potential.

3.1.3 bis(2-ethylhexyl) phthalate (DEHP) Reduction Efforts

The EPA rule that promulgated human health criteria for bis (2-ethylhexyl) phthalate (DEHP) for Washington became effective on December 28, 2016. The new criteria, for both fresh and marine waters, significantly changed from the previous CWA-approved standards in the NTR.

DEHP, a known carcinogen, is frequently detected in wastewater effluent. Phthalates are plasticizers that are commonly used in hundreds of common consumer and building products used in everyday life. The ubiquitous chemical has also been identified as a common sampling and laboratory contaminate. Ecology's Cost Benefit Analysis (CBA) associated with the HHC rule identified the chemical as difficult to control as it enters the environment and surface waters through several different pathways.

If phthalates are detected in a facility's effluent, Permit Writers shall require permittees to re-sample their effluent using clean sampling techniques to confirm that the detection is not a result of either sampling or laboratory contamination. Resampling can occur during permit development at the request of the Permit Writer following acceptance of the permit application.

Permittees should work with an accredited laboratory on specific clean sampling requirements. At a minimum, samples should be collected in clean glass bottles with polytetrafluoroethylene (PFTE or Teflon™) lids. Standard practice may also include an equipment rinse with a non-polar solvent to remove possible organics. Accidental sample contamination from safety equipment (e.g. gloves) is also possible. All samples should be kept from directly contacting plastics of any kind.

To help assess the sample contamination potential, permittees may opt to collect a field blank for comparison with the effluent sample so that field collection contamination may be quantified. It is the laboratory's responsibility to analyze method blanks and laboratory control samples when analyzing batches consisting of 20 or less discrete samples. These laboratory QA results should be submitted with the laboratory report.

In the event phthalates are confirmed to be present in the effluent, facilities must develop and implement a Source Control Plan (aka pollutant minimization plan). This plan should identify and remove detectable phthalate sources within the facility or collection system. Ultimately, this plan works to confirm residual phthalates in the discharge result from diffuse sources.

The CBA for the HHC rule outlines several steps for the specific actions required when facilities face detectable phthalate concentrations in their effluent. These actions should be implemented in sequential order in each subsequent permit cycle:

1. Require the facility to employ clean monitoring/testing methods for all phthalate sampling and analysis.
2. Require additional sampling when phthalates are detected. If the facility continues to show phthalates in their discharge after following clean monitoring techniques, Ecology will require the facility to develop a Source Control Plan.
3. The facility must implement the Source Control Plan including necessary actions to eliminate or reduce the source of phthalate contamination.
4. If phthalates are still present in the discharge following Source Control Plan implementation in levels that exceed effluent limits, then the facility must evaluate process upgrades that will remove the chemical. An extended compliance schedule with interim effluent limits could be used to provide the facility with attainable milestones as they work toward final effluent limit compliance.
5. Following evaluation of process improvements for phthalate treatment, facilities must implement the selected treatment alternative and comply with the final effluent limit.

In the event a facility cannot meet the water quality based effluent limit through process improvements, a facility may pursue a variance to the phthalate criteria or initiate a process to change the water body's beneficial use. Permittees must clearly document the actions listed above when electing to pursue a variance or use change as federal requirements (40 CFR 131.14) must be met to successfully navigate the rule change and approval by the Environmental Protection Agency. See Chapter 16, Section 2.2 for state requirements as they relate to variances.

3.2 Best Management Practices

NPDES permits have traditionally focused on chemical-specific numerical effluent limits. To improve water quality, the Act provides for water pollution controls, such as Best Management Practices (BMPs), to supplement effluent limitations guidelines. Pursuant to RCW 90.48 and sections 304 and 402 of the Act, BMPs may be incorporated as permit conditions. In the context of the NPDES program, BMPs are actions or procedures to prevent or minimize the potential for the release of pollutants or hazardous substances in significant amounts to surface waters.

BMPs, although normally qualitative, are most effective when used in conjunction with numerical effluent limits in NPDES permits.

Section 402(a)(1) of the Act allows the Administrator to prescribe conditions in a permit determined necessary to carry out the provisions of the Act, such as BMPs. The discharges to be controlled by BMPs are plant site runoff, spillage or leaks, sludge or waste disposal, and drainage from raw material storage.

BMPs are intended to complement other regulatory requirements imposed by RCRA, OSHA, the Clean Air Act, and SPCC plans for hazardous substances. Pursuant to section 311 of the Act, EPA has promulgated (40 CFR Part 151) requirements that SPCC plans prevent discharges of hazardous substances from facilities subject to NPDES permitting requirements. The guidelines proposed for hazardous substances SPCC plans are very similar to those required for oil SPCC plans in the Oil Pollution Prevention Regulations (40 CFR Part 112). The NPDES BMP regulation has also been structured to be similar to the highly successful oil SPCC regulation. Even though the State of Washington has no statutory authority to enforce federal SPCC plan requirements, the NPDES permitting program and state law (RCW 90.48.010 and RCW 90.48.520) allow state permit writers to address appropriate spill prevention requirements as permit conditions.

While EPA never finalized the BMP regulation as 40 CFR Part 125, Subpart K, it remains in the Code of Federal Regulations (44 FR 32954-5) and can be used as guidance by permit writers (EPA, 1993). The authority to incorporate BMPs into permits is contained in Section 304(e) of the CWA and regulations set forth in 40 CFR 122.44(k). In addition, state law (RCW 90.48.080) and rule (Chapters 173-220-150(1)(g) and 173-220-130(1)(b(iv) WAC) support the use of BMPs in permits.

3.3 Scope of BMPs

Any activity which is associated with the industrial manufacturing or treatment process is subject to BMPs. The federal BMP program is only concerned with toxic or hazardous chemical discharges. The State of Washington's BMP program is broader and covers the discharge or potential discharge of any substance which would affect water quality. All activities or sources at the plant should be examined to determine if there is a reasonable potential for equipment failure (e.g., spillage or leakage), natural conditions (e.g., plant site runoff or drainage from raw material storage), or other circumstances (e.g., sludge or waste disposal) which could result in the discharge of a significant amount of pollutants or hazardous substances to receiving waters. For the State of Washington, receiving waters include both surface waters and ground water. These activities or sources usually include: material storage areas, loading and unloading areas; plant site runoff; in-plant transfer, process, and material handling areas; and sludge disposal areas.

Material storage areas include storage areas for toxic and hazardous chemicals which may be raw materials, intermediates, final products or by-products. Included are liquid storage vessels that range in size from large tanks to 55-gallon drums; dry storage in bags, piles, bins, silos, and boxes; and gas storage in tanks and vessels.

Loading and unloading operations involve the transfer of materials to and from trucks or railcars but not in-plant transfers. These operations include pumping of liquids or gases from truck or railcar to a storage facility or vice versa, pneumatic transfer of dry chemicals to or from the loading or unloading vehicle, transfer by mechanical conveyor systems, and transfer of bags, boxes, drums, or other containers from vehicles by forklift trucks or other materials handling equipment.

Plant runoff is generated principally from rainfall on a plant site. Runoff from material storage areas, in-plant transfer areas, loading and unloading areas, and sludge disposal sites potentially could become contaminated with toxic pollutants and hazardous substances. Heavy metals from sludge (disposal sites are of special concern). Fallout, resulting from the plant air emissions which settle on the plant site, may also contribute to contaminated runoff. Contaminated runoff may reach a receiving body of water through overland flow, drainage ditches, storm or noncontact cooling water sewers, or overflows from combined sewer systems. Contaminated runoff can enter ground water by infiltrating through the soil or through recharge zones in surface waters.

In-plant transfer areas, process areas, and material handling areas encompass all in-plant transfer operations from raw material to final product. Various operations could include transfer of liquids or gases by pipelines including devices such as pumps, valves and fittings; movement of bulk materials by mechanical conveyor belt systems; and forklift truck transport of bags, drums, and bins. All transfer operations within the process area with a potential for release of toxic pollutants and hazardous substances to other than the process wastewater system are addressed in this grouping.

Sludge and other waste handling areas are potential sources of contamination of receiving waters. These operations include landfills, pits, ponds, lagoons, and deep-well injection sites. Depending on the construction and operation of these sites there may be a potential for leachate containing toxic pollutants or hazardous substances to seep into the ground water, or for liquids to overflow to surface waters from these disposal operations. BMP requirements are not intended to duplicate the requirements of RCRA. Actions taken for compliance with RCRA may be referenced in the BMP plan submitted with the permit application.

Any facility with an RCRA permit will already have plans addressing BMP requirements (e.g., contingency plans, personnel training plans, inspections and maintenance, security, reporting and records, compatibility testing, and housekeeping procedures). However, the RCRA requirements will usually be applied only to areas involved in the treatment, storage or disposal of hazardous waste. So these RCRA procedures may need to be expanded to meet BMP requirements.

3.4 Minimum Requirements for the BMP Plan

BMPs may include some of the same practices used by industry for pollution control, SPCC plans for oil and hazardous substances, safety programs, fire protection, protection against loss of valuable raw materials or products, insurance policy requirements or public relations. The minimum requirements of a BMP Plan are listed below and are divided into 2 categories: general requirements and specific requirements.

Minimum Requirements of a BMP Plan

A. General Requirements
- Name and location of facility
- Statement of BMP policy and objectives
- Review by plant manager

B. Specific Requirements
- BMP Committee
- Risk Identification and Assessment
    - Structural Modifications
    - Reporting of BMP Incidents
    - Materials Compatibility
    - Good Housekeeping
    - Preventive Maintenance
    - Inspections and Records
    - Security
    - Employee Training

3.4.1 General Requirements

The BMP plan should be organized and described in an orderly narrative format. A description of the facility, including the plant name, the type of plant, processes used, and the products manufactured should be included in the BMP plan. A map showing the location of the facility and the adjacent receiving waters also should be part of the plan. Any available data about site soils or ground water conditions should also be included. Specific objectives for the control of toxic pollutants and hazardous substances should be included in a statement of corporate policy. The plan should be reviewed by the plant manager.

3.4.2 Specific Requirements

Each of the nine specific requirements listed above should be addressed in the BMP plan. The size and complexity of the BMP plan will vary with the size, complexity, and location of the facility. It is anticipated that the length and detail of the BMP plan will be commensurate with the quantity of toxic and hazardous chemicals on site and their opportunity for discharge. The fundamental goal of the BMP plan is determining the potential for toxic and hazardous chemicals to reach receiving waters, and taking appropriate preventive measures.

3.4.3 BMP Committee

The BMP Committee is a group of individuals within the plant organization which is responsible for developing the BMP plan and assisting the plant management in its implementation, maintenance and updating. The scope of activities and responsibilities of the BMP Committee should include all aspects of the facility's BMP plan, such as identifying toxic and hazardous materials handled in the plant; identifying potential spill sources; establishing incident reporting procedures; developing BMP inspection and records procedures; reviewing environmental incidents to determine and implement necessary changes to the BMP plan; coordinating plant incident response cleanup and notifying authorities; establishing BMP training for plant personnel; and aiding interdepartmental coordination in carrying out the BMP plan. Other committee duties could include reviewing both new construction and changes in processes or procedures at the facility relative to spill prevention and control.

The plan should contain a clear statement of the management's policies and responsibilities related to BMPs. Authority and responsibility for immediate action in the event of a spill should be clearly established and documented in the BMP plan, with the Committee indirectly involved in that responsibility. The Committee should advise management on the technical aspects of environmental incident control, but should not impede the decision-making process for preventing or mitigating spills and incidents. Management should, of course, review and support the BMP plan.

The size and composition of the BMP Committee should be appropriate to the size and complexity of the plant, and to the specific toxic and hazardous chemicals handled at the plant. Facility personnel knowledgeable in spill control and waste treatment such as environmental specialists, production foreman, safety and health specialists, and any treatment plant supervisor should be included. In some small plants, the committee might consist of the one manager or engineer assigned responsibility for environmental control. For very small facilities, the Committee function might even have to be fulfilled by competent engineers or managers from the corporate staff or the nearest large plant.

A list of personnel on the BMP Committee should be included in the BMP plan. The list should have the office and home telephone numbers of the Committee members, and the names and phone numbers of backup or alternate people.

3.4.4 Risk Identification and Assessment

The areas of the plant that are subject to BMP requirements should be identified by the BMP Committee. Each such area should be examined for the potential risks for discharges of toxic pollutants or hazardous substances to receiving waters. Any existing physical means (dikes, diversion ditches, etc.) of controlling such discharges also should be identified.

The areas described above should be clearly indicated on a plant plot plan or drawing. A simplified materials flowsheet showing major process operations can be used to indicate the direction and quantity of materials flowing from one area to another. Areas with the potential for ground water contamination via subsurface infiltration or surface water recharge after spills should be identified and indicated on site drawings. The direction of flow of potential spills and surface runoff should also be estimated based on site topography and indicated on the plant site drawings. Dry chemicals that are either toxic pollutants or hazardous substances should be evaluated if they have the potential to reach surface or ground waters in significant quantities via rainfall runoff, for example.

A hazardous substance and toxic chemical inventory (materials inventory) should be developed as part of the "Risk Identification and Assessment." The detail of the materials inventory should be proportionate to the quantity of toxic pollutants and hazardous substances on site and their potential for reaching the receiving waters (both surface and ground water). For example:

1. The plant has determined that materials stored in bulk quantities at a tank farm have a high potential for reaching the receiving waters via surface runoff or subsurface infiltration in the event of structural failure or overfills. Therefore, the materials inventory for the tank farm should be detailed, and should provide the identity, quantities, and locations of each material.

2. The plant has determined that materials stored in small quantities at the research laboratory have a low potential for reaching the receiving waters. Therefore, the materials inventory for the laboratory could be minimally detailed, and may not include the identity, quantity, or location of each material but might include an estimate of the total quantity of toxic and hazardous materials stored and would provide the location of the laboratory. The rationale for the "low risk" nature of the laboratory would be provided in this part of the BMP plan.

3. The plant has determined that materials used in a batch operation in the manufacturing process have a high potential for reaching the receiving water. The plant supplies a variety of products through the batch operation process to accommodate fluctuations in public demand. Consequently, the materials used for the batch process vary from week to week, often times unexpectedly. Therefore, the materials inventory for the batch operation should be detailed but remain flexible. The inventory might include the identification of each material expected for use, the maximum quantity of material expected for use, and the maximum quantity of material that the batch process can handle. The materials inventory could be updated to include any material substitutions unanticipated at the time of the original inventory.

The examples above illustrate the flexibility of the materials inventory. A materials inventory should be part of the "Risk Identification and Assessment" of every BMP plan but the detail of the inventory will vary with the size and complexity of the plant, the quantities of toxic and hazardous chemicals on-site, and the potential for those materials to reach surface waters.

The materials inventory and other useful technical information should be made available to the BMP Committee but may require separate filing from the BMP plan documents to protect proprietary information or trade secrets. This data may include physical, chemical, toxicological and health information (e.g., technical bulletins or material safety data sheets) on the toxic pollutants and hazardous substances handled; the quantities involved in various operations; and the prevention, containment, mitigation, and cleanup techniques that would be used in the event of a discharge.

Materials planned for future use in the plant should be evaluated for their potential to be discharged in significant amounts to receiving waters. Where the potential is high, the same type of technical data described above should be obtained.

3.4.5 Structural Modifications

An important element of BMP implementation involves actual physical changes to the facility that prevent the potential release of a pollutant. These physical changes include overflow and overfill controls, secondary containment systems, ground water protection barriers, and emergency cut-offs. The purpose of these structural modifications to the facility is to confine potential pollutants to those portions of the facility where they belong by preventing spills, stopping spills that have started, or containing spills that have already happened. Because these structural modifications are physical changes, they do not need human intervention to work effectively. However, this does not mean that these devices are "fool proof" and do not need to be a part of other elements of BMP such as facility inspection programs, employee training or spill drills.

Overflow and overfill controls prevent spills in pipes, process vessels or storage tanks by stopping or rerouting flow when the unit is full or flow is blocked. The principle is the same as the pumps in gas stations which sense the level of gasoline in your car and shut-off when the tank is full. These devices sense the fluid level or the line pressure and automatically stop or reroute flow before the point of spillage. Liquids can be rerouted back to their source, to another vessel such as a process or storage tank or to secondary containment.

Secondary containment is a facility's extra storage capacity that automatically receives a spill from a process or storage unit. This extra storage capacity can be provided by earthen dikes, concrete pads, walls or curbing, concrete sumps, or a tank connected down gradient of the potential spill source. Secondary containment holds a spill safely until facility personnel can recover or dispose of the spilled material. A secondary containment device must be capable of holding more than the volume of the largest spill possible at the facility (for example, capable of holding more than the volume of the largest tank in a tank farm or 40% of the total volume of all drums which can be stored in a drum storage area). The permit writer should realize that other environmental programs such as SPCC or RCRA will have specific requirements on the volumes of many secondary containment systems.

Ground water protection barriers are made of natural or artificial materials designed to stop spills from infiltrating through the soil to contaminate ground water. Natural materials used as ground water protection barriers are usually clays that are placed in a layer between the source of the spill and the soil overlaying the ground water. Artificial materials take the form of impermeable synthetic liners which are placed under the spill source. These ground water protection barriers can be used as back-up for secondary containment in the event of an overflow or a structural failure such as a crack in a concrete drum storage pad, or they can be used in combination with secondary containment such as lining the bottom of a diked area around a tank farm. These devices are also useful for lining containment basins for stormwater which could be contaminated or for areas such as loading docks which are subject to frequent small spillage. Of course, ground water protection barriers are routinely installed under surface impoundments, waste piles and landfills.

Emergency cutoffs include many of the overflow/overfill control devices, but also include other types of control. One such device is the emergency cutoff for an entire industrial process that occurs when the wastewater or air pollution control system fails. A related type of emergency cutoff shuts down an industrial operation when internal pressures, chemical reactions or ambient vapors threaten an explosion at a facility. Other emergency cutoff systems shut storm sewer systems when a monitor has detected gasoline vapors or when special organic absorbents swell and block a sewer in reaction to solvents. Emergency cutoffs can also be installed to stop the discharge from a failed pollution control device such as a wastewater plant or air pollution scrubber.

Any of these structural modifications made to physically prevent the release of pollutants from a facility must be included in all of the related BMP activities such as inspections, maintenance, personnel training, and spill drills. A disconnected or neglected device will not work in the event of a spill. If facility personnel do not know about the functioning of the device, they cannot properly maintain or inspect it. Without training and spill drills which include the devices, personnel may misinterpret the cause of an emergency cutoff or may release material from secondary containment prematurely. Just because these structural devices operate automatically, does not mean that they can be left out of all other BMP elements. The BMP plan must describe these physical devices and outline their routine inspection and maintenance in addition to including them in personnel training and spill drills.

3.4.6 Reporting of BMP Incidents

A BMP incident reporting system is used to keep records of incidents such as spills, leaks, runoff and other improper discharges. The system minimizes recurrence, expedites containment or cleanup activities, and complies with legal requirements. Reporting procedures defined by the BMP Committee should include these three elements upon discharge:

1. Immediately notify appropriate plant personnel so they can initiate prompt action.
2. Write formal reports for management to review. Management should evaluate the BMP incident and consider revising the BMP plan accordingly.
3. (By law) Notify governmental and environmental agencies if a spill or other discharge reaches surface water or ground water.

The reporting system should designate the means for reporting incidents to responsible company and government officials. The names, office telephone numbers, and home telephone numbers of key employees ranked in order of responsibility should be listed for immediate reporting of BMP incidents to plant management personnel involved in implementation of emergency response plans.

The communications system should be described which is available for notification of an impending or actual BMP incident. Reliable communications with the person directly responsible is necessary to expedite immediate action for preventing, containing, or initiating cleanup of a discharge. Such a communication system could include telephone, radio, or alarm systems that could signal the location of an incident. Provisions to maintain communications in the event of a power failure must be addressed.

Written reports on all BMP incidents should be submitted to the plant's BMP Committee and plant management for review. Written reports should include the date and time of the discharge, weather conditions, nature of the materials involved, duration, volume, cause, environmental problems, countermeasures taken, people and agencies notified, and recommended revisions to the BMP plan involving changes to the plant operating procedures and/or equipment to prevent recurrence.

Procedures and important information should be outlined in the BMP plan for inclusion in reports of BMP incidents to federal, state, and local regulatory authorities. In some circumstances, notifying authorities such as municipal sewage treatment works, drinking water treatment plants, and fish and wildlife commissions may be desirable. The BMP plan should list the individuals who are responsible for notifying these authorities. The telephone numbers of these authorities and of people in the plant who need to be notified should also be listed in the BMP plan. The phone numbers should be reviewed periodically for accuracy and might actually be used in the course of a "spill drill."

3.4.7 Materials Compatibility

Incompatibility of materials can cause equipment failure through corrosion, fire, or explosion. Equipment failure can be prevented by ensuring that the materials of construction for containers handling hazardous substances or toxic pollutants are compatible with the containers' contents and surrounding environment.

Materials compatibility encompasses 3 aspects: compatibility of the chemicals being handled with the materials of construction of the container, compatibility of different chemicals upon mixing in a container, and compatibility of the container with its environment. The specific requirement of "Materials Compatibility" in the BMP plan should provide procedures to address these aspects in the design and operation of the equipment on site handling toxic and hazardous materials.

The BMP plan documentation on materials compatibility should describe the engineering practices already used in the plant, and should summarize these existing practices with regard to corrosion and other aspects of material compatibility. Specific consideration should be given to procedures and practices for the mixing of chemicals which might result in fire, explosion or unusual corrosion. Thorough cleaning of storage vessels and equipment before use with another chemical should be standard practice to avoid unexpected reactions or releases of hazardous material. Coatings or cathodic protection should be considered for protecting a buried pipeline or storage tank from corrosion.

Where applicable, material testing procedures should be described in the BMP plan. Proposed substitutions for currently used toxic or hazardous chemicals should be studied to determine whether they are compatible with the construction materials of the existing containers. The procedures utilized by the plant or an outside contractor to perform the materials compatibility study should be documented. Materials compatibility situations which are covered by the RCRA hazardous waste regulations should be referred to in the BMP plan.

3.4.8 Good Housekeeping

Good housekeeping is essentially the maintenance of a clean, orderly work environment and contributes to the overall facility pollution control effort. Periodic training of employees on housekeeping techniques for those plant areas where the potential exists for discharges reduces the possibility of incidents caused by mishandling of chemicals or equipment.

Examples of good housekeeping include neat and orderly storage of bags, drums, and piles of chemicals; prompt cleanup of spilled liquids to prevent significant runoff to surface water or infiltration to ground water; sweeping, vacuuming, or other cleanup of accumulations of dry chemicals as necessary to prevent them from reaching receiving waters; and provisions for storage of containers or drums to keep them from protruding into open walkways or pathways. Maintaining employee interest in good housekeeping is a vital part of the BMP plan. Methods for maintaining good housekeeping goals could include regular housekeeping inspections by supervisors and higher management; discussions of housekeeping at meetings; and publicity through posters, suggestion boxes, bulletin boards, slogans, incentive programs, and employee publications.

3.4.9 Preventive Maintenance (PM)

An effective preventive maintenance (PM) program is important to prevent spills or releases. A PM program involves inspection and testing of plant equipment and systems to uncover conditions which could cause breakdowns or failures which result in significant discharges of chemicals to receiving waters. The program should prevent breakdowns and failures by adjustment, repair, or replacement of items. A PM program should include a suitable records system for scheduling tests and inspections, recording test results, and facilitating corrective action. Most plants have existing PM programs which provide a degree of environmental protection. It is not the intent of the BMP plan to require development of a redundant PM program. Instead, the objective is to have qualified plant personnel and the BMP Committee evaluate the existing plant PM program and recommend to management those changes, if any, needed to address BMP requirements.

A good PM program should include the following: (1) identification of equipment or systems to which the PM program should apply; (2) periodic inspections or tests of identified equipment and systems; (3) appropriate adjustment, repair, or replacement of items; and (4) maintenance of complete PM records on the applicable equipment and systems.

The BMP plan documentation on PM may include a list of procedures, examples of record keeping, a list of the principal systems to which the PM program is applicable, and directions for obtaining the records for any particular system included or referred to in the BMP plan. In general, it will be adequate to refer to the scope of existing PM procedures and location of PM records.

3.4.10 Inspections and Records

The purpose of the inspection and records system is to detect actual or potential BMP incidents. The BMP plan should include written inspection procedures and optimum time intervals between inspections. Records to show the completion date and results of each inspection should be signed by the appropriate supervisor and maintained for a period of 3 years. A tracking (follow-up) procedure should be instituted to assure that adequate response and corrective action have been taken. The record keeping portion of this system can be combined with the existing spill reporting system in the plant.

While plant security and other personnel may frequently and routinely inspect the plant for BMP incidents, these people are not necessarily capable of assessing the potential for such incidents. Certain inspections should be assigned to designated qualified individuals, such as maintenance personnel or environmental engineering staff.

The inspection and records system should include those equipment and plant areas identified in the "Risk Identification and Assessment" portion of the BMP plan as having the potential for significant discharges. To determine the inspection frequency and inspection procedures, competent environmental personnel should evaluate the causes of previous incidents and assess the probable risks for incidents. Furthermore, the nature of chemicals handled, materials of construction, and site-specific factors including age, inspection techniques, and cost-effectiveness should be considered.

Qualified plant personnel should be identified to inspect designated equipment and plant areas. Typical inspections should include examination of pipes, pumps, tanks, supports, foundations, dikes, and drainage ditches. Records should be kept to determine if changes in preventive maintenance or good housekeeping procedures are necessary.

Material storage areas for dry chemicals should be inspected for evidence of, or the potential for, wind blowing which might result in significant discharges.

Liquid storage areas should be inspected for leaks in tanks, for corrosion of tanks, for deterioration of foundations or supports, and for closure of drain valves in containment facilities. Inspections could include the examination of seams, rivets, nozzle connections, valves, and connecting pipelines. Storage tanks should be inspected for evidence of corrosion, pitting, cracks, abnormalities, and deformation and such evidence should then be evaluated.

For in-plant transfer and materials handling of liquids, inspections should include visual examination for evidence of deterioration of pipelines, pumps, valves, seals and fittings. The general condition of items such as flange and expansion joints, pipeline supports, locking valves, catch or drip pans, and metal surfaces also should be assessed.

For loading and unloading operations, inspections during transfer of materials would permit immediate response if an incident occurred. The conditions of pipelines, pump, valves, and fittings for liquid transfer systems and pneumatic conveying systems used for transferring dry chemicals should be inspected. Inspections (together with monitoring) should be used to ensure that the transfer of material is complete before flexible or fixed transfer lines are disconnected prior to vehicular departure. Before any tank car or tank truck is filled, the lower most drain valve and all outlets of such vehicles should be closely examined for evidence of leakage and, if necessary, tightened, adjusted, or replaced. Before departure, all tank cars or tank trucks should be closely examined to ensure that all transfer lines are disconnected and that there is no evidence of leakage from any outlet.

For plant runoff, inspect the integrity of the stormwater collection system and the diversion or overflow structures, and ensure that the drain valves and pump for diked areas are properly closed. The plant sewer and storm sewer system should be periodically surveyed to ensure that toxic and hazardous pollutants are not discharged in significant amounts. Inspections also should include diked areas to ensure that hazardous and toxic chemicals are not discharged from inside diked areas to waterways. Any liquid, including rainwater runoff, should be examined, and where necessary, analyzed, before being released from the diked areas to a receiving water. The permit should include site-specific methods for determining whether rainwater has received contamination. For examples, a facility handling acids could check to see that the pH of the rainwater is close to neutral, or a facility handling oils could check for sheen on the rainwater before discharge. If inspection reveals any indication of contamination, then the rainwater must be analyzed and properly treated before discharge.

Visual inspections should include examinations for leaks, seepage, and overflows from land disposal sites such as spray fields, pits, ponds, lagoons, and landfills. Other procedures and inspection techniques should be considered on a site-specific basis. Any inspections made or records kept to comply with a solid waste permit may be included in the BMP plan by reference.

Emergency equipment and supplies for spill control or fire fighting must be inspected to ensure that equipment is in good condition and supplies are adequate. The communication system must also be inspected.

3.4.11 Security

A security system is needed to prevent accidental or intentional entry to a plant which might result in vandalism, theft, sabotage or other improper or illegal use of plan facilities that could possibly cause a BMP incident. Most plants have security system to prevent unauthorized entry leading to theft, vandalism, sabotage or a spill. The BMP plan should describe those portions of the existing security system which ensure that chemicals or other pollutants are not discharged either accidentally or deliberately to receiving waters in significant quantities.

The BMP Committee, plant security manager, plant engineer or other qualified plant personnel should evaluate the coverage of the existing security system over those areas of the plant identified by the "Risk Identification and Assessment" as having the potential for significant discharges. They should recommend to plant management any changes necessary to improve the security system.

Examples of security measures include: routine patrol of the plant by security guards in vehicles or on foot; fencing to prevent intruders from entering the plant site, good lighting; vehicular traffic control; a guardhouse or main entrance gate, where all visitors are required to sign in and obtain a visitor's pass; secured or locked entrances to the plant; locks on certain valves or pump starters; and television surveillance of appropriate plant sites, such as plant entrance, and loading and unloading areas.

Whenever possible, security personnel should be instructed to observe leaks from tanks, valves, or pipelines while patrolling the plant and also be informed of the procedures to follow when a spill or other discharge is detected. Many plants use contractor or plant security personnel who may not be qualified or may not have time to carry out such surveillance. In such cases, the surveillance can be incorporated in the "Inspection and Records" specific requirement and should be conducted by production or environmental staff.

3.4.12 Employee Training

Employee training programs should result in personnel, at all levels of responsibility, having a complete understanding of the BMP plan. Employee training meetings should be conducted at least annually to ensure adequate understanding of the objectives of the BMP plan and the individual responsibilities of each employee. Typically, these meetings could be a part of routine employee meetings for safety or fire protection. Such meetings should highlight previous spill events or failures, malfunctioning equipment components, and recently developed BMP precautionary measures. Training sessions should review the BMP plan and associated procedures. Just as fire drills are used to improve an employee's reaction to a fire emergency, spill or environmental incident drills may serve to improve the employee's reactions to BMP incidents. Large or complex facilities are required to conduct spill drills on a quarterly or semi-annual basis. Smaller facilities are strongly encouraged to conduct spill drills too. Spill drills also serve to evaluate the employees' knowledge of BMP-related procedures, and are a fundamental part of employee training.

Adequate training in a particular job and process operation is essential for understanding potential discharge problems. Knowledge of specific manufacturing operations and how discharges could occur, or have occurred in the past, is important in reducing human error that can lead to BMP incidents.

The training program must include the protocol used to report discharges to the people responsible for implementing countermeasures. In addition, personnel involved in spill response should be trained to use cleanup materials such as sorbents, gelling agents, foams, and neutralizing agents. They should also be educated in safety precautions, in the side effects of the chemicals they are working with, and in possible chemical reactions. Operating manuals and standard procedures for process operations should include appropriate sections on the BMP plan and the spill control program and must be readily available for reference.

The BMP plan must contain records showing the dates, names and positions of the employees trained and also include the lesson plans, subject material covered, and instructors' names and positions. BMP-related training may be combined with other forms of training, such as safety, fire prevention, or RCRA required training.

In addition to permanent personnel, contractors or temporary personnel should be trained in procedures for preventing BMP incidents since these individuals may be unfamiliar with the normal operating procedures or location of equipment (pipelines, tanks etc.) at the facility. Adequate supervision of contractor maintenance personnel should be provided to minimize the possibility of BMP incidents resulting from damaging equipment such as buried pipelines. This supervision or training must be described in the BMP plan.

3.5 Specific BMPs

Ecology has developed specific BMPs for vehicle and equipment washing (Ecology 95-056) and for prevention of pollution from stormwater discharge in stormwater management and design manuals available here:
https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Stormwater-manuals

3.6 Spill Plans

3.6.1 General Requirements

Most wastewater discharge permits for industrial facilities include a requirement to prepare and implement a spill plan. Industrial facilities discharging to a municipal wastewater treatment plant are usually also required to prepare and implement a slug discharge control plan. Facilities that treat their own wastewater should also consider preparing a plan. These plans are intended to prevent or minimize the impact of a spill.

This section describes common sources of spills, prioritization of spill potentials, and typical methods for limiting spills. Most are common sense, too often recognized only in hindsight. A short outline of a spill plan follows the discussion of what to look for when developing the plan and suggestions for how to limit and manage spills.

There are federal regulations that require spill plans for some facilities (e.g. Spill Prevention, Control, and Countermeasure (SPCC) Rule). Ecology's Spills Program lists other requirements here: https://ecology.wa.gov/About-us/Get-to-know-us/Our-Programs/Spills-Prevention-Preparedness-Response.

There are also regulations governing the cleanup of spills of materials that designate as hazardous or dangerous waste that must be followed. There may also be requirements from fire departments, emergency management agencies, etc., governing management of spills or leaks of flammable or toxic materials.

Some requirements of other agencies are consistent with the expectations required by the wastewater discharge permit, others will not include protecting water quality after the fire or toxicity hazard has been addressed. Plans that address impacts on water quality (including discharges to sewers) may be incorporated into the spill plan. A plan addressing water quality should mesh smoothly without interfering with fire and safety concerns.

Water quality concerns from spills include contamination of surface and groundwater and interference with the operation of a wastewater treatment plant. For example, fruit juice and concentrate are biodegradable, which requires the consumption of oxygen. When the amount of juice spilled is too great, the amount of oxygen consumed can result in dead fish in surface water, overloading aeration equipment at a wastewater treatment plant, or changing the groundwater chemistry from aerobic to anaerobic. Water quality changes can range from unpleasant to unhealthy and result in violations of standards.

3.6.2 Planning for a Spill Plan or Slug Discharge Control Plan

Responsibility for overseeing the plan must be at a level in the organization with the authority to obtain adequate resources, and the ability to commit the time required. It should be overseen by someone with at least broad familiarity with all operations at the site.

To develop a spill or slug control plan, potential sources of spills or slug discharges must be identified and the probable magnitude of the impact of a spill estimated. For example, a spill of one gallon of juice concentrate down the drain to the sewer is probably not much of a problem. Discharge of a thousand gallons would be likely to cause a treatment plant upset at small to medium size plants (the BOD load from such a spill is equivalent to the discharge from several thousand residences). Meanwhile, one gallon of concentrated acid or caustic can significantly affect the pH of one million gallons of water and cause an upset in a moderate sized treatment plant. Toxic chemicals such as biocides and concentrated solutions of metals can also cause significant impacts from even smaller discharges.

In the plan, chemicals used on site, raw materials, products, and waste solutions should be listed in groups: highly toxic, moderately toxic, non-toxic with high BOD, through to clean water. Don't forget to include fuels, refrigerants and fluids in heating and cooling systems. The level of security in handling and storing the moderately toxic group can be less than that for the highly toxic group. The toxic groups will require plans for managing spills (or disposing of material no longer needed) as hazardous or dangerous waste.

Materials in the low toxicity or non-toxic group with high BOD concentrations, if present in large volumes, must be managed to prevent slug discharges. They should also be managed to minimize spills to keep wastewater treatment costs down. Spills due to failure of a water pipe or a boiler can also be a problem and may pick up other spilled material. All spills represent money wasted, the value of the material wasted and the cost of cleanup.

For many chemicals it is cost effective to buy a year's worth of material in a single drum rather than many smaller containers. This may be especially true when the cost of cleaning and properly disposing of many, non-returnable containers is included in the calculation. Bulk purchase should be balanced against the potential impact of spilling the larger container or the risk of spillage when transferring from the bulk container to a working container. Bulk storage vessels should always be provided with secondary containment. Proper design of storage areas and transfer facilities can capture the savings of buying in bulk without the risk of a major spill.

For each chemical, or group of chemicals with similar uses, the typical and highest usage rates should be determined. The quantity of chemical at risk for spillage (e.g. in high traffic area) should be limited, to the amount typically used during one shift or one week. It may make sense to measure out the amount needed in a storage and dispensing facility rather than measuring the required amount near where it is needed. The smaller quantity at risk of spillage may be offset by the increased number of transfers, but proper procedures and equipment can reduce this risk.

For some materials, it may be appropriate to pipe chemicals from a secure storage area to where they will be used. Proper design of the pumps, alarms, valves and piping is required. Properly designed storage areas will minimize the risk of accidents, such as a fork lift knocking over or puncturing a drum. Well-designed transfer facilities will minimize the risk of spillage when filling a smaller container. This can be accomplished by providing no pathway for spills to reach a drain, sewer or ground, insuring there are hooks or other devices to hold hoses so they drain back into the main container without drips the risk of creating a siphon, using drip pans, and providing ready access to spill containment and clean up supplies. Pumps equipped with automatic shut off (by volume, sensing the level in the receiving vessel, or time) can reduce the risk of a spill due to inattention when filling the vessel takes a long time.

In the plan, a general level of control and containment should be developed for each group of materials with a similar level of potential risk.

Very toxic materials should be stored under lock and key with access limited. The amount taken out of storage should be limited to the amount needed for "immediate" use. Special attention should be paid to transfer equipment and procedures and clean up. Training on proper transfer and clean up procedures and reporting in the event of a spill is important. Cleaning containers should be done in a manner that results in utilization of the residue rather than disposal. For expensive or easily misused chemicals, access control can be an effective way to regulate usage as well.

Materials used or generated in large volumes with minimal toxicity, but the potential to cause an upset or significant water quality violations if spilled, should be stored in areas with secondary containment. For example, the cold room housing juice tanks can be designed to perform this function provided you pay attention to floor drains used for cleaning up small spills. Small spills can be washed down the sewer using the minimum volume of water. Diluting the spill generally only increases the impact. Instead of just a BOD problem there would also be a flow problem. When in doubt, call the wastewater treatment facility operator.

3.6.3 Common Sources of Spills

The sources of spills of concern for water quality include: chemicals used in the process, lubricants, fuels and other petroleum products, some refrigerants (especially ammonia) and working fluids in heating or cooling circuits (antifouling agents, antifreezes, etc.), in some cases the product itself (e.g. fruit juice or concentrate), and waste materials. The charging station for battery powered forklifts is another area of concern, spills from broken batteries or overflows due to problems during charging are likely to designate as hazardous waste and are not to be discharged to surface or groundwater or to a wastewater treatment system.

Transfer facilities where small volumes are transferred can be equipped with drip pans, spill containment and clean up kits. Facilities for transferring large volumes (e.g. between storage tanks, loading or unloading tanker trucks) involve high flow rates and large volumes of liquid in the hoses used. Making certain that hose connections are secure is critical. Monitoring for leaks should be required whenever toxic or flammable materials are being transferred. The transfer facility should be equipped with automatic shut off devices that sense when the receiving vessel is approaching full or when a connection or hose has failed. Timers or flow meters that limit how long a pump can run to less than the time required to fill the vessel are also useful.

Hoses should be purged or drained into either the source or receiving vessel before being disconnected. If the hose needs to be cleaned, procedures for doing this should be established that satisfy the safety and sanitation requirements for the product and minimize the impact of discharge from cleaning. Transfers of bulk fluids to or from trucks or rail cars are often out-of-doors, paved, and equipped with a storm drain. The storm drain should be blocked during the transfer and spills cleaned up and disposed of properly before unblocking the drain. Spills must not be washed into a storm drain. Storm drains usually discharge to surface or groundwater and this would constitute an illicit discharge.

Fuel facilities are a special case of transfer facilities. Secondary containment is usually present, but may be defeated by running the filling pipes through the wall of the containment so that failure of the valve or breaking the pipe would bypass the containment (this is especially a problem if there is no air break in the fill pipe) or having the delivery system (pump, meter or hose) outside of the containment. Put the hose holder where the hose and nozzle are above the secondary containment not draped on the outside.

Heating and cooling systems can use chemicals that cause problems if spilled: ammonia, antifreeze, anti-scaling and anti- fouling agents are typical. Food grade glycol or oils have high COD concentrations and can cause harm to surface or groundwater or overload a treatment facility if spilled. Anti-scaling and anti-fouling agents are usually toxic to aquatic organisms, including the organisms in wastewater treatment facilities.

Ammonia is a gas at ordinary temperatures and pressures, but is typically stored at a pressure such that the ammonia is liquid at room temperature. The priorities when there is an ammonia leak are usually human health and fire hazard. A mist of water will "knock down" ammonia by absorbing it, controlling the human health and fire risks. The resulting ammonia solution is toxic to aquatic organisms and may overload or poison a wastewater treatment system. Ammonia solutions can also lead to groundwater pollution. Ammonia spills are often the result of draining a refrigeration system. Bulk ammonia removed for routine maintenance can be stored in rented tanks or sold. Small quantities of ammonia can be absorbed into water, adding a mild acid will increase the effectiveness. Disposal of this water must be to a treatment facility, with the approval of the treatment facility, or used as a fertilizer at agronomic rates to prevent accumulation in the groundwater and in a manner which prevents volatilization.

Water leaks can overwhelm a sewer collection system or wastewater treatment plant or reduce the effectiveness of treatment. Hot water leaks can create a risk of injury to workers, damage sewers and interfere with treatment. Cold water, such as stormwater from roof drains, can interfere with treatment by dilution or cooling, both of which reduce the efficiency of wastewater treatment.

3.6.4 Preventing Spills

Checking for leaks – Pipes, tanks, pumps, valves and hoses should be checked regularly for evidence of leaks, loss of strength (e.g. abrasion or cracks) or other indications of potential failure. Secondary containment vessels should be checked regularly for evidence of leaks or spills from the primary container. They also should be checked for evidence of weakening or corrosion (for example, plastic vessels in sunlight and steel vessels in contact with water) or punctures or other damage. Secondary containment vessels outside should be checked regularly for accumulation of stormwater. The inventory in tanks should also be checked regularly for evidence of leaks.

Stopping a spill in progress – This could include turning off a pump, close valves on both sides of broken pipe or hose, applying a "bandage" to a ruptured tank, hose or pipe, turning a barrel upright, etc.

Capturing spills – Areas with a high probability of spills or a large impact due to failure of a storage vessel should be provided with drip pans and secondary containment. The drainage system should be reviewed for opportunities to capture spills before discharge to surface or groundwater or a sewer. These include using sand bags, rubber drain stoppers (flexible sheets to put over screened drains), plugs, slide gates, etc., to block trench drains, pipes and basins with gravity overflows. Also consider turning off pumps so that a float switch does not turn the pump on and cause discharge.

Contractors – Make arrangements with a company licensed for managing hazardous waste for emergency response. Have a list of local contractors (e.g. septic haulers) who have equipment to pick up spills and knowledge of proper disposal options, consider establishing a contract for emergency services so that clean up is not delayed by haggling over costs. Have potential clean up contractors walk through facilities and prepare a response plan and how duties and responsibilities will be divided.

Cleaning and rinsing procedures – should be established for pipes, hoses, tanks, buckets, etc. Rinsing and cleaning result in diluted product and cleaning chemicals, which are often discarded. By carefully planning and monitoring these procedures, it is possible to save product or reduce the use of chemicals. When transferring materials, drain hoses if possible before rinsing. Provide a place to hang a hose to allow it to self-drain appropriately if possible. Consider using air to purge pipes and hoses of the bulk of a liquid before washing.

Mists and high velocity/low volume (pressure washers) can be effective at rinsing, with minimal dilution of the material; this is especially valuable if the product can be used, potentially by blending the rinse water into the bulk, if only slightly diluted. For example, by using a device such as a refractometer, it may be practical to identify rinsewater from cleaning a concentrate line that is still more concentrated than raw juice and worth returning to the process. Disinfection chemicals lose effectiveness through dilution and reaction. By using the disinfection solution from the previous cleaning cycle (if it is safe to do so) as a pre-rinse, the amount of chemical used for the final can usually be reduced.

When cleaning floors, parking lots, etc., after a spill, clean up as much as possible before washing. Use as little water as possible for discharges to treatment plants, extra water typically increases the difficulty of treatment. Do not discharge to ground unless approval from Ecology has been obtained first. Do not discharge to storm drains, surface water, or a dry well.

Clean Up, Start Up, and Shut Down Procedures – Many industries operate several days with routine cleaning and then have a major cleaning cycle. For seasonal industries there is usually a start up and shut down procedure which generates additional cleaning solutions. While these are not "spills", they often result in discharges which are different from the normal discharge. Increased discharges of detergents, disinfectants and other cleaning aids as a result of these periodic activities can adversely affect wastewater treatment facilities, the wastewater treatment operator should be consulted on the need to change compounds (e.g. the plant experiences excessive foaming on Saturdays following cleaning) or restrict the rate of discharge. Make sure that tanks, pipes, etc., have been drained and consider pumping out settled solids before cleaning.

Training – All employees responsible for managing liquids and toxic solids, including staff who maintain equipment, and supervisors, must receive training in spill prevention and clean up.

3.6.5 Example Spill Plan

Spill Control Plan
for
[company name, division and address]

Responsible Official:
Title:
Telephone:

Titles of persons responsible for overseeing daily implementation of plan:

Telephone numbers to call when a spill occurs:

- Spill information hot line (your chemical supplier probably has an 800 number or uses a national spill information hot line)
- Fire Department
- Police Department
- Department of Ecology spills report line (https://ecology.wa.gov/About-us/Get-involved/Report-an-environmental-issue/Report-a-spill)
- Spill response team:
- Spill cleanup contractors:

Training (who is responsible for training, who requires training, frequency)

Inventory of materials of concern

- Organized by hazard class (toxic, flammable, etc.)
- Organized by location (chemical storage area 1, cold storage room, laboratory, etc.)

Spill control information:

Map of site with areas where spills are most likely to occur, drains (floor and storm), valves, pumps and switches, and other control structures to contain spills, paved areas and drainage patterns for outdoor spills, and spill containment and clean up equipment. Include sanitary and storm sewers, ditches, drains and streams on site and on adjacent property.

Procedures for managing spills (by category or location)

- Toxic (pay attention to worker safety, hazardous waste regulations; minimize quantity lost to drain or ground)

- Flammable (control fire hazard, contain water or foam used for fire control and obtain approval of Ecology and wastewater treatment system before disposal if possible)
- High BOD strength (capture as much as possible for use as cattle feed, composting, etc.; obtain approval and discharge schedule from treatment plant before discharging to sewer; obtain approval from Ecology before land application; do not discharge to a ditch)
- Water (shut off water source; keep toxic materials out of flood; obtain approval from wastewater treatment plant or Ecology as appropriate before discharging; limit discharge rate to sewer or drain; cool hot water before discharge; neutralize chemicals used for controlling fouling if appropriate)

Elements to be included in written report submitted to Ecology following spill:

- Time and date of spill
- Person(s) responding to spill
- Nature of spill (type of material, amount, cause, impacts [sewer, ground, surface water])
- Clean up (how was accomplished, where material was disposed of)
- Follow up (actions that will be taken to limit potential for recurrence, improvements to response plans, etc., changes in training program)

3.6.1 Spill Plans Required by Others

Some facilities are required by other laws to have spill plans. The following Table 37 lists the facilities that are required to have spill plans for oil and petroleum products under RCW 90.56. These spill plans are reviewed by the Spill Program.

Table 36. Facilities Covered by the Spill Program's Facility Oil Handling Regulation, for oil spill prevention planning/Chapter 173-180 WAC

Plan ID*	Facility Name
NW006	BP West Coast Products Terminal, Seattle
NW029	Rainier Petroleum, Seattle
NW008	BP Cherry Point Refinery, Blaine
NW011	ConocoPhillips Refinery, Ferndale
SW004	Tesoro Terminal, Port Angeles
NW005	ConocoPhillips Terminal, Renton
SW002	ConocoPhillips Terminal, Tacoma
NW002	Tesoro Northwest, Anacortes
NW020	Shell, Seattle
SW003	NuStar, Vancouver
SW013	Sound Refining, Tacoma
ER006	Chevron Pipeline, Pasco
SW010	ST Services, Tacoma
NW007	Paramount Petroleum Richmond Beach Terminal, Seattle
SW005	Tesoro Terminal, Vancouver
ER002	Chevron USA, Pasco
NW003	Shell Refinery, Anacortes
ER003	Tidewater Terminal, Clarkston
ER004	Tidewater Terminal, Pasco
NW009	Kinder Morgan Energy Partners Terminal, Seattle
NW016	Terasen Pipeline, Bellingham
SW009	US Oil & Refining, Tacoma
SW007	Weyerhaeuser, Longview
NW004	Manchester Naval Fuel Depot, Manchester
SW017	McNeil Island Corrections Center, Steilacoom
NW014	Naval Air Station, Whidbey Island
ER007	Yellowstone Pipeline, Spokane

* The plan ID indicates which region is reviewing the plan. Copies of those plans are available at that regional office. Copies of all plans are available at HQ by contacting the Spills Program.

4. Certified Operators at Industrial Sites With Domestic Wastewater Treatment Facilities

Many industrial facilities have small domestic wastewater treatment facilities at the site or treat small quantities of domestic wastewater with the industrial wastewater. The personnel who work at these treatment facilities must be certified in accordance Chapter 173-230 WAC (Certification of Operators of Wastewater Treatment Plants). This regulation was primarily intended for municipal wastewater treatment plants but it applies to any wastewater treatment plant treating domestic wastewater. The level of certification ranges from OIT (operator-in-training) to Group IV. The level of certification required is in accordance with the size and complexity of the wastewater treatment facility. Wastewater discharge permits for industrial facilities treating domestic wastewater should include a requirement for a certified operator. Permit managers who are uncertain of the classification of a facility should call the operator certification coordinator, for assistance. Inspections of these facilities should verify the operator is certified and that the certification is of the proper level.

Chapter 13. Monitoring Guidelines

This chapter presents guidance and provides the technical references and the few statutory references which a permit writer should consider when establishing the special permit conditions for frequency of sampling, sample types, sampling locations and the analytical methods in a wastewater discharge permit. The eight sections of this chapter include:

1. The general considerations of self-monitoring.
2. POTW monitoring (excluding land treatment).
3. Industrial and commercial facility monitoring.
4. WET testing monitoring.
5. Stormwater monitoring.
6. Receiving environment monitoring.
7. Sediment monitoring.
8. Summary checklist.

> "Monitoring is truly the cornerstone of the NPDES program. It is the primary means of ensuring that the permit limitations are met. It is also the basis for enforcement actions against permittees who are in violation of their permit limits."

Having so stated in the opening of its primary permit-writing training manual, EPA dedicates four pages of a 100 page training manual to the topic of monitoring (EPA, 1987d). There is little explicit guidance which provides the permit writer with a framework for decisions relating to monitoring. This chapter informs the permit writer of what methods to follow to establish monitoring conditions in a permit.

EPA directed the states to require recording and reporting of monitoring results:

> "All permits shall specify requirements concerning the proper use, maintenance, and installation, when appropriate, of monitoring equipment or methods (including biological monitoring methods when appropriate). All permits shall specify required monitoring including type, intervals, and frequency sufficient to yield data which are representative of the monitored activity including when appropriate, continuous monitoring" (40 CFR 122.48).

"In addition to §122.48, the following monitoring requirements:

(1) To assure compliance with permit limitations, requirements to monitor:

- (i) The mass (or other measurement specified in the permit) for each pollutant limited in the permit;
- (ii) The volume of effluent discharged from each outfall;
- (iii) Other measurements as appropriate including pollutants in internal waste streams under §122.45(h); pollutants in intake water for intake credits under §122.45(g); frequency,

rate of discharge, etc., for noncontinuous discharges under §122.45(e); pollutants subject to notification requirements under 122.42(a); and pollutants in sewage sludge or other monitoring as specified in 40 CFR part 503; or as determined to be necessary on a case-by-case basis pursuant to section 405(d)(4) of the CWA.

(iv) According to test procedures approved under 40 CFR part 136 for the analyses of pollutants having approved methods under that part, and according to a test procedure specified in the permit for pollutants with no approved methods.

(2) Requirements to report monitoring results with a frequency dependent on the nature and effect of the discharge, but in no case less than once a year..." (40 CFR 122.44[i])

The two citations quoted above give the permit writer extreme flexibility in monitoring, from yearly to continuous. The most important requirement is that the data "are representative of the monitored activity."

Washington State regulations provide more detailed requirements:

WAC 173-220-210 (1) Monitoring.

(a) Any discharge authorized by a permit may be subject to such monitoring requirements as may be reasonably required by the department, including the installation, use, and maintenance of monitoring equipment or methods (including, where appropriate, biological monitoring methods). These monitoring requirements would normally include:

(i) Flow (in gallons per day);

(ii) Pollutants (either directly or indirectly through the use of accepted correlation coefficients or equivalent measurements) which are subject to reduction or elimination under the terms and conditions of the permit;

(iii) Pollutants which the department finds could have a significant impact on the quality of surface waters; and

(iv) Pollutants specified by the administrator, in regulations issued pursuant to the FWPCA, as subject to monitoring.

(b) Each effluent flow or pollutant required to be monitored pursuant to (a) of this subsection shall be monitored at intervals sufficiently frequent to yield data which reasonably characterizes the nature of the discharge of the monitored effluent flow or pollutant. Variable effluent flows and pollutant levels may be monitored at more frequent intervals than relatively constant effluent flows and pollutant levels which may be monitored at less frequent intervals.

(c) Monitoring of intake water, influent to treatment facilities, internal waste streams, and/or receiving waters may be required when determined necessary by the department to verify compliance with net discharge limitations [intake credits] or removal requirements, to verify that proper waste treatment or control practices are being maintained, or to determine the effects of the discharge on the surface waters of the state...

(3) Reporting of monitoring results.

(a) The permittee shall periodically report (at a frequency of not less than once per year) on the proper reporting form, the monitoring results obtained pursuant to monitoring requirements in a permit. In addition to the required reporting form, the department at its discretion may require submission of such other results as it determines to be necessary." [WAC 173-220-210]

WAC 172-216-110 (1) Any permit issued by the department shall specify conditions necessary to prevent and control waste discharges into the waters of the state, including the following, whenever applicable:

(g) Any appropriate monitoring, reporting and recordkeeping requirements as specified by the department, including applicable requirements under sections 307 and 308 of FWPCA.

The nature and effect of the discharge are important factors in determining monitoring frequency and so it is important that the discharge be adequately characterized. The permit writer should recognize the costs of monitoring while deciding how much is enough for an adequate characterization.

Consulting with individuals, including the permittee, who are knowledgeable about the facility or type of operation will save time on appeals, enforcement and future permit renewal or modification efforts. A prime source of information about a facility is the inspector who deals with the facility or similar facilities.

1. General Considerations of a Self-Monitoring Program

The general considerations apply to all facilities in the wastewater permit program administered by the Washington State Department of Ecology. Exceptions and additional considerations are explained in the chapter sections for POTWs, industrial facilities, stormwater and for receiving environment monitoring. The general considerations are presented in this section in the following sequence:

- Objectives of monitoring
- Parameters to monitor
- Frequency of monitoring
- Special monitoring strategies
- Sampling and testing methods
- Sampling locations
- Data validation, management and reporting
- Quality assurance and quality control

All permits must require monitoring of effluent in order to determine if the facility is in compliance with the permit. The permit must state the sampling location, frequency, methods of analyses, and sample type for each parameter with limits. Parameters without limits may be monitored as required by the department. Internal process control monitoring may be required of dischargers exhibiting noncompliance. Tiered monitoring and indicator parameters should be used when appropriate.

The variability of the effluent is one of the most important factors in establishing monitoring frequency, particularly for industrial dischargers, and therefore the degree of monitoring frequency is dependent on the characterization of the effluent. The characterization should ideally occur as a part of the renewal or application process. A high frequency monitoring study is presented as a means of effluent characterization. High frequency monitoring, usually within a tiered framework or as a special study, is recommended to characterize effluent.

1.1 Establish Monitoring Objectives

The main purpose of self-monitoring requirements is to determine compliance with effluent limits and other permit conditions. Monitoring may also be required in order to gather information necessary to derive an effluent limit, determine if a limit is necessary, to determine impacts on the receiving environment, or to support implementation of a TMDL.

The parameters, frequency of monitoring, and sampling locations for POTWs are listed in Tables 36 (A-E) and 37 (A-M). The limits and monitoring strategies for POTWs are standardized and based on Best Conventional Treatment for pollutants generally associated with municipal sewage treatment plants (Section 2. POTW Monitoring). Industrial or commercial facilities which have the same type of treatment system, in particular a secondary biological process, should receive similar monitoring requirements for the pollutants listed. POTW monitoring frequency for permit conditions based on water quality standards and toxic discharges must be derived separately.

Discussion and guidance on requirements for monitoring compliance with whole effluent toxicity are found in Section 4. The permit writer should use the guidance presented in this chapter to determine the monitoring frequency, the level of detail required and the relevancy of the testing results toward evaluating the potential for environmental harm from the effluent.

The permit writer should be able to justify the monitoring requirements on the basis of the value of the data. Know how the data may be used. The most useful, valid and cost-effective data are generated when the purpose or monitoring objectives of monitoring are understood. Some general objectives include:

- To determine compliance with technology-based and water quality-based effluent limits.
- To determine adequacy of O & M procedures.
- To determine specific impacts on water or sediment quality.
- To determine effectiveness of source control measures and BMPs.
- To determine baseline or background conditions in the receiving environment.

- To determine the variability of the wastewater as a prerequisite to establishment of monitoring schedules.
- To characterize the wastewater for determining the need for additional limits.

1.2 Parameters to Monitor

All parameters with effluent limits must have monitoring requirements. Additional parameters to monitor will depend on the monitoring objectives explained previously.

Monitoring flow rates is important for determining loading and is required in all NPDES permits [40 CFR 122.44(i)]. Methods and techniques of flow measurement are explained in the *Water Quality Inspection Manual*, Ecology, 1992.

When monitoring metals use the term total metals, not total *recoverable* metals. EPA determined that total metals are equivalent to total recoverable metals. For the determination of total metals the sample is not filtered before processing. A digestion procedure is required to solubilize analytes in suspended material and to break down organic-metal complexes. Regardless of the digestion procedure used, the results of the analysis after digestion procedure are reported as ‘‘total’’ metals [40 CFR Part 136.3 Table 1B Note 4].

1.2.1 Effluent Monitoring

The pollutant parameters to be monitored in effluent are based on application data, history of the facility discharge, pollutants discharged from similar facilities and any applicable EPA development documents. Minimum parameters for POTWs are outlined in Section 2.

The permit may require monitoring of pollutants in the effluent for reasons other than to determine compliance with effluent limits. The general objectives stated in section 1.1 contain many objectives other than the compliance objective. For example, the objective "to determine effectiveness of source control measures" only indirectly determines compliance. BMPs may be followed as required in the permit but the BMPs may not be adequate to prevent undesirable effects. The monitoring becomes a feedback mechanism to fine tune the BMPs. Another important objective is to gather information to determine if further effluent limits are necessary. The authority to require monitoring is derived from Section 308 of the FWPCA and 90.48.260 RCW.

The discharger may be required to monitor for pollutants which the permit writer knows or suspects to be present in the discharge, even those not listed in the permit application. Additional parameters to monitor include toxic chemicals or substances that could upset the treatment system. These substances could be introduced from raw materials, compounds resulting from chemical interactions, or impurities in raw materials including solvents.

1.2.2 Process Control and In-Plant Monitoring

"Monitoring of intake water, influent to treatment facilities, internal waste streams, and/or receiving waters may be required when determined necessary by the department to verify compliance with net discharge limitations [intake credits] or removal requirements, to verify that proper waste treatment or control practices are being maintained, or to determine the effects of a discharge on the surface waters of the state." (WAC 173-220-210(1)(c))

Process control monitoring refers to monitoring of internal waste streams in order to verify that proper waste treatment or control practices are being maintained. In-plant monitoring refers to monitoring at internal sample points due to the inability or impracticality to apply limits or conditions at the typical point of compliance.

Process Control Monitoring

Process control monitoring may be included in an enforcement order when a facility has been out of compliance with its permit. Process control monitoring should not be a requirement in the permit in most circumstances. The permit manager may select certain internal waste streams for monitoring which can generate data to assist the discharger in efficient operation of the treatment system. An enforcement order may also specify monitoring to assist in identifying pollutant sources. Reasonable cause for internal process control monitoring includes:

- Enforcement action for permit noncompliance when the monitoring is intended to identify the source or cause of noncompliance.
- Evaluating pollutant inputs from various functional areas of the facility as part of a Toxicity Identification Evaluation (TIE), a BMP for pollutant identification or quantification or the application of a performance standard for a process employed.
- Other circumstances to verify that proper waste treatment or control practices are being maintained (e.g., the certification period for a grant related project or as a condition of a demonstration or experimental project)

The wastewater treatment process will determine the types of process control monitoring needed. For industries with biological treatment systems and wastewater characteristics and flows that are similar to comparable POTWs, the monitoring frequency can follow the schedules of Table 37(A-M). For physical and chemical treatment systems, the permit manager should review any development document for the industrial category, the treatability manuals and other engineering literature for information regarding parameters to use for process control monitoring.

In-Plant Monitoring

Under both federal (40 CFR 122.45[h]) and state regulation (Chapter 173-220-210 [1][c] WAC), in-plant monitoring may be required as a permit condition. In-plant monitoring for industries may be required at the discretion of the permit writer when reasonable cause exists and the cause is explained in the fact sheet. In-plant monitoring may be required:

- When the sample at final discharge is not characteristic of undiluted effluent because of dilution from other parts of the plant (and to determine whether the waste flow is being diluted to meet effluent limits).
- When interferences among pollutants at the point of discharge would make detection or quantification impractical.
- When the final discharge point is inaccessible (but make every effort to require accessibility).
- When determining chlorination efficiency.

1.2.3 Indicator Parameters

Indicator parameters may be used in certain instances when a close correlation exists between concentrations of pollutants in a wastestream. Indicator tests or observations can be useful in determining the effectiveness of the treatment process. Indicator parameters can be used only for well documented processes where the effluent concentration of an easily measured component parallels the concentration of a component more difficult to measure or detect. The correlation must be consistent over the range of varying raw material input to the system. A treatment process that reduces the concentration of the indicator in equal or less proportion to the contaminant of concern is essential.

Limits on indicators may not be used as a substitute for federally promulgated technology-based limits or limits developed on a case-by-case basis on parameters in the discharge. Contaminants of interest in the effluent for which no limits are specified can be monitored by an indicator when a positive correlation is established. There are correlations between some parameters which allow tests for one parameter to indicate the relative value of another parameter. A procedure for calculating correlations is located in the *Handbook for Sampling and Sample Preservation of Water and Wastewater*, EPA, 1982b, p.146. Computer software packages such as Excel™, the agency standard spreadsheet software calculates correlation coefficients. In many cases significant correlations exist between the following parameters:

- BOD and TOC
- Chlorides and Conductivity
- Total Dissolved Solids and Conductivity
- Acidity, Alkalinity and pH
- Hardness, Calcium, and Magnesium

Besides the cost considerations, indicator tests are also advantageous if they give quicker feedback for process control testing. An example would be analyzing TOC instead of 5 day BOD if a reasonably consistent mathematical relationship is established through special comparison studies. BOD is not always the most useful indicator of oxygen demand because of the long incubation time required to obtain a meaningful result. Once a correlation has been established, the TOC measurements can be translated to BOD. *Monitoring the effluent for an indicator cannot substitute for monitoring on a parameter which has an established effluent limitation.*

The utility of an indicator must be explained in the fact sheet. The explanation should be based on:

- Similarities between causative pollutants and a convenient monitoring parameter (e.g., monitoring Total Petroleum Hydrocarbon to indicate control of polynuclear aromatic hydrocarbons where the removal technology equally reduces the concentration of both or preferentially reduces the PAH component).
- The effectiveness of a particular treatment process and a control parameter for that process (e.g., limits on TOC to ensure proper performance of an activated carbon process).

Indicators might be appropriate for an industry that generates a waste stream containing metals in which the relative concentration of metal pollutants does not vary because of consistent raw material composition and internal process control. An internal process control parameter could be monitored to assure process stability. One metal could serve as an indicator for most other metals. TSS has been used by EPA as an indicator of toxics for some effluent guidelines.

Where there is no water quality criterion for a specific pollutant which causes or contributes to an excursion above a narrative criterion, the permit writer may establish effluent limits and monitor an indicator parameter. The permit should require all effluent and ambient monitoring necessary to show that the limit on the indicator continues to attain and maintain applicable water quality standards [40 CFR 122.44(d)(1)(vi)(C)].

1.3 Monitoring Frequency

"Each effluent flow or pollutant...shall be monitored at intervals sufficiently frequent to yield data which reasonably characterizes the nature of the discharge of the monitored effluent flow or pollutant. Variable effluent flows and variable pollutant concentrations may be monitored at more frequent intervals than relatively constant effluent flows and pollutant concentrations which may be monitored at less frequent intervals" [WAC 173-220-210(1)(b)]. Limited pollutants in NPDES permits must be monitored for at least once per year [40 CFR Part 122.44(i)(2)].

The frequency of sampling should result in the production of data that provide a reasonable characterization of the effluent. Reasonableness can be demonstrated on the basis of the value of data collected. A primary value of the data is the establishment of effluent variability, an important factor in calculating discharge limits, determining compliance and establishing the basis for monitoring frequency. Routine compliance monitoring frequency may be adjusted to reflect the variability. The intent is to establish a frequency of monitoring which will detect most events of noncompliance without requiring needless or burdensome monitoring.

For example, at equivalent average flow rates, a large lagoon system which is not susceptible to short circuiting requires less frequent monitoring than an overloaded treatment facility which experiences fluctuating flow rates due to infiltration or large batch discharges from an industrial user on the system. The large lagoon should have a relatively low coefficient of variation (CV = population standard deviation divided by the population mean: sd/mean) compared to the facility receiving batch discharges.

1.3.1 Establishing Monitoring Frequency

The frequencies for monitoring pollutants from a POTW with limits based on a performance standard are presented in Section 2 of this chapter. The permit writer should consider these as minimum frequencies.

The frequencies for monitoring pollutants for informational purposes, for performance-based limited pollutants from non-POTWs or for water quality-based effluent parameters from any facility should be derived at the discretion of the permit-writer by one of the two following methods.

Method 1. Estimate the variability of the concentration of the parameter by reviewing DMRs and the record of similar dischargers. In addition to the estimated variability, other factors for determining sampling frequency include:

- Size and design capacity of facility
- Type of treatment
- Compliance history
- Number of pollutant sources from a facility
- Cost of monitoring relative to the discharger's capability and benefits obtained
- Environmental significance of pollutants
- Receiving water quality (including dilution effects)
- Detection limits and analytical precision/accuracy
- Production schedule of the facility (seasonal, daily, etc.)
- Plant wash down or cleanup schedule
- Number of monthly samples used in developing the permit limit
- Batch type process and discharge or continuous operation

These factors and other facility-specific factors used to determine monitoring frequency should be presented and discussed in the permit fact sheet.

Method 2. See Appendix D.2

1.3.2 Tiered Monitoring

The *Puget Sound Water Quality Management Plan*, Puget Sound Water Quality Authority, 1991 states:

> "Monitoring requirements included in permits shall be tiered so that if initial (baseline) sampling discloses no problems, a reduced monitoring scheme may then apply. Likewise, if initial (baseline) sampling indicates the possibility of problems, a more frequent and/or more comprehensive monitoring schedule would apply. Initial monitoring schemes shall be set to ensure that enough data is collected to determine if additional discharge limits should be set."

The concept of tiered monitoring should be considered for all permits. It is a permit program goal to require sufficient monitoring to meet the objectives mentioned earlier but to avoid excessive monitoring. Tiered monitoring requires that implementation of additional monitoring methods or reduction of certain monitoring frequencies be based on the results of previous monitoring. This step-wise approach could lead to lower monitoring costs for the permittee while still providing an adequate degree of protection for the receiving environment and human health. The term "tiering" for this chapter means a reduction or increase in frequency of monitoring within a permit cycle. The conditions for increase and decrease are explained in the permit.

The recommendation at this time is to consider tiering only for parameters with established limits. Monitoring for information should be done in the context of a "Special Study" with a definite beginning and ending established in the permit.

The use of tiering should be restricted to a one-time reduction in monitoring frequency with no provision for reversion to the high frequency in the permit. If the permit manager feels that a reversion to high frequency is warranted, require the reversion through an administrative order or a subsequent permit modification (minor modification).

The application of tiering will generally be left to the judgment of the permit writer. Justification for the level or degree of monitoring required in the permit should be presented in the fact sheet. The time frames associated with establishment of the baseline monitoring period should be determined by the permit writer. The initial (baseline) monitoring period should reflect the environmental consequence and the likelihood of presence of the pollutant(s). If tiering is also used to generate variability and LTA data, these needs should be considered in establishing the schedule.

Until there is sufficient data available by the methods stated previously, require a minimum of 10 observations every month for all pollutants of concern for which there are limits specified as explained in the *TSD* (EPA, 1991). The permit writer should require that data be accumulated until the level of variability is established. One approach would be to request that semi-weekly to daily monitoring results of effluent parameters be submitted in addition to the routine DMRs during the early months of the permit cycle. Analysis of this data would indicate whether monitoring frequency can be reduced while maintaining adequate characterization of the effluent. This strategy should be explained briefly in the fact sheet. Once variability is established, monitoring frequency should be based on the confidence that effluent limit excursions will be detected.

The total cost of monitoring for toxic pollutants could be reduced by requiring a high initial monitoring frequency that is reduced if the permittee consistently meets the limit. The overall purpose of such requirements is to first establish a compliance history using a relatively high monitoring frequency and then reduce the frequency if they routinely comply with permit conditions. The requirements should be specified in the permit.

An example of a decrease in monitoring is a requirement to test for chemicals such as volatile organics monthly or bimonthly in the first year of a permit cycle, then reduction to annually if no volatiles of concern as specified in the permit are detected. This strategy may suffice if the permit writer has doubts about information presented in an application or if improvements in pollutant control are expected which reduce the likelihood of discharge of volatiles.

The triggers for the tiered elements of a permit must be well defined in the permit and explained in the fact sheet. For the above example, the simplest approach is to state the trigger in a footnote in the special condition for monitoring frequencies. The footnote should explain to what frequency the tiered parameter will revert if not detected or not found to be at a level of concern. The numeric "level of concern" must be defined in the permit and explained in the fact sheet. The reduction or elimination of monitoring should also be contingent upon the permittee requesting approval from Ecology. The regional DMR data input coordinator must be in the paper trail loop of "approval of frequency or parameter-change" in order to be able to track these changes.

It is convenient to begin the permit cycle with baseline monitoring which specifies a high frequency of monitoring for the wide variety of pollutants suspected to be present. Elimination or reduction of monitoring can be accomplished through compliance and discharge at levels of non-concern and after written approval from the permit manager.

An increase in monitoring frequency or scope of monitoring is usually more difficult to administer. The trigger for increased monitoring would need to be established and explained. Except for relatively simple triggers for additional types of monitoring or increased frequency, the recommended approach for an additional monitoring schedule is to issue an administrative order based on noncompliance with the permit. The few instances where additional monitoring may be required do not justify the resource investment involved in satisfying all possibilities or contingencies in the permit text.

A common example of an increase in monitoring is a requirement to test an effluent for toxic chemicals when the effluent violates a WET limit. This is discussed further in Chapter 6.

1.3.3 Monitoring Reduction for Exemplary Performance

Another concept related to tiered monitoring is the reduction of monitoring frequency for demonstrated good performance. This process is generally applied at the time of permit renewal and the monitoring frequency is reduced from some baseline frequency. The following guidance is adopted from EPA guidance (EPA memorandum from Robert Perciasepe and Steven A. Herman to Regional Administrators, April, 1996). The guidance is applicable to NPDES permitted discharges, State permitted discharges, and discharges to a POTW.

Criteria for Exclusion

- Facilities whose owners or operators have been criminally convicted under any Federal or State environmental statute of falsifying monitoring data or of committing violations which presented an imminent and substantial endangerment to public health or welfare will not receive any reductions. These facilities may be eligible at any time Ecology determines there has been a wholesale change in ownership and management from those convicted.
- Facilities whose owners or operators have been convicted of any other criminal violation under any Federal or State environmental statue will not receive any reductions for at least 5 years from the time of conviction.
- Facilities where an individual employed by the permittee, not the permittee itself, was convicted of a criminal violation under any Federal or State environmental statute, will be eligible for reduced monitoring frequency provided the permittee discovered and self-disclosed the violation, and took prompt action to correct the root cause in order to prevent future criminal violations.
- Facilities involved in civil environmental, judicial actions brought by the State are eligible for consideration of reduction 1 year after completion of injunctive relief and payment of penalty.

- Facilities involved in administrative actions are eligible for consideration after the permittee has complied with Administrative Order (AO) requirements, and payment of any assessed penalty. A permittee that is issued an AO, in conjunction with reissuance of its permit, to extend a compliance schedule, may be eligible if the permittee is in compliance with the interim milestones and schedule in the AO. For example, in order to comply with a newly promulgated effluent guideline, an industrial sector may be required to install a new technology. Some facilities may not be able to attain the new technology immediately so an AO is issued at the time the facility's permit is reissued. The AO sets a compliance schedule to allow the permittee additional time to install the technology needed to meet the new effluent guideline limitation.

- Facilities are not eligible for monitoring reduction for any parameter that exceeds a one percent noncompliance during the past two years. Noncompliance includes monthly average, weekly average or daily maximum. Other permit noncompliance such as failure to submit a DMR or other permit submittals should be considered before authorizing a reduction.
- Facilities are not eligible for monitoring reduction until at least one permit cycle from the time of restoration of lab accreditation if the accreditation was lost for not performing to standards.
- Facilities are not eligible for monitoring reduction until at least two years from the time of a Class II inspection in which it was found the facility was submitting invalid results. Monitoring reduction for effluent data which has not been continuously reported over the two year period, interrupted or discontinuous data, intermittent, short-term, and batch discharges must be considered on a case by case basis. These will require performance data for longer than two years to determine a long-term average. New dischargers will be eligible for reduced monitoring after meeting the two year compliance requirement. Normally, the reduced monitoring provisions would be applied after one permit cycle of five years and at permit reissuance.

Permit writers should evaluate the discharge situation when considering monitoring reduction. For example, discharges to a shellfish area should generally not be considered for reduction in fecal coliform monitoring and discharge to a core summer salmonid habitat water body generally should not be considered for reduction in toxics monitoring.

Permit writers should also evaluate the prospect of the permittee maintaining good performance during the life of the permit. A municipal treatment plant that is lightly loaded but is expected to be near capacity by the end of the permit term would probably not be meeting the performance criteria by the end of the permit term. Similarly, an industrial facility which demonstrates good performance for the past two years because of greatly reduced production would not be a good prospect for maintaining good performance if production increased during the term of the permit.

Procedures

Reduction of monitoring frequency will generally be granted at time of permit renewal by examination of performance in the two years preceding renewal. The amount of reduction is dependent upon the ratio of performance for the last two years to the monthly average effluent limitation (Table 38). The baseline monitoring frequency is discussed in Section 1.4 below.

Monitoring reduction will be granted during the permit term at the request of the permittee and as appropriate. Monitoring reduction during a permit term is a major modification and requires public notice. Each request for modification must include documentation from the permittee demonstrating eligibility. Permit managers will track the number of requests for modification and the disposition of those requests.

Table 37. Allowable Monitoring Frequency Based on Ratio of Long-Term Effluent Average to the Average Monthly Limit (AML).

Baseline Monitoring	Ratio of Long-Term Average to the AML			
	75-66%	65-50%	49-25%	<25%
7/wk	5/wk	4/wk	3/wk	1/wk
6/wk	4/wk	3/wk	2/wk	1/wk
5/wk	4/wk	3/wk	2/wk	1/wk
4/wk	3/wk	2/wk	1/wk	1/wk
3/wk	3/wk	2/wk	1/wk	1/wk
2/wk	2/wk	1/wk	2/mo	1/mo
1/wk	1/wk	1/wk	2/mo	1/2 mos
2/month	2 mo	2 mo	2 mo	1/quarter
1/month	1 mo	1/mo	1/quarter	1/6 mos

Note: See above eligibility requirements

Facilities which satisfy the entry criteria but are not experiencing discharges of 75% or less of their permitted levels of water quality-based parameters may still be eligible for reductions in monitoring/reporting frequencies. Monitoring will only be reduced for such parameters if the applicant can demonstrate a coefficient of variation (ratio of standard deviation to the mean) of 0.20 or less and no monthly average limit violation for the two year averaging period. Reduction will be allowed as shown in Table 39 below.

Table 38. Allowable Monitoring Reduction with a Ratio of Long-Term Effluent Average to Monthly Average Limit 100-76% and a CV of 0.2 or Less.

Monitoring	
Baseline	Reduced
7/wk	6/wk
6/wk	5/wk
5/wk	4/wk
4/wk	4/wk
3/wk	3/wk
2/wk	2/wk
1/wk	1/wk
2/month	2/month
1/month	1/month

Permittees that receive monitoring frequency reductions in accordance with Table 38 or Table 39 are still expected to take all appropriate measures to control both the average level of pollutants of concern in their discharge (mean) as well as the variability of such parameters in the discharge (variance), regardless of any reductions in monitoring frequencies granted from the baseline levels. To remain eligible for these reductions, the permittee may not have any violations for effluent limitations of the parameters for which reductions have been granted or failure to submit DMRs, or may not be subject to a new formal enforcement action. For facilities that do not maintain performance levels, Ecology may require increased monitoring by minor permit modification or administrative order.

Background material on the statistical derivation of the reduction allowance is presented in the original EPA memo. This material is reproduced in Appendix D. Permit writers may wish to alert permittees that this background material points out that the probability of reporting a violation increases as the monitoring frequency decreases in some cases.

1.4 Baseline Monitoring Frequencies

The permit writer must establish a baseline monitoring frequency in order to determine any allowable reduction for good performance. The baseline monitoring frequency may be established by using:

1. The POTW monitoring frequencies given in Section 2 of this chapter.
2. The original monitoring frequency in the permit before any reduction for performance was granted.
3. The statistical formulas given in Appendix D Part 2.

A baseline must be established each time a reduction in monitoring frequency is granted (usually at time of renewal). For example, the first time POTW is granted a reduction in monitoring, the baseline is the monitoring frequency in the expiring permit (assuming that the monitoring frequency is consistent with Section 2 of this Chapter). At the time of next renewal the baseline frequency would be based on the appropriate tables in Section 2 and not on the reduced monitoring frequency in the permit. Similarly, if an industrial discharger is granted a reduction in monitoring, then at the time of the next renewal the reduction is based on the original frequency before the reduction was granted or on a frequency calculated by the statistical formulas in Appendix D.

Monitoring reductions should be stated in the fact sheet for future reference.

1.5 Special Monitoring Strategies

Routine effluent and facility monitoring can meet some of the objectives stated at the beginning of this chapter but some objectives are best met through the use of special timing strategies and studies. Special studies are typically for a single purpose and are conducted during a limited time frame within the permit cycle. Section 6 on receiving environment monitoring also discusses considerations relevant to special studies of the receiving environment.

1.5.1 Stratified Sampling

Uniform sampling intervals may not always be the best approach, considering the cyclic variations in water quality and effluent variability. Stratifying a sampling program into different time periods may result data more suited to characterizing the impact of the discharge.

An example is to require increased monitoring frequency during critical receiving water periods to measure potential impacts to water quality. Seasonal monitoring schedules could be applied. This type of sampling scheme has been used by Ecology for determining compliance with some water quality based effluent limits. More frequent sampling may be required during the receiving water's critical flow, with less intensive monitoring during the rest of the year. Such an approach could be taken for scheduling toxicity testing. Variable sampling frequency could also be used to allocate sampling to periods of peak production or times of largest effluent variation.

1.5.2 Unusual Sampling Frequencies

A unique approach is to require that certain parameters traditionally monitored at a frequency of quarterly or twice annually be monitored under a non-traditional schedule such as "once every fifth month," which results in one monitoring event for each calendar month of a five year permit cycle. This method of scheduling frequencies supplies a degree of randomness. True random sampling is usually difficult to administer.

1.5.3 Studies to Determine Effluent Variability, A High Frequency Study

The variability can be established by a special monitoring study conducted prior to permit renewal or during an early portion of the permit cycle. The survey should cover a span of discharge which represents the range of effluent quality and quantity. The sampling frequency on which the data are based should be frequent enough to cover a time span of discharge which considers the swings in effluent quality and quantity. A high frequency study required by the permit should specify the time frame within which the study is to be conducted.

An alternative to a specific permit requirement is to require that the same type of data be generated through a permit-required engineering report. The report should involve an intense analysis that demonstrates the variation or CV, the co-dependence of variables and the mean or LTA of the pollutant concentrations in the discharge.

The generic factors available for estimating variability listed in section 1.3.1.A should be considered in establishing the schedule for the high frequency study.

This strategy should be explained briefly in the fact sheet. Once variability is established, monitoring frequency should be based on the confidence that effluent limit excursions will be detected.

1.6 Sampling and Testing Methods

Monitoring requirements in the permit should specify the sampling frequency, the sample type (grab, composite or continuous) and the analytical methods for each parameter. NPDES permit conditions must require the use of sampling and analytical methods conforming to 40 CFR Part 136 as required by 40 CFR Part 122.41(j) and 122.44 (i) unless another method is required un 40 CFR subchapters N (Effluent Guidelines) or O (Sewage Sludge). Permittees can apply to EPA for approval of alternative methods as per 40 CFR Part 136.5. The Program Development Services Section can provide EPA region 10 contact information. Ecology has used non-part 136 methods in NPDES permits to obtain monitoring data but not for compliance with limits.

Detailed information for developing the sampling program is found in the publication, *Monitoring Industrial Wastewater*, EPA, 1973. The information is also applicable to POTWs. Test procedures which are approved for NPDES monitoring are listed in Tables IA-IF of 40 CFR 136 (see: http://water.epa.gov/scitech/methods/cwa/). The tables include methods published in:

- *Methods for the Chemical Analysis of Water and Wastewater*, EPA 600/4-79-020.
- *Standard Methods for the Examination of Water and Wastewater*, 21st Edition, APHA.
- *Annual Book of ASTM Standards*, Volumes 11.01 and 11.02.
- *Methods for Analysis of Inorganic Substances in Water and Fluvial Sediments*, USGS, 1989.

Methods for the analysis of organic chemicals are published in 40 CFR 136, Appendix A. Specific requirements and guidance for toxicity testing (bioassays) are included in Chapter 173-205 WAC, Whole Effluent Toxicity Testing and Limits and are explained in Section 4.

Some parameters and samples may require special considerations. Parameters which have no approved testing method in Part 136 can be tested and reported using other methods. The permit must specify the test method and include a reference [40CFR Part 122.44(i)]. Contact the Program Development Services Section for assistance in selecting test methods. The method itself should be included as an appendix to the fact sheet if the method is not readily available to the permittee. An example is saltwater samples, which may require modifications to the approved methods to avoid matrix interferences from the high salt content.

Approved analytical methods for parameters usually include sampling and handling requirements. Refer to Ecology's *Laboratory User's Manual* for information regarding sample preservation and handling.

The sample type will depend on:

- The parameter to be monitored. To determine appropriate sample types consult 40 CFR Part 136, *Standard Methods* or other approved methods;
- The temporal and pollutant concentration variability of the discharge; and
- The type of limit. Limits based on instantaneous or one hour values may be sampled using grab sampling techniques. Limits based on average values or daily maximums may be sampled using time or flow proportional composite samples. This is acceptable for certain conventional pollutants, nutrients, and bioaccumulative pollutants, for which percent removal and total loading to the receiving water are of concern.

1.6.1 Discrete Grab or Sequential Grab Samples

A grab sample is an individual sample collected in less than 15 minutes time. It represents more or less "instantaneous" conditions.

Use grab samples when:

- The wastewater characteristics are relatively constant.
- The parameters to be analyzed are likely to change with storage such as temperature, residual chlorine, soluble sulfide, cyanides, phenols, microbiological parameters and pH.
- The parameters to be analyzed are likely to be affected by the compositing process such as oil & grease and volatiles.
- Information on variability over a short time period is desired.
- Composite sampling is impractical or the compositing process is liable to introduce artifacts of sampling.
- The spatial parameter variability is to be determined. For example, variability through the cross section and/or depth of a stream or a large body of water.
- Effluent flows are intermittent from well-mixed batch process tanks. Sample each batch dumping event.

Grab samples can measure maximum effect only when the sample is collected during flows containing the maximum concentration of pollutants toxic to the test organism.
Another type of grab sample is sequential sampling. A special type of automatic sampling device collects relatively small amounts of a sampled waste stream, with the interval between sampling either time or flow proportioned. Unlike the automatic composite sampler, the sequential sampling device automatically retrieves a sample and holds it in a bottle separate from other automatically retrieved samples. Many individual samples can be stored separately in the unit, unlike the composite sampler which combines aliquots in a common bottle. This type of sampling is effective for determining variations in effluent characteristics over short periods of time.

1.6.2 Composite Samples

A composite sample consists of a series of individual samples collected over time into a single container, and analyzed as one sample. There are two general types of composites and the permit writer should clearly express which type is required in the permit:

- Time composite samples collect a fixed volume at equal time intervals and are acceptable when flow variability is not excessive. Automatically timed composited samples are usually preferred over manually collected composites. Composite samples collected by hand are appropriate for infrequent analyses and screening.
- Composite samples can be collected manually if subsamples have a fixed volume at equal time intervals when flow variability is not excessive.
- Flow proportional compositing is usually preferred when effluent flow volume varies appreciably over time. The equipment and instrumentation for flow-proportional compositing have more downtime due to maintenance problems.

- When manually compositing effluent samples according to flow where no flow measuring device exists, use the influent flow measurement without any correction for time lag. The error in the influent and effluent flow measurement is insignificant except in those cases where extremely large volumes of water are impounded, as in reservoirs.

Use composite samples when:

1. Determining average concentrations, or
2. Calculating mass loading/unit of time.

There are numerous cases where composites are inappropriate. Samples for some parameters such as pH, residual chlorine, temperature, cyanides, volatile organics, microbiological tests, oil and grease, and total phenols should not be composited. They are also not recommended for sampling batch or intermittent processes. Grab samples are needed in these cases to determine fluctuations in effluent quality.

For bioassays, composite samples are used unless it is known that the effluent is most toxic at a particular time. Some toxic chemicals are short-lived, degrading rapidly, and will not be present in the most toxic form after lengthy compositing even with refrigeration or other forms of preservation. Require grab samples for bioassays to be taken under those circumstances.

In the absence of an expressed sampling protocol in regulation, the duration of the compositing time period and frequency of aliquot collection is established by the permit writer. Whether collected by hand or by an automatic device, the time frame within which the sample is collected should be specified in the permit. The number of individual aliquots which compose the composite should also be specified. NPDES application requirements specify a minimum of four aliquots for non-stormwater discharges lasting four or more hours. The sampling procedures for general pretreatment specify a minimum of twelve aliquots for 24-hour composites.

1.6.3 Continuous Monitoring

Continuous monitoring is another option for a limited number of parameters such as TOC, temperature, pH, conductivity, fluoride and dissolved oxygen.

Reliability, accuracy and cost vary with the parameter. Continuous monitoring can be expensive, so continuous monitoring will usually only be an appropriate requirement for the most significant dischargers with variable effluent. The environmental significance of the variation of any of these parameters in the effluent should be compared to the cost of continuous monitoring equipment available.

The regulations concerning pH limits allow for a period of excursion when the effluent is being continuously monitored (40 CFR 401.17). Continuous monitoring or labor-intensive periodic monitoring by grab sampling is necessary where pH excursions are allowed.

1.7 Determining the Sampling Location

The permit writer must determine permanent sampling locations, and identify them in the monitoring requirements. The permit applicant should provide a description of the effluent outfall location and in most cases, a line drawing and description of the flows and processes involved in wastewater treatment.

The point at which a sample is collected can make a large difference in the monitoring results. Important factors to consider in selecting the sampling station are:

- The flow at the sampling station should be measurable.
- The sampling station should be easily and safely accessible.
- The sample must be truly representative of the effluent during the time period which is monitored. The wastewater should be well mixed, such as near a Parshall flume or at a location in a sewer with hydraulic turbulence. Weirs tend to enhance the settling of solids immediately upstream and the accumulation of floating oil or grease immediately downstream. Such locations should be avoided for sampling.

It is often convenient to combine a flow measurement station with a sampling station. When flumes are used for flow measurement, the sample is usually well mixed.

Effluent samples should be collected at the most representative site downstream from all entering waste streams. Sampling of POTWs for conventional pollutants and nutrients (except for BOD) should be collected downstream of any chlorination or disinfection units.

Separate samples should be taken if two outfalls are used and the effluent which enters the outfalls comes from different parts of the plant.

If there is no practical way to sample the effluent, the permit must require that the permittee establish an appropriate effluent monitoring station for determining flow rates and compliance with effluent limits.

The location of sample sites for receiving environment and benthos testing vary with each discharger and the dimensions of any mixing or sediment impact zone. More detail can be found in Section 6.

1.8 Quality Assurance/Quality Control

The data gathered in self-monitoring programs provides information to decision makers on the quantity and quality of the effluent, the adequacy of operation and maintenance procedures, and the potential for discharges to affect receiving waters. Given the importance of monitoring data in assessing compliance and in assessing whether receiving waters may be affected, it is important that the processes involved in generating monitoring data be standardized, comparable among dischargers, and free from practices that would generate inaccurate or faulty data. A quality assurance or quality control program can help to ensure that data meet the above requirements.

> "Quality assurance (QA) has been described as a system of activities that assures the producer or user of a product or a service that defined standards of quality with a stated level of confidence are met. Quality control (QC) differs in that it is an overall system of activities that controls the quality of a product or service so that it meets the needs of

users. In other words, QC consists of the internal (technical), day to day activities, such as use of QC check samples, spikes, etc., to control and assess the quality of the measurements, while QA is the management system that ensures an effective QC system is in place and working as intended." (Keith, 1991)

The objective of quality assurance for a self-monitoring program is to ensure the production and reporting of valid results. Valid and useful results are those that answer a question or provide a basis on which a decision can be made (Keith, 1991). Within Ecology's regulation of self-monitoring data, the QA of a discharger's self-monitoring program is examined by different groups within Ecology. The EA Program's laboratory accreditation group oversees the QA/QC program for laboratories. Permitted dischargers are required to have their samples analyzed by labs accredited by the state. As part of the laboratory accreditation process, labs must develop an approved QA/QC plan that addresses laboratory operations. In addition, with few exceptions, dischargers will use specified and standardized methods (40 CFR 136) to measure compliance with permit limitations. These methods are specified in discharge permits by reference to use of Part 136 methods.

In most cases, dischargers are not required to submit formal QA plans addressing sampling technique because sampling technique is generally uncomplicated, and can be easily checked by inspectors during Ecology inspections. Poor sampling technique is likely to result in sample contamination, which is generally to the disadvantage of dischargers. However, because some dischargers with low dilution now have water quality based effluent limits that are in the low parts per billion range, it is important to ensure that sample collection techniques do not introduce contamination, and that data can be verified (e.g., by use of appropriate blank samples).

Contamination can be introduced by improper cleaning of sampling vessels, during sampling, or during handling and analysis of the sample in the lab. The laboratory that is preparing sampling bottles and analyzing samples will generally depend on the person who does samples to minimize contamination in the field. If you suspect that sample contamination is occurring at any point in the process of sampling and analysis, you should first discuss your concerns with the discharger. In most cases, since sample contamination is not to the benefit of the discharger, they will try to determine on their own if a problem exists (e.g., a small corroded area on a composite sampler at one municipal discharge was adding from 10-20 ppb of excess nickel to effluent samples, but was found after several weeks of examining all possible sources of contamination). If this is not effective, you may need to require a formal Ecology inspection with split samples analyzed by the state, or even a formal requirement for a full QA/QC sampling plan. When assessing potential sample contamination, it is also a good idea to discuss the contaminants with the staff at the Manchester Environmental Laboratory to attempt to rule out common laboratory contaminants as being present in the discharge.

Flow data is not compromised by sample contamination, but data verification is important to consider when collecting flow measurements during inspections. In some cases flow measurements cannot be safely verified because of the position of the flow measurement device. In other cases the flow measurement device may not be properly constructed, so there is doubt about the measurements produced by the device (e.g., a weir may not be level, thus the original engineering calculations used to gauge flow on the weir may not be appropriate for use with the structure as built). Data verification for flow devices should be approached carefully, because in many cases the cost of verification can be great. In some cases documentation showing proper calibration can be presented as a flow verification (inexpensive option), but in other cases complex models may be the only way to provide verification. If there is reason to believe that flow data is suspect, the permit manager should evaluate whether flow data is a highly critical parameter to verify for the discharger at the time. If the discharge is nearing capacity, approaching a water quality based concentration limit, or mass loading limits (total mass per day or year) have been imposed on the discharge, measurement of flow may be critical. In those cases, flow verification, even if costly, should be strongly considered, and may be required. The permit writer should use his/her best professional judgment when making the determination of whether a flow verification is needed.

If there is a need for the discharger to submit a QA/QC plan for all or a portion of a self-monitoring program (e.g., if contamination is suspected), the plan should include:

1. **Project Description** - Outlines the scope of the monitoring project.
2. **Responsibilities** - Identifies the responsibilities of personnel in implementing the QA plan.
3. **Quality Assurance Objectives** - Identifies the monitoring objectives including quantitative objectives for generating and measuring data in terms of accuracy, precision, completeness, representativeness, and compatibility.
4. **Sampling Procedures** - Describes the following for each measurable variable:
    - Guideline used to select sample site.
    - Specific sampling procedures (including chain of custody requirements).
    - Information for special containers, conditions for preparation of sampling equipment and containers.
    - Sampling preservation methods and holding times.
5. **Calibration Procedures, References, and Frequencies** - Identifies the procedures for properly maintaining the accuracy and precision of field and laboratory equipment, and for properly obtaining, using, and storing analytical standards.
6. **Analytical Procedures** - Identifies standard procedures for sample analysis by reference, and describes specialized procedures in detail.
7. **Data Reduction, Validation, and Reporting** - Provides the data reduction scheme for measurement data, including equations used for calculations, criteria used to validate data integrity, and methods used to identify and treat abnormal data or statistical outliers.
8. **Internal Quality Control Checks and Frequency** - Identifies all procedures used to assess quality during sample collection and analysis, including the uses and frequency of replicates, spikes, blanks, surrogate samples or reference materials, control charts, and calibration materials.
9. **Quality Assurance Audits** - Describes procedures used to determine the effectiveness of the QA program and its implementation.
10. **Preventive Maintenance Procedures and Schedules** - Details procedures for maintaining equipment in a ready state, including lists of critical spare parts.

11. **Procedures and Deliverables for Data Validation** - Provides a compilation of routine data analysis techniques used to assess data precision and accuracy, representativeness, comparability, and completeness of the measured parameters.

12. **Corrective Action** - Identifies predetermined limits for data acceptability beyond which corrective action is necessary, the specific corrective action to be taken for out-of-control data (including action in response to system and performance audits), and the individual responsible for each corrective action.

Additionally, the QA Section of the EA Program has prepared an Ecology publication "Guidelines and Specifications for Preparing Quality Assurance Project Plans", which specifically addresses issues faced by Ecology when sampling in Washington State. Permit writers should consult these guidelines as well as consider the items listed above.

Federal regulations require laboratories used by major NPDES dischargers to analyze proficiency testing (PT) samples (i.e., they must participate in the DMR-QA program) using the analytical methods in 40 CFR Part 136. The EA Program's Lab Accreditation Section can provide a list of accredited laboratories and the analyses they are accredited for to the permit writer. Alternatively, Scopes of Accreditation for accredited labs can be accessed at https://fortress.wa.gov/ecy/laboratorysearch/SearchLabName.aspx .

Additional sampling information is given in *Handbook for Sampling and Sample Preservation of Water and Wastewater*, EPA 600/4-82-029). Flow measurement is discussed in *Monitoring Industrial Wastewater* (EPA, 1973). By specifying, in a permit, a particular method to use for self-monitoring, any QA/QC procedures included in that method become permit requirements. Whenever QA/QC standards are not met, the analyses should be repeated until the specified level of performance is met. The reasons for inadequate QA/QC should be explained by the permittee when retesting is not possible. The EA Program or Headquarters staff should be contacted to help review this information.

1.9 Data Management

The format of data submitted to Ecology can directly influence how that data is interpreted, therefore it is critical that data be given to Ecology in a format most suitable for the data's intended use. The information obtained by the permittee's self-monitoring program is submitted to the permitting agency using a Discharge Monitoring Report (DMR) with a standardized format. The DMR is submitted to Ecology on a regular schedule stated in the permit. Special reports may be required in a permit, in which case the permit writer must designate the frequency and format of the report. In all cases, the data must be presented in an organized and clear manner, and if necessary, supporting data may be required (e.g., duplicate measures, spike recoveries, etc.). These reporting requirements should be specified in the special conditions section of the permit, enforcement order, or application requirements notification.

Reporting requirements for WET are given in the canary book (Ecology Publication No. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*). This manual which provides instructions to labs and includes our detailed test review criteria, and is now referenced in the acute and chronic WET language in the permit shells. Dischargers should instruct labs to follow the instructions for both testing and reporting in the canary book and in the EPA toxicity test manuals referenced in the permit language. WET test reports are rejected for serious omissions or deviations from these instructions. The test review system has been in place for several years now and the labs are familiar with it and its consequences.

The other routine monitoring data required in the permit will be entered into a computerized database located at each Region's office. This database is called the Permitting and Reporting and Information System (PARIS). PARIS will generate compliance reports determining whether or not dischargers are in compliance. Even though the PARIS will generate compliance reports, the permit manager may still find it useful to inspect the DMRs because of the information they contain, including data on effluent variability and trends in changing effluent quality. All special reports should be reviewed by the permit writer or appropriate staff at Headquarters or at the EA Program.

Other considerations concerning data interpretation (e.g., quantitation levels) are discussed in Chapter 6, Section 4 Effluent Limits Below Quantitation.

2. POTW Monitoring

Regulatory agencies are more involved in the day-to-day operation of POTWs than with industrial plants. Some examples of this are the regulatory requirements for operation and maintenance (O&M) plans and O&M inspections, operator certification requirements, and historical process control monitoring requirements. This involvement is largely due to the history of public funding for construction of POTWs and the protection of that investment.

POTWs are a single, large category of discharger for which monitoring guidance has evolved over time. The tests, sample points, frequencies, and sample types listed in the accompanying tables represent the level of monitoring which seeks to balance the minimum cost to the discharger while assuring the permit manager that the POTW is being operated correctly and is meeting the conditions of its permit.

This section builds on the previous General Considerations section to provide the permit writer more specific guidance for writing a permit for a POTW. Land treatment monitoring information is covered in *Implementation Guidance for the Ground Water Quality Standards* (Ecology 96-02). The following information is included in this section:

- Influent and Effluent Monitoring for:
    - Compliance with limits, treatment efficiency,
    - Sludge,
    - Pretreatment requirements, and
    - Whole Effluent Toxicity Testing

- Process Control
    - Use in response to significant noncompliance with limits
    - If required, implement in a permit, with an Order or as a requirement for O&M Manual update

- Sludge Monitoring
  - Satisfy new Part 503 Regulation requirements
  - Satisfy pretreatment requirements

- Combined Sewer Overflows
  - Provides guidance on CSOs monitoring
  - Defines CSO event

- Monitoring Bypasses
  - Provides guidance on sampling bypassed flows

2.1 Influent and Effluent Monitoring of POTWs

2.1.1 General

Table 40(Parts A-E) contain the recommended minimum influent, effluent, and sludge monitoring frequencies for various types of POTWs. These tables are organized according to treatment method and design flow. For clarity, each table is divided into several types of monitoring such as compliance, sludge, WET testing, and pretreatment.

For conventional pollutants, the minimum recommended frequency for compliance monitoring in Table 40 (Parts A-E) is 1/week. This minimum frequency is suggested for two reasons:

1. It is a reasonable minimum frequency for monitoring compliance with effluent limits.
2. It fulfills the implicit weekly reporting requirement associated with the seven-day average discharge standards described in Chapter 173-221 WAC and 40 CFR 133.102. ""Seven-day average" means the arithmetic mean of pollutant parameter values for samples collected in a period of seven consecutive days."

Since the tables represent the ***minimum*** recommended frequencies rather than the ***median*** recommended frequencies, it is more likely that more monitoring will be required than less. If significantly more or less than the recommended monitoring is required for a particular facility, this should be discussed in the fact sheet. Reasons for ***more*** monitoring may include:

- Frequent upset.
- Poor O&M performance.
- Discharge to a sensitive environment.
- A coefficient of variation is greater than 0.6 (EPA, 1991).
- Periods of significant non-compliance.

Reasons for ***less*** monitoring may include:

- POTW operating significantly below effluent limits
- Non-continuous discharge (seasonal)
- Long detention time (e.g., lagoons)
- Good O&M performance
- Good history of compliance with limits (inspection reports, DMRs)

POTWs are required to sample both the influent and effluent streams for BOD_5 and total suspended solids (TSS) in order to determine the removal efficiencies. Secondary treatment is generally defined as 85% removal of TSS and BOD_5 with a maximum limit of 30 mg/L each although exceptions do exist for waste stabilization ponds and trickling filters as discussed in Chapter 5, Municipal Effluent Limitations and Other Requirements.

Flow may be measured as either inflow or outflow. The sampling point should be specified in the permit. However, for some lagoon systems, due to rainfall or evaporation, both influent and effluent flow measurement may be required. Also for lagoons, effluent flow measurements are preferred for determining compliance with effluent limits.

The permit writer should attempt to identify the period of peak discharge into the POTW from the commercial and industrial users expected to be discharging any pollutants of concern and then specify monitoring frequencies and sample types that will include the period of peak industrial discharge. Monitoring during times of peak commercial and industrial discharge will increase the likelihood of detecting the presence of any toxic pollutants which are or maybe of concern.

The choice of sampling techniques for chemical-specific analyses is dependent on the type of compounds to be measured (e.g., grab sampling for volatile organic compounds, pH, cyanide, oil and grease, dissolved oxygen and phenols). More guidance is provided in the *Laboratory Users Manual*, Ecology, 1991b, the *Handbook for Sampling and Sample Preservation of Water and Wastewater*, EPA-600/4-82-029, EPA, 1982b, the *Water Quality Program Inspection Manual*, Ecology, 1992, *Standard Methods for Examination of Water and Wastewaters*, 17th Edition, pp. 1-37 and 1-38, and Chapter 13-1.5 & 1.6 of this manual.

2.1.2 Influent Monitoring

The influent must be sampled (BOD_5,TSS) and measured (flow) ahead of the point of entry of recycle flows such as digester supernatant, filter backwash, sludge thickener subnatant or supernatant, and any other in-plant recycle flows. Also, influent samples should generally be collected just downstream of the coarse screens or grit chamber but may include sampling points such as:

- The upflow siphon following a comminutor (in absence of grit chamber).
- The upflow distribution box following pumping from main plant wet well.
- Aerated grit chamber.
- Flume throat (assuming no impact on flow measurement).
- Pump wet well.

BOD_5 and TSS monitoring frequency in the influent should usually correspond with effluent monitoring frequency to determine compliance with percent removal requirements. However, influent monitoring may sometimes be at a higher frequency than effluent monitoring such as when influent flows into a lagoon cannot match the evaporative loss.

For parameters other than BOD_5 and TSS, any influent monitoring frequency should consider the variabilities in wastewater flow and characteristics, the quantity and quality of industrial input to the facility, and if the influent monitoring is being required for local pretreatment limits development or updating.

If multiple waste streams enter the plant and a representative sample cannot be collected, a flow-proportional composite sample of the various inflows may be used for influent analysis.

2.1.3 Effluent Monitoring

Effluent samples for POTWs should be collected downstream of any chlorination/dechlorination units or other disinfection units, with the exception of BOD and perhaps WET testing.

Post-chlorination BOD_5 samples should be dechlorinated and reseeded as described in *Standard Methods for the Examination of Water and Wastewater*, 18^{th}, 19^{th}, 20^{th}, or 21^{st} Edition. The sample for the BOD_5 test, usually a refrigerated composite, may be drawn prior to chlorination to avoid the inhibiting effect of chlorine on biological oxidation. This would require two effluent composite samplers (pre- and post-chlorination) which may represent a significant expense for some smaller POTWs.

WET testing samples should be taken following the protocols in Section 4 of this Chapter.

Separate samples should be taken if multiple effluent outfalls representing different treatment modes are present. For example, a parallel system with several treatment processes with different treatment efficiency requirements such as a trickling filter or lagoons <u>and</u> aeration basin, RBC, etc. Multiple discharges from equivalent treatment processes need not be analyzed separately provided there is a common effluent outfall that represents the combined total effluent discharge.

A lagoon with a long retention time may require lagged collection of effluent samples relative to influent samples for the purpose of determining compliance with the percent removal requirement, particularly if a review of historical data indicates a wide seasonal or periodic variation in influent concentrations (e.g., seasonal industrial input). A dye study should be used to decide whether it makes sense to require a lag time or not.

Samples should be collected during "typical" discharge periods. An evaluation of the condition of the facility's treatment system can be made by comparing the effluent sample concentrations of BOD, TSS, and other pollutants to long-term historical averages and/or permitted values for these parameters.

Table 39. Recommended Minimum Monitoring for POTWs Discharging to Surface Waters

Table 40, Part A.
For: 1. All Treatment Plants < 0.1 MGD Average Design Flow

Monitoring Type (Plant category)	Test	Sample Pt.	Frequency	Sample Type
Compliance (1)	Flow, mgd	Infl. or Fin. Eff.	Continuous	Measurement
"	pH	Final effluent	5/week	Grab
"	BOD_5	Infl.; Fin. Eff.[a]	1/week; 1/week	24-hr. Composite
"	TSS	Infl.; Fin. Eff.	1/week; 1/week	24-hr. Composite
"	Tot. Res. Cl_2	Chlorinated Eff.[f], Fin. Eff.[g]	5/week	Grab
"	Fecal Coliform	Fin. Eff.	1/week [c]	Grab
Sludge	See Chapter 13-2.3,	See Chapter 13-2.3, Table 37	See Chapter 13-2.3,	
WET Test.	See Chapter 13-4	Final Eff.		

(See also reapplication requirements for NH3, TKN, NO2+NO3, O+G, Total P, and TDS in Chapter 3, Section 3)

Table 40, Part B.

For: 1. Trickling Filter Plants < 0.5 MGD Average Design Flow
2. RBC Plants < 0.5 MGD Average Design Flow
3. Sewage Lagoons < 0.5 MGD Average Design Flow

Monitoring Type (Plant category)	**Test**	**Sample Pt.**	**Frequency**	**Sample Type**
Compliance (1,2,3)	Flow, mgd	Infl. or Fin. Eff.	Continuous	Measurement
"	pH	Final effluent	Daily	Grab
"	BOD_5	Infl.; Fin. Eff.[a]	1/week; 1/week	24-hr. Composite
"	TSS	Infl.; Fin. Eff.	1/week; 1/week	24-hr. Composite
"	Tot. Res. Cl_2	Chlorinated Eff.[f], Fin. Eff.[g]	Daily	Grab
"	Fecal Coliform	Fin. Eff.	1/week [c]	Grab
Sludge (1,2,3)	See Chapter 13-2.3,	See Chapter 13-2.3, Table 37	See Chapter 13-2.3,	
Sludge (3)	Sludge Depth	Each Cell, numerous locations	2/year	Measurement
WET Test.	See Chap. 13-4	Final Eff.		

(See also reapplication requirements for NH3, TKN, NO2+NO3, O+G, Total P, and TDS in Chapter 3, Section 3)

Table 40, Part C.

For: 1. Trickling Filter Plants 0.5-2.0 MGD Average Design Flow
2. RBC Plants 0.5-2.0 MGD Average Design Flow
3. Sewage Lagoons > 0.5 MGD Average Design Flow
4. Activated Sludge Plant < 2.0 MGD Average Design Flow
5. Oxidation Ditches

Monitoring Type (Plant category)	**Test**	**Sample Pt.**	**Frequency**	**Sample Type**
Compliance (1,2,3,4,5)	Flow, mgd	Infl. or Fin. Eff. [b]	Continuous	Measurement
"	pH	Final effluent	Daily	Grab
"	BOD_5	Infl.; Fin. Eff.[a]	2/week; 2/week	24-hr. Composite
"	TSS	Infl.; Fin. Eff.	2/week; 2/week	24-hr. Composite
"	Tot. Res. Cl_2	Chlorinated Eff.[f], Fin. Eff.[g]	Daily	Grab
"	Fecal Coliform	Fin. Eff.	2/week [c]	Grab
Sludge (1,2,3,4,5)	See Chapter 13-2.3	See Chapter 13-2.3,	See Chapter 13-2.3,	
Sludge (3)	Sludge Depth	Each Cell, numerous locations	2/year	Measurement
WET Test. (1,2,3,4,5)	See Chapter 13-4	Final Eff.		
(See also reapplication requirements for NH3, TKN, NO2+NO3, O+G, Total P, and TDS in Ch III, Section 6)				
Pretreatment (1,2,3,4,5) (see 2.1.4)	Oil and grease, pH, priority pollutant metals, and cyanide Priority pollutant organics and other toxic pollutants likely to be present	Influent Final effluent Sludge Influent Final effluent Sludge	Quarterly[d] Quarterly[d] 1 taken within 30 days after influent sample Annually[d] Annually[d] 1 taken within 30 days after influent sample	24 hour composite[e] except grab for O&G 24 hour composite[e] Grab 24 hour composite[e] 24 hour composite[e] Grab

Table 40, Part D.

For: 1. Trickling Filter Plants > 2.0 MGD Average Design Flow
2. RBC Plants > 2.0 MGD Average Design Flow
3. Activated Sludge Plant 2.0 - 5.0 MGD Average Design Flow

Monitoring Type (Plant category)	Test	Sample Pt.	Frequency	Sample Type
Compliance (1,2,3)	Flow, mgd	Infl. or Fin. Eff.	Continuous	Measurement
"	pH	Final effluent	Daily/ Continuous	Grab/ Measurement
"	BOD_5	Infl.; Fin. Eff.[a]	3/week; 3/week	24-hr. Composite
"	TSS	Infl.; Fin. Eff.	3/week; 3/week	24-hr. Composite
"	Tot. Res. Cl_2	Chlorinated Eff.[f], Fin. Eff.[g]	Daily	Grab
"	Fecal Coliform	Fin. Eff.	3/week [c]	Grab
Sludge (1,2,3)	See Chapter 13-2.3,	See Chapter 13-2.3,	See Chapter 13-2.3,	
WET Test. (1,2,3)	See Chapter 13-4	Final Eff.		
(See also reapplication requirements for NH3, TKN, NO2+NO3, O+G, Total P, and TDS in Ch III, Section 3)				
Pretreatment (1,2,3) (see 2.1.4)	Oil and grease, pH, priority pollutant metals, and cyanide	Influent Final effluent Sludge	Quarterly[d] Quarterly[d] 1 taken within 30 days after influent sample	24 hour composite[e], except grab for O&G 24 hour composite[e] Grab
Pretreatment (1,2,3) (see 2.1.4)	Priority pollutant organics and other toxic pollutants likely to be present	Influent Final effluent Sludge	Annually[d] Annually[d] 1 taken within 30 days after influent sample	24 hour composite[e] 24 hour composite[e] Grab

Table 40, Part E.
For: 1. Activated Sludge Plants > 5.0 MGD Average Design Flow

Monitoring Type (Plant category)	Test	Sample Pt.	Frequency	Sample Type
Compliance (1)	Flow, mgd	Infl. or Fin. Eff.	Continuous	Measurement
"	pH	Final effluent	Continuous	Measurement
"	BOD_5	Infl.; Fin. Eff.[a]	5/week; 5/week	24-hr. Composite
"	TSS	Infl.; Fin. Eff.	5/week; 5/week	24-hr. Composite
"	Tot. Res. Cl_2	Chlorinated Eff.[f], Fin. Eff.[g]	Daily	Grab
"	Fecal Coliform	Fin. Eff.	Daily [c]	Grab
Sludge (1)	See Chapter 13-2.3,	See Chapter 13-2.3,	See Chapter 13-2.3,	
WET Test. (1)	See Chapter 13-4	Final Eff.		
(See also reapplication requirements for NH3, TKN, NO2+NO3, O+G, Total P, and TDS in Ch III, Section 3)				
Pretreatment (1) (see 2.1.4)	Oil and grease, pH, priority pollutant metals, and cyanide	Influent Final effluent Sludge	Quarterly[d] Quarterly[d] 1 taken within 30 days after influent sample	24 hour composite[e], except grab for O&G. 24 hour composite[e] Grab
Pretreatment (1) (see 2.1.4)	Priority pollutant organics and other toxic pollutants likely to be present	Influent Final effluent Sludge	Annually[d] Annually[d] 1 taken within 30 days after influent sample	24 hour composite[e] 24 hour composite[e] Grab

[a] Samples for BOD_5 analysis may be taken before or after the disinfection process. If taken after, the sample must be

dechlorinated and reseeded.

[b] Influent flow must be provided if the permittee requests relief from 85% removal requirement as allowed in WAC 173-221-050. Influent flow monitoring is recommended for all lagoons to track influent loading.

[c] Sampled concurrently with Total Residual Chlorine (before dechlorination, if applicable).

[d] The days selected for sampling shall be rotated annually or quarterly (e.g., first quarter sample Monday, second quarter sample Tuesday, etc.). If the facility has undergone screening and prioritization for human health criteria the testing must be done during a wet season and a dry season.

[e] Cyanide, Volatile Organics and Phenols must be taken as a minimum of 4 grab samples and separately analyzed in place of each 24 hour composite.

[f] Sampled before dechlorination, if applicable.

[g] Sampled after dechlorination, if applicable.

Definitions

"Continuous" means readings are being taken and recorded at all times.

"Daily" in these tables is equivalent to 7 days/week.

"Final Effluent" means wastewater which is exiting, or has exited, the last treatment process or operation. Typically, this is after or at the exit from the chlorine contact chamber or other disinfection process.

"Grab" means an individual sample collected in less than fifteen minutes.

"Influent" means the raw sewage flow excluding any sidestreams returned to the headworks of the plant.

"24-hour composite" means a series of individual samples collected over a 24 hour period into a single container, and analyzed as one sample.

2.1.4 Pretreatment

2.1.4.1 Monitoring for local limit development

The federal pretreatment regulation 403.8(f)(4) requires pretreatment POTWs to develop local pollutant discharge limitations for any pollutants which cause Pass Through or Interference, or demonstrate they are not necessary. This requirement to develop local limits becomes Ecology's in the non-delegated pretreatment POTWs.

All pretreatment POTWs, both delegated and non-delegated, are required to have influent, effluent, and sludge sampled for toxic pollutants in order to characterize the industrial input and to determine if pollutants are or have the potential to interfere with the treatment process or pass through the plant to sludge or the receiving water. The monitoring data are used by Ecology or the municipality to develop technically defensible local limits which commercial and industrial users must meet.

A delegated POTW must conduct monitoring to support the development of local limits as a condition of its POTW Pretreatment Program. For non-delegated pretreatment POTWs, the permit writer may choose to have the POTW conduct the monitoring for Ecology so that local limits can be developed by Ecology for the non-delegated POTWs. Measurement of pH, oil and grease, priority pollutants (metals and organics), and any other pollutants likely to be present from commercial or industrial users are used as indicators to determine the need for local limits.

The list of priority pollutants to be monitored for is contained in 40 CFR part 122, Appendix D, Table II (organics) and Table III (metals and cyanide). Other toxic pollutants that should be monitored for if likely to be present are listed in 40 CFR part 122, Appendix D, Table V.

In addition to quantifying pH, oil and grease, and all priority pollutants, a reasonable attempt should be made to identify all other substances and quantify all organic pollutants shown to be present by gas chromatograph/mass spectrometer (GC/MS) analysis per 40 CFR 136, Appendix. A, Methods 624 and 625. Determinations of pollutants should be attempted for each fraction which produces identifiable spectra on total ion plots (reconstructed gas chromatograms). Determinations should be attempted from all peaks with responses 5% or greater than the nearest internal standard. The 5% value is based on internal standard concentrations of 30 μg/l, and must be adjusted downward if higher internal standard concentrations are used or adjusted upward if lower internal standard concentrations are used. Non-substituted aliphatic compounds may be expressed as total hydrocarbon content. Identification shall be attempted by a laboratory whose computer data processing programs are capable of comparing sample mass spectra to a computerized library of mass spectra containing at least sixty-thousand (60,000) compounds, with visual confirmation by an experienced analyst. (Note: The current National Institute of Standards and Technology GC/MS computerized library of mass spectra, covers 62,000 compounds. The phone number of the NIST Office of Standards Data is 301-975-2208). For all detected substances which are determined to be pollutants, additional sampling and appropriate testing shall be conducted to determine concentration and variability, and to evaluate trends (refer to "Determining Reasonable Potential", Chapter 6).

Local limits development requires one year of data collection. To develop local limits, the permit writer should require that each pretreatment POTW establish a data base from sampling and analysis over one year. Sampling will include both wet and dry weather flows. The sample locations, types, and frequencies are specified in the matrix below and apply to all pollutants as discussed in this section on monitoring for local limit development.

Matrix of monitoring requirements for local limits development

Location	Sample Type	Frequency[b]
Raw Influent	24 hour composite[a]	Once quarterly
Primary Clarifier Effluent	24 hour composite[a]	Once quarterly concurrently with influent
Final Effluent	24 hour composite[a]	Once quarterly concurrently with influent
Sludge	Grab	Taken within 30 days following influent sampling

a. Cyanide, Volatile Organics, and Phenols must be taken as a minimum of 4 grab samples and separately analyzed in place of each 24 hour composite.

b. The days selected for sampling shall be on days when industrial flow to the POTW is expected to be at a maximum and rotated quarterly (e.g., first quarter sample Monday, second quarter sample Tuesday, etc.).

At a minimum, Ecology should require all pretreatment POTWs to establish local limits for pH, oil and grease, the priority pollutant metals, cyanide, and phenols.

A pretreatment POTW is required to analyze for priority pollutants and any other toxic pollutants likely to be present. After local limits have been established, it is recommended that the monitoring frequency for toxic pollutants not be less than annually for toxic organics and not less than quarterly for toxic metals, unless reduced monitoring can be justified.

For additional information of identifying pollutants of concern, the permit writer is encouraged to consult the EPA *Guidance Manual of the Development and Implementation of Local Discharge Limitations Under the Pretreatment Program*, (EPA, 1987a).

2.1.4.2 Monitoring for updating of local limits

The federal pretreatment regulation 403.5(c) requires pretreatment POTWs to continue to update local pollutant discharge limitations for any pollutants which cause Pass Through or Interference. This requirement to update local limits becomes Ecology's in the non-delegated pretreatment POTWs.

The POTW should continue to survey its commercial and industrial users to find out what toxic metals and organics are reasonably expected to be present in its influent at detectable levels and then analyze its plant influent, effluent, and sludge for those pollutants. A reasonable attempt should be made to identify all other substances and quantify all pollutants shown to be present by GC/MS analysis per 40 CFR 136, Appendix. A, Methods 624 and 625. Determinations of pollutants should be attempted for each fraction which produces identifiable spectra on total ion plots (reconstructed gas chromatograms). Determinations should be attempted from all peaks with responses 5% or greater than the nearest internal standard. The 5% value is based on internal standard concentrations of 30 μg/l, and must be adjusted downward if higher internal standard concentrations are used or adjusted upward if lower internal standard concentrations are used. Non-substituted aliphatic compounds may be expressed as total hydrocarbon content.

Identification shall be attempted by a laboratory whose computer data processing programs are capable of comparing sample mass spectra to a computerized library of mass spectra containing at least sixty-thousand (60,000) compounds with visual confirmation by an experienced analyst. (Note: The current National Institute of Standards and Technology GC/MS computerized library of mass spectra, covers 62,000 compounds. The phone number of the NIST Office of Standards Data is 301-975-2208). For all detected substances which are determined to be pollutants, additional sampling and appropriate testing shall be conducted to determine concentration and variability, and to evaluate trends (refer to "Determining Reasonable Potential", Chapter 6).

All pretreatment POTWs, both delegated and non-delegated, are required to continue monitoring influent, effluent, and sludge for toxic pollutants in order to characterize the industrial input and to determine if pollutants are or have the potential to interfere with the treatment process or pass through the plant to sludge or the receiving water. The monitoring data is used by Ecology or the municipality to update the local limits for commercial and industrial users. The remainder of this section on pretreatment monitoring will focus on the monitoring requirements for pretreatment POTWs with established local limits.

A delegated POTW must conduct monitoring to support the update of its local limits as a condition of its POTW Pretreatment Program. For non-delegated pretreatment POTWs, the permit writer may choose to have the POTW conduct the monitoring for Ecology so the local limits can be updated. This section, including Tables 36 C, D, and E, establishes the monitoring that should be conducted for updating of local limits. Measurement of pH, oil and grease, priority pollutants (metals and organics), or any other pollutants of concern that are likely to be present from commercial or industrial users are used as indicators to determine compliance with local limits or the need for additional local limits.

The list of priority pollutants to be monitored for is contained in 40 CFR part 122, Appendix D, Table II (organics) and Table III (metals and cyanide). Other toxic pollutants which should be monitored for if likely to be present are listed in 40 CFR part 122, Appendix D, Table V.
A pretreatment POTW is required to analyze for priority pollutants and any other toxic pollutants likely to be present. After local limits have been established, it is recommended that the monitoring frequency for toxic pollutants not be less than annually for toxic organics and not less than quarterly for toxic metals, unless reduced monitoring can be justified.

For additional information of identifying pollutants of concern, the permit writer is encouraged to consult the EPA *Guidance Manual of the Development and Implementation of Local Discharge Limitations Under the Pretreatment Program,* (EPA, 1987a).

2.2 Process Control Monitoring

2.2.1 General

Process control monitoring provides a check on the efficiency of the treatment process and it allows the operator to make adjustments to optimize the process efficiency. It was commonly required as a permit condition in the past, especially for those facilities having difficulty complying with their permit limitations. Recently however, several factors have combined to limit the use of process control monitoring in permits:

1. Workload considerations emphasizing effluent limit compliance.
2. A general reluctance to initiate enforcement for noncompliance with permit process control parameters.
3. An internal policy memorandum suggesting process control monitoring be left out of permits (Stan Springer, July, 1990).
4. Language in Puget Sound Water Quality Plan Element P-8 suggesting that permit managers "leave most of the in-plant process control monitoring to the discretion of the discharger except in cases of significant non-compliance, as necessary to meet permit effluent limits."

Process control monitoring should not be required in permits. This type of monitoring is best implemented as part of an enforcement action for non-compliance and may be placed in an order. Routine process control monitoring may also be implemented through the submission of an updated O&M Manual.

2.2.2 Table 41(Parts A-M)

These tables present ***suggested*** process control monitoring for POTWs applicable to O&M manual revision and administrative orders. Because process control monitoring is applicable to relatively few facilities and tends to be facility specific, it should be a matter of the professional judgment of the permit manager in consultation with the permittee. Frequencies should be established that allow for the minimum amount of resource investment for the discharger while assuring the best available treatment.

It may be advantageous to require a short-term intensive survey in order to determine appropriate sampling times and frequencies, and to establish possible correlations between parameters such as TOC and BOD_5, or BOD_5 and $CBOD_5$. Daily sampling for one to two months during both the wet season and dry season is recommended for short-term studies. In the long run, conducting a short-term study may save the POTW from sampling more frequently than necessary or sampling during non-representative times. If a correlation is determined between TOC and BOD_5, the permit writer may allow the permittee to substitute TOC tests for BOD_5 for process control. This allows the operator to respond quickly with process adjustments. The COD can also be related empirically to BOD_5 or TOC but the Manchester Laboratory has recommended the use of alternative equivalent methods (BOD_5 and TOC) to eliminate the generation of highly toxic hazardous waste. A method for determining a correlation between parameters may be found in Chapter four of the *Handbook for Sampling and Sample Preservation of Water and Wastewater*, EPA, 1982b. The topic of indicators is presented in Chapter 13-1.

POTWs with industrial pretreatment programs or significant industrial input require more extensive in plant testing if current or expected concentrations of pollutants in the influent are detrimental to the secondary process. (e.g., priority pollutant analysis of primary effluent, in addition to the influent, is warranted to determine whether interference will result).

When sampling waste streams within the POTW, sampling points that are most representative of the process area (e.g., the common channel for secondary clarifiers) should be chosen and unwanted waste streams should be avoided. For branching flows, samples should be taken ahead of the branching point or from each stream after the branching point.

Samples on the aeration basin influent in the activated sludge process must be taken ahead of the point of entry of the recycle sludge. Sampling points should be located where the flow stream is well mixed.

In addition to sampling at the established process control locations, other unit processes may be sampled periodically when the variability of a parameter adversely affects the efficiency of a unit process. The basis for additional monitoring should be explained in the fact sheet.

Samples should be collected from channels at mid-channel and mid-depth where the flow is turbulent, well-mixed, and the settling of solids is minimal. Sampling should avoid skimming the water surface, or dragging the channel bottom. The sampling of wastewater for immiscible liquids, such as oil and grease, requires special attention and no specific rule can be given for selection of the most representative site because of wide range of conditions encountered in the field.

Sampling locations may be specified in an order or O&M Manual using a schematic flow diagram of the treatment process that shows the direction of flow between the processes, and shows all recycle flows. All sampling points should be identified on the schematic diagram. Include final sludge and/or other solids disposal where applicable. List all tests, sampling methods, frequencies, and sample types with the monitoring requirements.

The timing and frequency of sampling should be based on the relative complexity of the influent and the processes, as opposed to the design capacity of the facility.

If additional information is needed for process control monitoring for individual processes, Table 5.2 in the *Handbook for Sampling and Sample Preservation of Water and Wastewater*, EPA, 1982b, includes minimum sampling recommendations for each treatment process.

Table 40. Suggested Process Control Monitoring For POTWs Applicable to O&M Manual Revision and Administrative Orders

Table 41, Part A.
For: Activated Sludge Plants < 2 MGD Average Design Flow

Test	Sample Pt.	Frequency	Sample Type
Flow, mgd Instantaneous	RAS	2/week	Measurement
pH	Primary Effluent Aeration Basin Digester(s) (An/A)[a] Digester Feed Sludge (An/A)	5/week 5/week 5/week Daily	Grab
BOD_5	Primary Effluent	2/week	Grab
TSS	Primary Effluent Aeration Basin(MLSS) RAS WAS	2/week 2/week 2/week 1/event	Grab
Dissolved O_2	Influent Final Effluent Aeration Basin(s) Primary Effluent Digester (A)	Daily Daily Daily 5/week Daily	Grab
Temperature	Influent Digester(s) (An/A)	Daily Daily	Measurement
Chlorine Usage	(Effluent Disinfection)	Daily	Measurement
30 Minute Settleometer	Activated Sludge	2/week	Grab
SVI, Loading Index	Aeration Basin	2/week	Grab
Mean Cell Res. Time	Calculation	2/week	
Volatile Acids	Digester (An)	1/week	Grab
Alkalinity	Digester (An)	1/week	Grab
Gas Analysis & Vol.:CO_2	Digester(s) (An)	Daily	Grab
% Total Solids	Digester Feed Sludge Digester (An/A) Stabilized Sludge	1/week [a] 1/week [a] 1/week [a]	Grab
Volume & lbs. to Waste	WAS Primary Sludge	Per Event Per Event	Measurement
Sludge Blanket Depth	Secondary Clarifiers	Daily	Measurement

Additional Process Control Monitoring to Consider

Ammonia	Influent Aerators (Mixed Liquor) Final Effluent	1/week 1/week 2/week	Grab
Nitrate	Aerators (Mixed Liquor)	1/week	Grab
Settleable Solids	Influent Final Effluent	2/week 2/week	Grab
Vol. Suspended Solids	Aeration Basin	2/week	Grab
Food/Mass	Calculation	2/week	
Centrifuge Spin	Aeration Tank Conc. Return Sludge Conc. Waste Sludge Conc.	3/week 3/week 3/week	Grab

Table 41, Part B.
For: Activated Sludge Plants Between 2 And 5 Mgd Average Design Flow

Test	Sample Pt.	Frequency	Sample Type
Flow, mgd Instantaneous	RAS	Daily	Measurement
pH	Primary Effluent Aeration Basin Digester(s) (An/A) Digester Feed Sludge (An/A)	Daily Daily Daily Daily	Grab
BOD_5	Primary Effluent	3/week	Grab
TSS	Primary Effluent Aeration Basin(MLSS) RAS WAS	3/week 3/week 3/week 1/event	Grab
Dissolved O_2	Influent Final Effluent Aeration Basin(s) Primary Effluent	Daily Daily Daily Daily	Grab
Temperature	Influent Digester(s) (An/A)	Daily Daily	Measurement
Chlorine Usage	(Effluent Disinfection)	Daily	Measurement
30-Minute Settleometer	Activated Sludge	5/week	Grab
SVI, Loading Index	Aeration Basin	3/week	Grab
Mean Cell Res. Time	Calculation	5/week	
Vol. Acids	Digester (An)	2/week	Grab
Alkalinity	Digester (An)	2/week	Grab
Gas Analysis & Vol.: CO_2	Digester(s) (An)	Daily	Grab
% Total Solids	Digester Feed Sludge Digester(s) (An/A) Stabilized Sludge	3/week [b] 3/week [b] 3/week [b]	Grab
Volume & lbs. to Waste	WAS Primary Sludge	Per Event Per Event	Measurement
Sludge Blanket Depth	Secondary Clarifiers	Daily	Measurement

Additional Process Control Monitoring to Consider

Ammonia	Influent Aerators (Mixed Liquor) Final Effluent	2/week 2/week Daily	Grab
Nitrate	Aerators (Mixed Liquor) Clarifier Effluent	2/week 2/week	Grab
Settleable Solids	Influent Final Effluent	5/week 5/week	Grab
Vol. Suspended Solids	Aeration Basin	2/week	Grab
Food/Mass	Calculation	3/week	
Centrifuge Spin	Aeration Tank Conc. Return Sludge Conc. Waste Sludge Conc.	5/week 5/week 5/week	Grab

Table 41, Part C.
For: Activated Sludge Plants > 5 Mgd Average Design Flow

Test	Sample Pt.	Frequency	Sample Type
Flow, mgd Instantaneous	RAS	Daily	Measurement
pH	Primary Effluent Aeration Basin Digester(s) (An/A) Digester Feed Sludge (An/A)	Daily Daily Daily Daily	Grab
BOD_5	Primary Effluent	5/week	Grab
TSS	Primary Effluent Aeration Basin(MLSS) RAS WAS	5/week 5/week 5/week 1/event	Composite Grab Grab Grab
Dissolved O_2	Influent Final Effluent Aeration Basin(s) Primary Effluent	Daily Daily Daily Daily	Grab
Temperature	Influent Digester(s) (An/A)	Daily Daily	Measurement
Chlorine Usage	(Effluent Disinfection)	Daily	Measurement
30 Minute Settleometer	Activated Sludge	Daily	Grab
SVI, Loading Index	Aeration Basin	5/week	Grab
Mean Cell Res. Time	Calculation	5/week	
Volatile Acids	Digester(s) (An)	3/week	Grab
Alkalinity	Digester (An)	3/week	Grab
Gas Analysis & Vol.: CO_2	Digester(s) (An)	Daily	Grab
% Total Solids	Digester Feed Sludge Digester(s) (An/A) Stabilized Sludge	5/week [b] 5/week [b] 5/week [b]	Grab
Volume & lbs. to Waste	WAS Primary Sludge	Per Event or Daily	Measurement
Sludge Blanket Depth	Secondary Clarifiers	Daily	Measurement

Additional Process Control Monitoring to Consider

Ammonia	Influent Aerators (Mixed Liquor) Final Effluent	2/week 2/week Daily	Grab
Nitrate	Aerators (Mixed Liquor) Clarifier Effluent	2/week 2/week	Grab
Settleable Solids	Influent Final Effluent	Daily Daily	Grab
Vol. Suspended Solids	Aeration Basin	2/week	Grab
Food/Mass	Calculation	5/week	
Centrifuge Spin	Aeration Tank Conc. Return Sludge Conc. Waste Sludge Conc.	Daily Daily Daily	Grab

Table 41, Part D.
For: Package Aeration Plants < 0.1 MGD Average Design Flow

Test	Sample Pt.	Frequency	Sample Type
Flow, mgd Instantaneous	RAS	2/week	Measurement
TSS	Mixed Liquor RAS WAS	2/week 2/week 1/event	Grab
Dissolved O_2	Influent Final Effluent Aeration Basin(s) Digester (A)	5/week 5/week 5/week 5/week	Grab
Temperature	Aeration Basin(s)	5/week	Measurement
Chlorine Usage	(Effluent Disinfection)	5/week	Measurement
30 Minute Settleometer	Mixed Liquor	2/week	Grab
SVI, Loading Index	Aeration Basin	2/week	Grab
Mean Cell Res. Time	Calculation	2/week	
% Total Solids	Unstabilized Sludge Digester(s) (An/A) Stabilized Sludge	1/month [b] 1/month [b] 1/month [b]	Grab
Volume & lbs. to Waste	WAS Primary Sludge	Per Event Per Event	Measurement
Sludge Blanket Depth	Secondary Clarifiers	Daily	Measurement

Additional Process Control Monitoring to Consider

Ammonia	Influent Aerators (Mixed Liquor) Final Effluent	1/week 1/week 2/week	Grab
Settleable Solids	Final Effluent	2/week	Grab
Food/Mass	Calculation	2/week	
Centrifuge Spin	Aeration Tank Conc. Return Sludge Conc. Waste Sludge Conc.	2/week 2/week 2/week	Grab

Table 41, Part E.
For: Oxidation Ditches

Test	Sample Pt.	Frequency	Sample Type
Flow, mgd Instantaneous	RAS WAS	2/week per event	Measurement
pH	Ditch Digester(s) (An/A)	Daily 3/week	Grab
TSS	Aeration Basin (MLSS) RAS WAS	2/week 2/week per event	Grab
Dissolved O_2	Influent Final Effluent Aeration Basin(s) Digester (A)	Daily Daily Daily 2/week	Grab
Temperature	Influent	Daily	Measurement
Chlorine Usage	(Effluent Disinfection)	Daily	Measurement
30 Minute Settleometer	Activated Sludge	2/week	Grab
SVI, Loading Index	Aeration Basin	2/week	Grab
Mean Cell Res. Time	Calculation	2/week	
% Total Solids	Unstabilized Sludge Digester(s) (An/A) Stabilized Sludge	1/week [b] 1/week [b] 1/week [b]	Grab
Volume & lbs. to Waste	WAS Primary Sludge	Per Event Per Event	Measurement
Sludge Blanket Depth	Secondary Clarifiers	Daily	Measurement

Additional Process Control Monitoring to Consider

Ammonia	Influent Aerators (Mixed Liquor) Final Effluent	1/week 1/week 2/week	Grab
Nitrate	Mixed Liquor Clarifier Effluent	1/week 1/week	Grab
Settleable Solids	Final Effluent	2/week	Grab
Food/Mass	Calculation	2/week	
Centrifuge Spin	Aeration Tank Conc. Return Sludge Conc. Waste Sludge Conc.	3/week 3/week 3/week	Grab
Alkalinity	Influent Clarifier Effluent	1/week 1/week	Grab

Table 41, Part F.
For: Trickling Filter Plants ≤0.5 Mgd Average Design Flow

Test	Sample Pt.	Frequency	Sample Type
Flow, mgd Instantaneous	Trickling Filter Recycle	Daily	Measurement
pH	Primary Effluent Filter Effluent Digester(s) (An/A) Digester Feed Sludge (An/A)	5/week 5/week 5/week 1/week	Grab
TSS	Aeration Basin (MLSS) RAS WAS	2/week 2/week per event	Grab
Dissolved O_2	Influent Final Effluent Primary Effluent Filter Effluent Aerobic Digester (A)	Daily Daily 2/week 2/week Daily	Grab
Temperature	Influent Digesters (An/A)	Daily Daily	Measurement
Chlorine Usage	(Effluent Disinfection)	Daily	Measurement
30 Minute Settleometer	Activated Sludge	2/week	Grab
SVI, Loading Index	Aeration Basin	2/week	Grab
Mean Cell Res. Time	Calculation	2/week	
Volatile Acids	Digester (An)	1/week	Grab
Alkalinity	Digester (An)	1/week	Grab
Gas Analysis & Vol.: CO_2	Digester(s) (An)	5/week	Grab
% Total Solids	Digester Feed Sludge Digester(s) (An/A) Stabilized Sludge	1/week [b] 1/week [b] 1/week [b]	Grab
Volume & lbs. to Waste	Waste Primary Sludge Filter Sludge	Per Event Per Event	Measurement
Sludge Blanket Depth	Secondary Clarifiers	Daily	Measurement
Recirculation Ratio	Filter Effluent/ Filter Influent	1/week	Measurement

Additional Process Control Monitoring to Consider

Ammonia	Influent Final Effluent	1/week 2/week	Grab
Settleable Solids	Trickling Filter Eff. Final Effluent	2/week 2/week	Grab

Table 41, Part G.
For: Trickling Filter Plants 0.5 to 2.0 Mgd Average Design Flow

Test	Sample Pt.	Frequency	Sample Type
Flow, mgd Instantaneous	Trickling Filter Recycle	Daily	Measurement
pH	Primary Effluent Filter Effluent Digester(s) (An/A) Digester Feed Sludge (An/A)	5/week Daily 5/week Daily	Grab
TSS	Aeration Basin (MLSS) RAS WAS	2/week 2/week per event	Grab
Dissolved O_2	Influent Final Effluent Primary Effluent Filter Effluent Digester (A)	Daily Daily 2/week 2/week Daily	Grab
Temperature	Influent Digesters (An/A)	Daily Daily	Measurement
Chlorine Usage	(Effluent Disinfection)	Daily	Measurement
30 Minute Settleometer	Activated Sludge	2/week	Grab
SVI, Loading Index	Aeration Basin	2/week	Grab
Mean Cell Res. Time	Calculation	2/week	
Volatile Acids	Digester (An)	1/week	Grab
Alkalinity	Digester (An)	1/week	Grab
Gas Analysis & Vol.: CO_2	Digester(s) (An)	Daily	Grab
% Total Solids	Digester Feed Sludge Digester(s) (An/A) Stabilized Sludge	1/week [b] 1/week [b] 1/week [b]	Grab
Volume & lbs. to Waste	Waste Primary Sludge Filter Sludge	Per Event Per Event	Measurement
Sludge Blanket Depth	Secondary Clarifiers	Daily	Measurement

Test	Sample Pt.	Frequency	Sample Type
Recirculation Ratio	Filter Effluent/ Filter Influent	Daily	Measurement

Additional Process Control Monitoring to Consider

Ammonia	Influent Final Effluent	1/week 2/week	Grab
Nitrate	Influent Final Effluent	1/week 1/week	Grab
Settleable Solids	Trickling Filter Eff. Final Effluent	2/week 2/week	Grab

Table 41, Part H.
For: Trickling Filter Plants > 2.0 MGD Average Design Flow

Test	Sample Pt.	Frequency	Sample Type
Flow, mgd Instantaneous	Trickling Filter Recycle	Daily	Measurement
pH	Primary Effluent Filter Effluent Digester(s) (An/A) Digester Feed Sludge	Daily Daily Daily Daily	Grab
BOD_5	Primary Effluent	3/week	Grab
TSS	Primary Effluent	3/week	Grab
Dissolved O_2	Influent Final Effluent Primary Effluent Filter Effluent	Daily Daily Daily Daily	Grab
Temperature	Influent Digesters (An/A)	Daily Daily	Measurement
Chlorine Usage	(Effluent Disinfection)	Daily	Measurement
Volatile Acids	Digester (An)	2/week	Grab
Alkalinity	Digester (An)	2/week	Grab
Gas Analysis & Vol.: CO_2	Digester(s) (An)	Daily	Grab
% Total Solids	Digester Feed Sludge Digester(s) (An/A) Stabilized Sludge	3/week [b] 3/week [b] 3/week [b]	Grab
Volume & lbs. to Waste	Waste Primary Sludge Filter Sludge	Per Event Per Event	Measurement
Sludge Blanket Depth	Secondary Clarifiers	Daily	Measurement

Additional Process Control Monitoring to Consider

Ammonia	Influent Final Effluent	2/week Daily	Grab
Nitrate	Influent Final Effluent	2/week 2/week	Grab
Settleable Solids	Trickling Filter Eff. Final Effluent	3/week Daily	Grab
Total Solids	Supernatant	3/week	Grab

Table 41, Part I.
For: Sewage Lagoons < 0.5 MGD Average Design Flow

Test	Sample Pt.	Frequency	Sample Type
pH	Each Cell	1/week	Grab
Dissolved O_2	Influent Final Effluent Each Cell	2/week 2/week 1/week	Grab
Temperature	Influent Each Cell	2/week 1/week	Measurement
Chlorine Usage	(Effluent Disinfection)	Daily	Measurement
Lagoon Depth	Each Cell	1/week	Measurement

Additional Process Control Monitoring to Consider

Ammonia	Influent Final Effluent	1/week 2/week	Grab
Settleable Solids	Final Effluent	1/week	Grab
Dissolved O_2	Lagoon Profile	1/month	
Precipitation/Evaporation	On-site	Daily	

Table 41, Part J.
For: Sewage Lagoons > 0.5 MGD Average Design Flow

Test	Sample Pt.	Frequency	Sample Type
pH	Each Cell	Daily	Grab
Dissolved O_2	Influent Final Effluent Each Cell Lagoon Profile	2/week 2/week 1/week 1/month	Grab
Temperature	Influent Each Cell	2/week 1/week	Measurement
Chlorine Usage	(Effluent Disinfection)	Daily	Measurement
Lagoon Depth	Each Cell	1/week	Measurement

Additional Process Control Monitoring to Consider

Ammonia	Influent Final Effluent	1/week 2/week	Grab
Nitrate	Influent Final Effluent	1/week 1/week	Grab
Settleable Solids	Final Effluent	2/week	Grab
Precipitation/Evaporation	On-site	Daily	

Table 41, Part K.
For: RBC Plants < 0.5 MGD Average Design Flow

Test	Sample Pt.	Frequency	Sample Type
pH	Primary Effluent RBC Tank Digester(s) (An/A) Digester Feed Sludge	5/week 5/week 5/week 1/week	Grab
Dissolved O_2	Influent Final Effluent Primary Effluent RBC Tank Effluent	Daily Daily 2/week 2/week	Grab
Temperature	Influent Digester(s) (An/A)	Daily Daily	Measurement
Chlorine Usage	(Effluent Disinfection)	Daily	Measurement
Volatile Acids	Digester (An)	1/week	Grab
Alkalinity	Digester (An)	1/week	Grab
Gas Analysis & Vol.: CO_2	Digester(s) (An)	5/week	Grab
% Total Solids	Digester Feed Sludge Digester(s) (An/A) Stabilized Sludge	1/week [b] 1/week [b] 1/week [b]	Grab
Volume & lbs. to Waste	Waste Primary Sludge Waste RBC Sludge	Per Event Per Event	Measurement
Sludge Blanket Depth	Secondary Clarifiers	Daily	Measurement

Additional Process Control Monitoring to Consider

Ammonia	Influent Final Effluent	1/week 2/week	Grab
Settleable Solids	Final Effluent	2/week	Grab
Soluble BOD_5	Primary Effluent RBC Tank Effluent	1/week 1/week	Grab
Load Cell		1/week	Report
Dissolved O_2 Profile	RBC Tank	1/week	Grab
Bio-Growth Observations	RBC	1/week	

Table 41, Part L.
For: RBC Plants 0.5-2.0 MGD Average Design Flow

Test	Sample Pt.	Frequency	Sample Type
pH	Primary Effluent RBC Tank Digester(s) (An/A) Digester Feed Sludge (An/A)	Daily Daily Daily 1/week	Grab
Dissolved O_2	Influent Final Effluent Primary Effluent RBC Tank Effluent	Daily Daily 2/week 2/week	Grab
Temperature	Influent Digester(s) (An/A)	Daily Daily	Measurement
Chlorine Usage	(Effluent Disinfection)	Daily	Measurement
Volatile Acids	Digester (An)	2/week	Grab
Alkalinity	Digester (An)	2/week	Grab
Gas Analysis & Vol.: CO_2	Digester(s) (An)	Daily	Grab
% Total Solids	Digester Feed Sludge Digester(s) (An/A) Stabilized Sludge	3/week [b] 3/week [b] 3/week [b]	Grab
Volume & lbs. to Waste	Waste Primary Sludge Waste RBC Sludge	Per Event Per Event	Measurement
Sludge Blanket Depth	Secondary Clarifiers	Daily	Measurement

Additional Process Control Monitoring to Consider

Ammonia	Influent Final Effluent	1/week 2/week	Grab
Settleable Solids	Final Effluent	2/week	Grab
Soluble BOD_5	Primary Effluent RBC Tank Effluent	1/week 1/week	Grab
Load Cell		1/week	Report
Dissolved O_2 Profile	RBC Tank	1/week	Grab
Bio-Growth Observations	RBC	1/week	

Table 41, Part M.
For: RBC Plants > 2.0 MGD Average Design Flow

Test	Sample Pt.	Frequency	Sample Type
pH	Primary Effluent RBC Tank Digester(s) (An/A) Digester Feed Sludge	Daily Daily Daily 1/week	Grab
BOD_5	Primary Effluent	3/week	Grab
TSS	Primary Effluent	3/week	Grab
Dissolved O_2	Influent Final Effluent Primary Effluent RBC Tank Effluent	Daily Daily Daily Daily	Grab
Temperature	Influent Digester(s) (An/A)	Daily Daily	Measurement
Chlorine Usage	(Effluent Disinfection)	Daily	Measurement
Volatile Acids	Digester (An)	2/week	Grab
Alkalinity	Digester (An)	2/week	Grab
Gas Analysis & Vol.: CO_2	Digester(s) (An)	Daily	Grab
% Total Solids	Digester Feed Sludge Digester(s) (An/A) Stabilized Sludge	3/week [b] 3/week [b] 3/week [b]	Grab
Volume & lbs. to Waste	Waste Primary Sludge Waste RBC Sludge	Per Event Per Event	Measurement
Sludge Blanket Depth	Secondary Clarifiers	Daily	Measurement

Additional Process Control Monitoring to Consider

Ammonia	Influent Final Effluent	1/week 2/week	Grab
Settleable Solids	Final Effluent	2/week	Grab
Soluble BOD_5	Primary Effluent RBC Tank Effluent	1/week 1/week	Grab
Load Cell		1/week	Report
Dissolved O_2 Profile	RBC Tank	1/week	Grab
Bio-Growth Observations	RBC	1/week	

[a]. An = anaerobic, A = aerobic

[b]. "Digester feed" or "unstabilized" sludge samples may be taken when wasting from primary and secondary clarifiers to an aerobic digester, anaerobic digester, or sludge drying beds. "Stabilized sludge" samples can be taken when wasting from the sludge treatment recommended in the schedule.

2.3 POTW Sludge Monitoring and Special Conditions

Sludge (biosolids) disposal and the associated monitoring is a program separate from the NPDES permit process and codified in 40 CFR 503. See Chapter 5, Section 5. *Biosolids* for the current status of sludge and biosolids. Ecology may require sludge monitoring in permits in order to develop local limits under authority of 40 CFR 403 (see Chapter 10).

2.3.1 Sampling of Sewage Sludge

For flowing sludge, collect samples at the measuring weirs, or at another point where the sludge is well mixed.

Recommended sludge sampling locations are:

- **Primary Sludge**: Draw sludge from the settling tank hoppers into a well or pit before pumping, mix well and then collect a representative sample directly from this well. Alternatively, collect samples from openings in pipe near the sludge pumps or from the pump itself.
- **Activated Sludge**: Collect samples at the pump suction well, the pump or adjacent piping or the point of discharge of the return sludge to the primary effluent. The sample point should be located in a region of good agitation to maintain the suspension of solids.
- **Digested Sludge**: Collect samples at the point of the discharge of the digester drawoff pipe to the drying beds or the drying equipment. For batch sludges in digesters, collect samples from a mixed sink which is fed through lines attached at different levels in the digester. Be certain to remove sludge accumulated in the lines prior to sampling. For batch sludges in tanks, mix thoroughly if possible and collect samples. Collect samples at various depths and locations in the tank. Mix samples together prior to analysis.
- **Bed Dried Sludge**: Collect equal sized samples at several points within the bed without including sand. Mix thoroughly.
- **Filtered Sludge**: Collect equal size portions at the filter discharge.

The variability of sludge creates a need for frequent initial sampling in order to determine sampling frequencies. Samples should be composited, and should consist of at least 3 individually obtained samples. Batch operations should be sampled at the beginning, middle and end of a discharge, or more frequently if high variability is suspected. Tapped lines should also be sampled in three separate intervals because of variations in the sludge at the drawoff source (i.e., clarifier, digester, etc.). Sludges treated in aerobic or anaerobic digesters have long detention times within the digesters. Therefore, sampling should be no more frequent than the detention time of the digester.

Collect grab samples when analyzing for a parameter which is unstable, for example ammonia, or when analysis is required as soon as possible (e.g., sludge volume index test for activated sludge samples).

Analysis of composite samples is recommended in all other situations to reduce effects of sludge variability. Use at least three individual samples to form the composite. Wherever possible, collect frequent grab samples and composite according to flow rate.

Use manual sampling techniques in most situations unless special adaptations can be made for reliable automatic samplers. Automatic samplers have problems because of high fouling potential due to the solids content of the wastewater.

2.4 Combined Sewer Overflows

WAC 173-245-090(1) requires municipalities with combined sewer overflows (CSO's) to make an annual report to Ecology. The annual report must discuss three topics:

1. The past year's frequency and volume of combined sewage discharged from each CSO site, or group of CSO sites in close proximity.
2. The past year's CSO reduction accomplishments.
3. The projects planned for the next year.

To report on #1 above, the WAC requires field monitoring. The extent of field monitoring necessary should be agreed upon in advance by Ecology and the municipality. The agreement should be formalized by incorporating the monitoring schedule within the appropriate NPDES permit when it is renewed.

The purposes of the monitoring are to determine whether any CSO is increasing in volume or frequency over the "baseline annual" condition (see WAC 173-245-020), and to determine the success of CSO reduction efforts. Any increase triggers a requirement to accomplish additional CSO reduction (WAC 173-245-090(1)(a).

Actual flow recording equipment in each discharge location is preferable. If the discharge is not accessible to flow recording equipment, establish a relationship between flow in the sewer trunkline and flow in the discharge pipe to which the trunk overflows. If the discharger can establish a relationship between frequencies and quantities of overflows among a group of CSO's, then monitoring at one of the locations can suffice. Note that all parties should agree to these indirect measurements as satisfactory to determine compliance with the requirements of WAC 173-245-090(1).

As described in Chapter 5, Section 3.4.2, if the municipality has chosen at-site treatment facilities (e.g., primary treatment and disinfection) for CSO control, the permit writer can choose to permit the facility under the same permit as that for the secondary treatment plant, or write a separate permit. In either case, the permit should include numerical limits for the discharge, flow capacity limits for the facility, and reporting requirements. The influent and effluent during each storm event must be sampled for total suspended solids. The effluent during each storm event must be sampled for settleable solids. The sample types can be flow- or time-weighted composites for the time of the discharge. Flow-weighted is preferable since it will more accurately estimate actual discharge quality and quantity over the discharge.

2.5 Monitoring Bypasses

When emergency bypasses are made to a different outfall or discharge point, due to high inflows or treatment plant problems, separate samples of the bypassed flows should be taken (*Design of 301(h) Monitoring Programs for Municipal Wastewater Discharges to Marine Waters*, EPA 430/9-82-010, EPA, 1982a).

Reporting of bypasses (and by implication monitoring) is required in 40 CFR 122.41 (l) and (m). Noncompliance that endangers health or the environment must be reported including "any unanticipated bypass which exceeds any effluent limitation in the permit." In certain emergency situations, when all available manpower is required to correct the problem, monitoring the bypass may be difficult or even impossible. However, data on the total amount of wastewater bypassed and limited conventional pollutants such as BOD_5 and TSS may be helpful in understanding the effects of a bypass. Fecal coliforms in particular should be sampled because this test can provide both an indication of the concern to public health and, in certain situations, the amount of dilution afforded to the raw sewage by I/I. If the bypass occurs at a location where sampling is difficult, grab samples may substitute for composite samples.

3. Industrial and Commercial Facility Monitoring

The general considerations from part 1 of this chapter apply to all facilities discharging under the terms of wastewater permits issued by the department. Knowledge of the general considerations is necessary in order to write a permit in accordance with department guidelines. The topics which are expanded and exceptional for industrial and commercial facilities are presented in this section. This section is not intended to absolutely apply to indirect dischargers (industrial users) although some of the principles will apply. The topics discussed are:

1. Influent monitoring
2. Effluent monitoring frequency

The monitoring strategy of industrial and commercial wastewaters, because of the many different types of facilities, is less amenable to categorization than POTW monitoring. The operational processes that generate wastewater and the resultant effluents are much more diverse in industrial and commercial facilities. Individual wastewaters vary significantly with industry type and facility. Also, the influent pollutants may not be treated by biological treatment. Toxic and nonconventional pollutants are often the factors limiting the efficiency of wastewater treatment for industries.

For facilities with conventional pollutants that have biological treatment similar to POTWs, use the monitoring frequencies of Tables 36 (A-E) for facilities of comparable flows. Dairy products and other food processors may fit this approach.

The permit must contain monitoring requirements for all pollutants in the effluent with limits. Regulation states that the frequency of monitoring must result in a reasonable characterization of the nature of the discharge. A reasonable characterization should produce the variability and quantity of pollutant concentrations or loadings in the effluent as described in Chapter 13-1.3.

3.1 Influent Monitoring

Depending on the treatment process used, it may be beneficial to require an industry to monitor influent to the treatment process and the facility. Influent monitoring may be necessary when there is a change in process or treatment technology, when the source of effluent toxicity or violations of permit conditions are unknown, or when the influent process water is known or suspected to contain unusually high concentrations of a contaminant. Evaluating the removal efficiencies for certain pollutants may help to trace the sources of problems, and may be used to determine whether a facility is meeting AKART by comparing with treatment efficiencies of similar facilities or treatment systems.

Effluent limits based on treatment technology can be influenced by the quality of influent. Upon request of the discharger, credits for input water under certain conditions may be applied to the calculation of pollutants generated by the industrial process. This is only the case for technology-based limits and does not apply to water quality based limits. The permit must specify the frequency and sample point for data on input water. This should be concurrent with sampling frequencies for effluent sampling parameters where this is a factor. (40 CFR 122.45[g])

3.2 Effluent Monitoring

The most prevalent monitoring required by wastewater discharge permits is the monitoring at point of compliance, the effluent outfall. Until recently this was usually the only monitoring required for industries. There are virtually no regulations and little guidance for establishing frequency of monitoring.

An exception is found in the pretreatment regulations, 40 CFR Part 403.12. Significant Industrial Users (SIUs) must report results of wastewater analyses at least semi-annually to the Control Authority. The Control Authority is Ecology for all state waste discharge permits issued to Industrial Users.

Generally the permit writer is faced with a decision to either increase frequency over past permits and face the wrath of the permittee or imitate the monitoring requirements from other accepted permits.

Other than the SIUs, there is no fixed guidance from EPA on establishment of monitoring frequencies for industrial or commercial facilities.

The decision on the monitoring frequency is case-specific and needs to consider a number of factors, including those listed below:

- Type of treatment process, including retention time
- Environmental significance and nature of the pollutant or pollutant parameter
- Cost of monitoring relative to the discharger's capabilities and benefit obtained
- Compliance history
- Number of monthly samples used in developing the permit limit
- Effluent variability

Based upon an array of data analyzed for both individual chemicals and whole effluent toxicity, and independent of other considerations, EPA has observed that ideally 10 or more samples per month provides the greatest statistical likelihood that the average of the various monthly values will approach the true monthly LTA value. In practice, however, selection of monitoring frequencies will need to consider the previously mentioned factors and arrive at a reasonable compromise of the appropriate considerations" (*TSD*, page 113, EPA, 1991)

A facility not given to extreme fluctuations can be adequately regulated by selecting a frequency based on the single high-frequency monitoring study explained in Section XIII-1.4.3. Armed with enough data, the permit writer can calculate limits, establish the projected LTA, and determine a protective monitoring frequency capable of detecting a violation of the limits within a certain degree of confidence.

When needed to establish frequency of monitoring, the single high frequency monitoring study should occur during the application phase of the permit but this is not always possible. Some dischargers are too slow or lack the initiative to supply the data outside the structure of the permit. In these cases the permit writer should include a requirement in the permit which requires the discharger to conduct the high-frequency study during a critical phase of production. The high frequency monitoring study should be conducted at each permit cycle for some dischargers, unless other factors are present. The use of DMR and other data in lieu of the high frequency monitoring study is explained in Section 1.3.1. High frequency monitoring during the fourth year of a typical five year permit cycle will supply variability information for the renewal of the permit.

4. WET Testing Monitoring

4.1 Recommended Test Frequency for Characterization

Whole effluent toxicity tests are relatively expensive. Therefore, the test frequency should be related to the probability of any discharger having whole effluent toxicity. The following table ranks some factors associated with the discharger or the receiving water. A permit manager may use other factors to increase or decrease the rank of any discharge. A permit manager may also change the relative weight of the factors listed. All factors considered should be explained in the fact sheet.

The EPA application Form 2A for municipal dischargers requires WET testing data with the application. The specific requirements are based on the size of the discharge. The requirements are given at the end of Table 42.

Table 41. Discharge Ranking System

Applicant:__________ NPDES Permit #

A. Toxicity Likelihood (Circle the scores for all that apply.)

1. 5 points — Uses, stores, produces as a product or waste, or transfers hazardous substances listed in 40 CFR 302.4 with a statutory code of 1 or 2 with adequate Best Management Practices (adequate secondary containment, good housekeeping, good employee training, thorough self-inspection, sufficient emergency planning and spill control equipment, etc.)

2. 20 points — Uses, stores, produces as a product or waste, or transfers hazardous substances listed in 40 CFR 302.4 with a statutory code of 1 or 2 with inadequate Best Management Practices (no or undersized secondary containment, poor housekeeping, little employee training, poor self-inspection, little emergency planning, insufficient spill control equipment, history of spills which have reached receiving water, etc.)

3. 15 points — Discharges in the effluent any toxic pollutant listed in Appendix D of 40 CFR Part 122

4. 15 points — Discharger belongs in an industry category identified in 40 CFR Part 122, Appendix A

5. 15 points — Discharger is a municipal facility which receives a discharge from any industry category identified in 40 CFR, Parts 405-471, unless the municipality has an adequate pretreatment program which establishes and enforces local limits

6. 10 points — Any facility with toxicity detected during past acute toxicity testing based on less than 80% survival in 100% effluent

7. 15 points — Any facility with known or suspected receiving water impacts

Sum of scores in part A:

Table 42 (Continued)

B. Potential For Impact

1. Average Annual Discharge Flow Volume (Circle one score.)*

a. 5 points Flow < 0.5 mgd

b. 10 points Flow 0.5 mgd to 12.5 mgd

c. 15 points Flow 12.5 mgd to 25 mgd

d. 20 points Flow 25 mgd to 37.5 mgd

e. 25 points Flow 37.5 mgd to 50 mgd

f. 30 points Flow > 50 mgd

2. Chronic Critical Effluent Concentration at Edge of Mixing Zone (Circle one score. If not known, estimate or double the score in category B)*

a. 1 point CCEC < 0.1% effluent

b. 5 points CCEC = 0.1% effluent to 2% effluent

c. 10 points CCEC = 2% effluent to 4% effluent

d. 15 points CCEC = 4% effluent to 6% effluent

e. 20 points CCEC = 6% effluent to 8% effluent

f. 25 points CCEC = 8% effluent to 10% effluent

g. 30 points CCEC > 10% effluent

Sum of scores in part B:

C. Multiply the sum of scores from part A by the sum of scores in part B to rank the discharge:

Table 42 (Continued)

D. Discharge Ranks*

Rank 1- greater than 2500 points

Rank 2- 1500 points to 2500 points

Rank 3- 750 points to 1500 points

Rank 4- 100 points to 750 points

Rank 5- less than 100 points

*Borderline values go to any adjacent group at the discretion of the permit manager.

EPA Form 2A Requirements for Part E -WET data at the time of application.

Part E is required for all municipal dischargers with a design flow of 1 MGD or more, treatment works with an approved pretreatment program (and those that should have one), and any other municipal discharger directed by Ecology to submit WET data.

Part E requirements

- If chronic dilution factor $\geq$ 1000 – acute testing only with 2 species quarterly for a minimum of one year.
- If chronic dilution factor is between 100 and 1000 – acute or chronic testing with 2 species quarterly for a minimum of one year.
- If chronic dilution factor < 100 – chronic testing with 2 species quarterly for a minimum of one year.

Table 42 (Continued)

TESTING FREQUENCY

DISCHARGE RANK	EFFLUENT CHARACTERIZATION	
	Acute Toxicity	Chronic Toxicity
RANK 1	6/year, 1 fish 1 invert.	6/year, 1 fish 1 invert. 1 algal*
RANK 2	6/year, 1 fish 1 invert.	4/year, 1 fish 1 invert. 1 algal*
RANK 3	4/year, 1 fish 1 invert.	4/year, 1 fish 1 invert.
RANK 4	4/year, 1 fish 1 invert.	2/year, 1 fish 1 invert.
RANK 5	2/year, 1 fish 1 invert.	2/year, 1 fish 1 invert.

* optional at permit manager's discretion

4.2 Sampling

Samples for whole effluent toxicity testing may be composite or grab samples. Twenty four hour composite samples are recommended except:

a. when the permit manager has reason to believe that the effluent is significantly more toxic at a certain time of day,

b. when the permit manager suspects that toxicity may be lost by the compositing process (for example, chlorine or volatile organics vaporizing out of solution, or surfactants adsorbing to the composite sampler),

c. or when the toxicity testing will require a sample volume in excess of composite sampler volume which is usually about five gallons. Grab samples can be composited in these cases.

Samples taken for toxicity testing should be cooled to 4 degrees Celsius and sent to the lab immediately. The lab should begin the toxicity testing as soon as possible but no later than 36 hours after the time that sampling was begun.

Sampling should be evenly spaced during the year and timed to catch the maximum seasonal variation. For example, if sampling frequency is 2/year, then these should be taken in the summer and winter.

5. Stormwater Monitoring

The Clean Water Act did not exempt stormwater from regulation. Stormwater is considered wastewater and if it flows in a conveyance it is a point source discharge. Stormwater discharges have not been regulated in a consistent manner under the Clean Water Act because of funding limitations and because control mechanisms and monitoring requirements are different from other point sources.

As other point source pollution sources came under control, it was apparent that stormwater was often the cause of non-attainment of the water quality standards. The 1987 amendments to the Act explicitly required stormwater permits. These stormwater requirements have been clarified in EPA rule making. The regulatory history of stormwater pollution control is reviewed in 56 FR 40948 (August 16, 1991). Stormwater is unique in that EPA has established that the implementation of best management practices constitutes BCT/BAT for stormwater discharges associated with industrial activity. The fact sheet to the EPA industrial stormwater permit says that BMP's identified in pollution prevention plans substitute for numeric limitations for the general class of industrial stormwater.

Ecology has several types of stormwater permits and the monitoring requirements are different for each type.

5.1 Types of Stormwater Permits

5.1.1 Industries with Effluent Guidelines That Include Stormwater

EPA has promulgated effluent limitation guidelines (ELGs) or New Source Performance Standards (NSPS) for some industries which include stormwater requirements. The following industrial categories have stormwater requirements:

- Cement Manufacturing
- Feedlots
- Fertilizer Manufacturing
- Petroleum Refining
- Phosphate Manufacturing
- Steam Electric Power Generating
- Coal Mining
- Ore Mining and Dressing
- Mineral Mining and Processing
- Paving and Roofing Materials (Tars and Asphalt Emulsion)
- Airports

These categories of dischargers have effluent limitations in regulation and they address "non-process wastewater" and/or stormwater (e.g. runoff from storage piles). Even though some of these limitations specify the design storm (i.e., 10 year 24 hour storm) they do not specify monitoring frequency. Therefore the only regulatory monitoring requirement is the minimum of once per year as specified in 40 CFR 122.44(i)(2). These categories of stormwater dischargers typically receive individual permits but some may be covered by a general permit. The permit writer for one of these categories of discharge must review the development document to determine which waste streams are covered in the effluent limitations. If a permit writer finds that a waste stream in one of these categories of discharge is not covered by the effluent guidelines, the effluent limits for that waste stream are developed on a case-by-case basis.

5.1.2 Industries With Effluent Guidelines

Some industries with effluent guidelines for the process wastewater have stormwater that mixes with the process wastewater before the point of discharge. The permit typically includes both types of wastewater. An example of this type is the timber products processing category. These categories of dischargers would generally receive individual permits that include effluent limits developed on a case-by-case basis for the stormwater component.

5.1.3 Industries Without Effluent Guidelines but With Existing Individual Permits

These are usually industries that have permits because of some demonstrated water quality problem from stormwater runoff or because they are a remedial cleanup site. This category of discharger has an individual permit that contains stormwater effluent limits developed a case-by-case basis.

5.1.4 Industrial Stormwater General Permit

Ecology reissued a general permit for industrial stormwater on December 3, 2014. This general permit requires the permittees to develop and implement a stormwater pollution prevention plan (SWPPP), conduct quarterly effluent monitoring, and perform corrective actions when necessary. Certain discharges are subject to numeric effluent limits based on ELGs or impairment of the receiving water.

Ecology has also issued stormwater general permits for specific industry groups (e.g. boatyards). A current list is available here: https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Stormwater-general-permits.

5.1.5 Municipal Stormwater General Permit

Ecology has issued general stormwater permits to municipalities with populations greater than 250,000 (Phase 1) and to most municipalities with populations between 10,000 and 250,000 (Phase 2).

5.1.6 Dual Permits

A permit writer who is permitting an industrial facility may find the previous permit or the effluent guidelines do not cover stormwater discharge at the facility. This facility must have submitted a Notification of Intent (NOI) to be covered under the Industrial Stormwater General Permit (ISGP) if it is included in the regulations. Most industries are included in the SIC codes that require stormwater permits.

A facility should not be removed from coverage under the ISGP unless the permit manager considers the pollution control approach or the timing of the general permit to be inappropriate for that facility. Ecology will not charge a facility an additional fee for coverage under the stormwater general permit if they have an individual permit.

The ISGP may be inappropriate for facilities which the permit manager has reason to believe may be having significant water quality impacts, or where the discharge is a "significant contributor of pollutants" (40 CFR 122.28(b)(2)(i)(G)). If the permit manager decides to remove a facility from the ISGP and address stormwater discharge within an individual permit, the permit writer must apply the federal wastewater characterization process to the stormwater discharge (See Section 5.2 below).

Some industries may not be categorically required to be covered under the ISGP but the permit manager has reason to believe the stormwater discharge from the facility is causing pollution and therefore requires control. These facilities would be issued an individual permit or issued coverage under the ISGP as a significant contributor of pollutants (ISGP Condition S1.B).

5.2 Wastewater Characterization for Industrial Stormwater

Federal regulations require submission of Form 2F (40 CFR 122.26(c)) for characterizing the amount and nature of the stormwater. This form requires submission of sampling data and an assessment of the site. Permit writers and applicants can find Form 2F on Ecology's website at: https://ecology.wa.gov/Water-Shorelines/Water-quality/Water-quality-permits/Water-Quality-individual-permits#forms.

If the permit manager wants to include stormwater in an individual process waste water permit, but doesn't want to wait until the Form 2F is submitted before issuing the permit, the monitoring requirements of Form 2F should be included in the monitoring requirements of the permit. The other option is a permit requirement to submit a Form 2F and to comply with the sampling requirements of the stormwater regulations.

The stormwater regulations contain some specific requirements for characterizing stormwater pollutant concentrations and loading. Permit managers should require these sampling processes in individual permits to be consistent with the regulations. The requirements for stormwater sampling are contained in *NPDES Stormwater Sampling Guidance Document* (EPA 833-B-92-001). This document is available here: https://www3.epa.gov/npdes/pubs/owm0093.pdf. It should be referenced in permits requiring stormwater characterization.

The regulations require a grab sample for the first flush of the precipitation event during the first 30 minutes of a discharge and a flow-weighted composite for the rest of the storm event. The first flush grab sample is not required if the stormwater is from a detention basin with a detention time of 24 hours or more. The flow-weighted composite samples must be collected during the first three hours of the discharge or the entire period of discharge if less than three hours.

The regulations also specify the pollutants to be analyzed in each sample.

The first flush sample must be analyzed for:

- Oil and grease,
- pH,
- BOD,
- COD,
- TSS,
- Total P,
- Nitrate and nitrite nitrogen,
- Total Kjeldahl nitrogen,
- Any pollutant in the facilities effluent guideline,
- Any additional pollutants that are in the facility's permit including those for the purpose of characterization of the process waste stream, ***and***
- Any pollutant that the applicant denotes as believed to be present on the Form 2F. Permit writers should refer to Ecology's ISGP (Condition S5) for general and sector-specific stormwater pollutants typically present at industrial facilities.

The composite sample must be analyzed for all the parameters in the first flush sample except oil and grease and pH unless they happen to be parameters given in the permittees individual permit.

The stormwater regulations are explicit on the storm event to be sampled to characterize the stormwater discharge. The storm event must produce 0.1 inch of precipitation and occur at least 72 hours from the last 0.1 inch of precipitation. The duration and total precipitation for the storm event should be from 0.5 to 1.5 times the average or median storm event for the area.

The regulations also require that the permittee measure flow rate, estimate volume for the storm event sampled and provide the method of flow estimation. The permittee must also provide:

- The date and duration (in hours) of the storm event(s) sampled.
- The rainfall measurements or estimates of the storm event (in inches) which generated the sampled runoff.
- The duration between the storm event sampled and the end of the previous measurable storm event.

The sample volume is not specified in regulation but is contingent upon the number of pollutants to be analyzed. The samples generally should be a minimum of four liters for the first grab and three liters for the composite sample.

The regulations do not require an automatic sampler for stormwater but they do place a restriction on manual sampling. Samples collected manually for composite samples must be taken once in each hour for three hours and at least 15 minutes apart. The EPA guidance document contains a good discussion of the advantages and disadvantages of automatic versus manual sampling. The document also presents several strategies for sampling to meet the intent of the regulations.

5.3 Compliance Monitoring

The frequency of compliance monitoring is based upon the permit manager's best professional judgment. The permit manager should review the general considerations for determining the frequency of compliance monitoring given in the earlier sections of this chapter. For most industries and parameters, quarterly monitoring is recommended in both Ecology's ISGP and EPA's Multi-Sector General Permit (MSGP). The permit writer should consult the ISGP first, other applicable Ecology permits (https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Stormwater-general-permits), and then the MSGP for any industries that may not be addressed in an Ecology general stormwater permit. Reporting frequencies should typically match monitoring frequencies.

For some stormwater discharges, the first flush flow may contain many times the concentration of pollutants than sometime later in the storm event. The first flush concentration may also be dependent upon the season, resulting in a "seasonal first flush". An industry that has a large amount of deposition from industrial activity and off-site air pollutants would have the highest concentration of pollutants in the first heavy rain of the fall. This time of the year is also a low-flow period for streams that are dependent upon ground water recharge. The short-term biological impact (acute toxicity) would be greatest at this time and a grab sample of the first heavy fall rain would be the best predictor of impact. Grab samples are not as important in facilities with stormwater storage basins with long detention times.

For effluent limits based on treatment, composite samples are important for determining average performance. Composite samples are also better at predicting loading to a water body.

The permit manager should consider using tiered monitoring as discussed in an earlier section of this chapter. The reduction of monitoring frequency could be based upon compliance with effluent limits or upon a demonstrated reduction of pollutants attributable to implementation of Stormwater Pollution Prevention Plans (SWPPPs).

Table 42. Stormwater Pollutant Parameters

Type of Facility	Type of Stormwater Discharge	Parameters	Monitoring Frequency	Reporting Frequency
EPCRA, Section 313 Facilities subject to Reporting Requirements for Water Priority Chemicals	Stormwater discharges that come into contact with any equipment, tank, container, or other vessel or area used for storage of a Section 313 water priority chemical, or located at a truck or rail car loading or unloading area where a section 313 water priority chemical is handled	Oil and Grease, BOD5, COD, TSS, Total Kjeldahl Nitrogen[1], (NH_3-N_1 NO_3+NO_2-N)[3] Total Phosphorus, pH, acute whole effluent toxicity[2], any Section 313 water priority chemical for which the facility reports.	Quarterly	Quarterly
Primary Metal Industries (SIC 33)	All stormwater discharges associated with industrial activity	Oil and Grease, COD, TSS, pH, acute whole effluent toxicity[2], Total Lead, Total Cadmium, Total Copper, Total Arsenic, Total Chromium, Total Nickel, Total Silver, Total Zinc, Cyanide ,and any pollutant limited in an effluent guideline to which the facility is subject.	Quarterly	Quarterly
Land Disposal Units/Incinerators/ BIFs	Stormwater discharges from active or inactive land disposal units without a stabilized cover that have received any waste from industrial facilities other than construction sites; and stormwater discharges from incinerators and BIFs that burn hazardous waste	Total Magnesium, Magnesium (dissolved), Total Kjeldahl Nitrogen, COD, TDS, TOC, Oil and Grease, pH, Total Arsenic, Total Barium, Total Cadmium, Total Chromium, Total Cyanide, Total Lead, Total Mercury, Total Selenium, Total Silver, Alpha Terpineol, Benzoic Acid, P-Cresol (4 methylphenol), Phenol, acute WET [2] , and any pollutant limited in an effluent guideline to which the facility is subject.	Quarterly	Quarterly

Table 43 (Continued)

Type of Facility	Type of Stormwater Discharge	Parameters	Monitoring Frequency	Reporting Frequency
Animal Handling/ Meat Packing Facilities	Stormwater discharges from animal handling areas, manure management areas, production waste management areas exposed to precipitation at meat packing plants, poultry packing plants, facilities that manufacture animal and marine fats or oils.	BOD5, Oil and Grease, COD, TSS, Total Kjeldahl Nitrogen (TKN), (NH_3, NO_3,NO_2)[3], , pH, Fecal Coliform	Quarterly	Quarterly
Chemical and allied Product Manufacturers/ Rubber Manufacturers (SIC 28 & 30)	Stormwater discharges that come into contact with solid chemical storage piles	Oil and Grease, COD, TSS, pH, Total Phosphorus, Nitrate + Nitrite (as N), any pollutant limited in an effluent guideline to which the facility is subject.	Quarterly	Quarterly
Automobile Junkyards	Stormwater discharges exposed to: a) over 250 auto/truck bodies with drivelines, 250 drivelines, or any combination thereof b) over 500 auto/truck units c) over 100 units dismantled per year where automotive fluids are drained or stored.	Oil and Grease, COD, TSS, pH, Total Lead, Total Copper, and any pollutant limited in an effluent guideline to which the facility is subject.	Quarterly	Quarterly
Lime Manufacturing Facilities	Stormwater discharges that have come into contact with lime storage piles	Oil and Grease, COD, TSS, pH, any pollutant limited in an effluent guideline to which the facility is subject.	Quarterly	Quarterly
Oil-Fired Steam Electric Power Generating Facilities	Stormwater discharges from oil handling sites	Oil and Grease, COD, TSS, pH, any pollutant limited in an effluent guideline to which the facility is subject.	Quarterly	Quarterly

Table 43 (Continued)

Type of Facility	Type of Stormwater Discharge	Parameters	Monitoring Frequency	Reporting Frequency
Cement Manufacturing Facilities and Cement Kilns	All stormwater discharges associated with industrial activity (except those from material storage piles that are not eligible for coverage under this permit)	Oil and Grease, COD, TSS, pH, any pollutant limited in an effluent guideline to which the facility is subject.	Quarterly	Quarterly
Wood Treatment Facilities		PAHs, TSS, Oil and Grease, Phenols, pH, Total Copper, Total Chromium and Total Arsenic	Quarterly	Quarterly
Industrial Facilities with Coal Piles	Stormwater discharges from coal pile runoff	Oil and Grease, Total Iron, Total Manganese, pH, TSS (TOC)[3], Total Copper, Total Nickel, Total Zinc	Quarterly	Quarterly
Battery Reclaimers	Stormwater discharges from areas for storage of lead acid batteries, reclamation products, or waste products, and areas used for lead acid battery reclamation	Oil and Grease, COD, TSS, pH, Total Copper, Total Lead, (Cd)[3]	Quarterly	Quarterly
Airports (with over 50,000 flight operations per year)	Stormwater discharges from aircraft or airport deicing areas with over 1,000 annual jet departures	Oil and Grease, BOD5, COD, TSS, Total Ammonia, pH, and the primary ingredient used in the deicing materials	Quarterly	Quarterly

Table 43 (Continued)

Type of Facility	Type of Stormwater Discharges	Parameters	Monitoring Frequency	Reporting Frequency
Coal-fired Steam Electric Facility	Stormwater discharges from coal handling sites (other than runoff from coal piles which is not eligible for coverage under this permit)	Oil and Grease, pH, TSS, Total Copper, Total Nickel, Total Zinc, and any pollutant limited in an effluent guideline to which the facility is subject.	Quarterly	Quarterly
Ready-mix Concrete Facilities	All stormwater discharges associated with industrial activity	Oil and Grease, COD, TSS, pH, TDS, any pollutant limited in an effluent guideline to which the facility is subject	Quarterly	Quarterly
Ship Building and Repairing Facilities	All stormwater discharges associated with industrial activity	Oil and Grease, COD, TSS, pH, any pollutant limited in an effluent guideline to which the facility is subject, (Total Copper, Organo-tins)[3]	Quarterly	Quarterly

Notes:

[1] A discharger is not subject to the monitoring requirements provided the discharger makes a certification for a given outfall, on an annual basis, under penalty of law, that material handling equipment or activities, raw materials, intermediate products, final products, waste materials, by-products, industrial machinery or operations, significant materials from past industrial activities, or, in the case of airports, de-icing activities, that are located in areas of the facility that are within the drainage area of the outfall are not presently exposed to stormwater and will not be exposed to stormwater for the certification period.

[2] A discharger may, in lieu of monitoring for acute whole effluent toxicity, monitor for pollutants identified in Tables II and III of Appendix D of 40 CFR Part 122 that the discharger knows or has reason to believe are present at the facility site. Such determinations are to be based on reasonable best efforts to identify significant quantities of materials or chemicals present at the facility.

[3] Recommendations by the Washington Department of Ecology.

6. Receiving Environment Monitoring

Requirements to monitor receiving environments are a necessary component of some NPDES permits. Most receiving environment monitoring programs will be aimed at determining (1) the background concentrations of parameters in the receiving environment, and (2) the dilution available in the ambient environment for a proposed or existing discharge. A much less common need will be the requirement for assessment of impacts in receiving environments (please refer to the specific section on the media you are concerned with to determine when this need may exist).

Effluent limits that are calculated using appropriate data from dilution studies and ambient background level studies should not cause impacts to the aquatic life, drinking water, or sediment uses upon which the state's Water Quality Criteria are based. However, in some cases concerns will arise that prompt the permit writer to consider whether a monitoring survey to assess impacts is necessary. These cases are most likely to occur when beneficial uses that are not yet assigned protective criteria are concerned (e.g., wildlife uses).

The arrangement of this chapter is as follows:

1. The regulatory authority Ecology can use to require monitoring (6.1 General Considerations for Monitoring Receiving Environments);
2. Guidance to use when determining when and how to require effluent dilution and ambient background monitoring (6.1 General Considerations for Monitoring Receiving Environments); and,
3. Considerations to be aware of when a study to assess impacts to receiving environments may be necessary (in almost all circumstances the permit writer will work with the E.A. Program and the appropriate headquarters section to develop these requirements).
    a. What circumstances may prompt you to consider monitoring (6.1.1).
    b. How to determine if monitoring is needed (6.1.1 and 6.1.2).
    c. The steps needed to logically develop or review a receiving environment survey to get the greatest amount of useful data in the most cost effective way (6.1.3 through 6.1.5). This section also advises on when the EAP Program and Headquarters should be consulted within the course of determining environmental monitoring requirements, and what type of assistance you can expect from those groups.

Note: Throughout this section the permit manager is directed to contact both EAP and headquarters when determining the specifics of simple or complex receiving environment surveys. This has been emphasized because of the need to assure thorough understanding of the goals of surveys by all parties participating in their design. During the design of complex surveys, headquarters will assist the permit manager to clearly transmit the goals of a receiving environment monitoring project to EAP, and will work to ensure that EAP understands the regulatory need for studies, and the way in which data will be used. This process is recommended as one way of "translating" survey needs between the more regulatory requirement-based permit managers and the environmental assessment-based group at EAP. This should expedite a more thorough review of survey proposals and result in more effective monitoring programs.

6.1 General Considerations for Monitoring Receiving Environments

Environmental monitoring commonly includes surveys of surface and ground water, sediments and soils, and biota. In the State of Washington, major NPDES dischargers are likely to be required to perform some type of receiving environment monitoring. Minor dischargers may also be required to monitor receiving waters. By far the most frequent need for monitoring will be prompted by a lack of information of discharge specific dilution and ambient background concentrations of pollutants or other water quality parameters (e.g., hardness or pH). Other factors that could prompt the need for additional monitoring would likely be founded on a concern that the existing water quality criteria (based on toxicity to aquatic life and benthic invertebrates, and, drinking water concerns) are not providing adequate protection for other designated beneficial uses in waters of the state.

The decision to require or not require receiving environment monitoring must be explained in the fact sheet. Ecology has the regulatory authority to require surface water, sediment, soil, and groundwater monitoring. Regulatory authority for receiving environment monitoring is described below. Regulatory authority for receiving environment monitoring for the purposes of evaluating a technology-based intake credit can be found in Chapter 4, Section 5 of this manual.

State Authority

Our state authority derives from RCW 90.48 and is expressed in Chapters 173-220 and 173-216 WAC.

Chapter 173-220 is explicit in the authorization to require receiving water monitoring.

WAC 173-220-210(1)(c).

> "(c) Monitoring of intake water, influent to treatment facilities, internal waste streams, and/or receiving waters may be required when determined necessary by the Department to verify compliance with net discharge limitations [intake credits] or removal requirements, to verify that proper waste treatment or control practices are being maintained, or to determine the effects of the discharge on the surface waters of the state."

The state regulatory authority for receiving environment monitoring for ground discharges is clear but not explicit.

WAC 173-216-110 (1)(g).

> "(1) Any permit issued by the Department shall specify conditions necessary to prevent and control waste discharges into the waters of the state, including the following, whenever applicable:
>
> > (g) Any appropriate monitoring, reporting and record keeping requirements as specified by the Department, including applicable requirements under sections 307 and 308 of FWPCA;"

The WAC includes language that specifically allows Ecology to require environmental monitoring information as part of a permit application:

WAC 173-216-070 (4)(c).

> "(4) The requirement for a permit application will be satisfied, if the discharger files:

(c) Any other information determined as necessary by the Department."

WAC 173-216-080 (1)(c) and (d).

"(1) Any information submitted pursuant to this chapter may be claimed as confidential.... Claims of confidentiality for the following information will be denied:

(c) description of proposed receiving waters;

(d) description of quality and quantity of receiving water; and..."

Federal Authority

Ecology is authorized to implement the Clean Water Act by RCW 90.48.260 which states:

> "The Department of Ecology is hereby designated as the State Water Pollution Control Agency for all purposes of the Federal Clean Water Act as it exists on February 4, 1987, and is hereby authorized to participate fully in the programs of the act as well as take all action necessary to secure to the state the benefits and to meet the requirements of the act."

Ecology's authority under RCW 90.48.260 allows it to exercise whatever powers it needs "to meet the requirements" of the Clean Water Act. Whenever the Clean Water Act requires certain authority of an NPDES state, Ecology has that authority. The Clean Water Act, in 33 U.S.C. § 1342, requires that states be able to issue permits which apply federal effluent limitations and "[t]o inspect, monitor, enter, and require reports to at least the same extent as required in Section 1318..." 33 U.S.C. § 1342(b).

Section 308 of The Clean Water Act as Amended by the Water Quality Act of 1987, Public Law 100-4 [33 U.S.C. § 1318] states, in part:

> "Whenever required to carry out the objective of this Act, including but not limited to (1) developing or assisting in the development of any effluent limitation, or other limitation, prohibition, or effluent standard, pretreatment standard, or standard of performance under this Act; (2) determining whether any person is in violation of any effluent limitation, or other limitation...
>
> (a) the Administrator shall require the owner or operator of any point source to (i) establish and maintain such records, (ii) make such reports, (iii) install, use, and maintain such monitoring equipment or methods (including, where appropriate, biological monitoring methods), (iv) sample such effluent (in accordance with such methods, at such locations, at such intervals, and in such manner as the Administrator shall prescribe), and (v) provide such other information as he may reasonably require;"

The federal regulation which comes from this section of law is 40 CFR 122.41(h) which states:

> "(h) Duty to provide information. The permittee shall furnish to the Director, within a reasonable time, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit."

The legal test of monitoring and testing under the federal Clean Water Act demands only that the monitoring or testing be reasonably required for some purpose under the Act - including that of developing any new effluent limitation.

Court Opinions On Section 308

Referring to Section 308, the circuit court in *Natural Resources Defense Council v. U.S. Environmental Protection Agency*, 822 F.2d at 119, (D.C. Cir. 1987) commented upon the broad discretion granted by the statute:

> The breadth of this statutory grant of authority is obvious. In our view, the statute's sweep is sufficient to justify broad information disclosure requirements relating to the Administrator's duties, as long as the disclosure demands which he imposes are "reasonable."

In *United States Steel v. Train*, 556 F.2d 822, 850 (7th Cir. 1977), the company argued that an NPDES permit provision requiring a study of the impact of cooling water intake structures on aquatic life was unreasonable. The court rejected the argument saying:

> U.S. Steel's argument that, even if applicable, the permit provision is unreasonable must also be rejected. Not even a "rough cost-benefit analysis" is necessary as a basis for the requirement that the company conduct a study of the impact of the present cooling-water intake structures on aquatic life in Lake Michigan. Such a study, intended to assist EPA in developing 316(b) effluent limitations, is well within the agency's 308 [33 U.S.C. § 1318] authority.

The court's reasoning that "not even a 'rough cost-benefit analysis' is necessary" is important, because it confirms that there is no requirement in the statute that the cost of the monitoring must somehow be proportional to the value of the data expected to be obtained. These determinations are left to the discretion of the permitting agency.

Permitting agencies not only have broad discretion on whether to require monitoring, but the choice of what particular test to require is perhaps even more a matter of agency discretion. Courts only require that the agency's choices in the scientific arena be "rational" - that is, that these choices have some scientific support. If the agency's choice has scientific support, a court will not attempt to substitute its judgment for that of the agency by weighing the merits and demerits of competing scientific approaches. These limitations on review of Clean Water Act scientific judgments are discussed in *Reynolds Metals Company v. U.S. Environmental Protection Agency*, 760 F.2d 549, 558-59 (4th Cir. 1985):

> The scope of our review is further colored by the policy of the Clean Water Act and the sophisticated data evaluations mandated by that lengthy and complicated statute. The Act expresses a congressional insistence to eliminate water pollution within a short time-span... Further, technological and scientific issues, such as those presented in this case, are by their very nature difficult to resolve by traditional principles of judicial decision making. For this reason "[w]e must look at the decision not as the chemist, biologist or statistician that we are qualified neither by training nor experience to be, but as a reviewing court exercising our narrowly defined duty of holding agencies to certain minimal standards of rationality." More specifically, we note that an agency's data selection and choice of statistical methods are entitled to great deference, and its conclusions with respect to data and analysis need only fall within a "zone of reasonableness."

The court went on to note, "[a]s frequently has been written, we do not sit as a scientific body minutely comparing competing research methods and results." 760 F.2d at 560.

This echoes the sentiments expressed in the earlier opinion in *Weyerhaeuser Company v. Costle*, 590 F.2d 1011, 1026 (D.C. Cir. 1978):

> Where existing methodology or research in a new area of regulation is deficient, the agency necessarily enjoys [a] broad discretion to attempt to formulate a solution to the best of its ability on the basis of available information.". . . Indeed, the mere fact that the counsel on both sides in this suit could draw upon the opinions of diverse experts sitting virtually at their elbows during preparation of their briefs, while we are faced to decide between their resulting arguments on the basis of our "generalists" judicial backgrounds, argues for restraint on our part. In sum, unless we are quite certain of our basis for doing so, we must be slow to overturn the Agency's judgment, whichever way it may incline, when Congress has required it to act quickly and decisively despite the lack of exact data.[Citations omitted; footnotes omitted.]

The cases provide some "real world" examples of how these standards of review are applied. In *Natural Resources Defense Council v. U.S. Environmental Protection Agency*, supra, the court was reviewing an EPA requirement that each NPDES permit applicant provide EPA with a list of "any toxic pollutant which the applicant currently uses or manufactures as an intermediate or final product or byproduct." Industry argued that this requirement was invalid because EPA was authorized only to regulate toxic discharges and not toxics which may be involved only in some intermediate manufacturing step. The court stated, "[t]he indications are abundant that EPA was intended to possess broad latitude in identifying and regulating suspected toxics." EPA had identified three reasons for requiring the information: (1) to make sure that the effluent limitations in the permit covered the right toxicants; (2) to provide guidance on what to test for in the effluent; and (3) to aid setting "best management practices" that might be imposed to prevent spills. The court found these reasons sufficient to require the information under 33 U.S.C. § 1318.
A final example of a federal case construing 33 U.S.C. § 1318 is *American Petroleum Institute vs. Environmental Protection Agency,* 787 F.2d 965, 978 (5th Cir. 1986). In this case, the court rejected a challenge to use of a bioassay test in making NPDES permit determinations:

> The nub of the industry's contention is that the bioassay test, based on a four-day long exposure of critical marine fauna to drilling mud, creates a completely unrealistic situation which would never occur in nature because of the rapid dispersion of drilling mud from an offshore platform as a result of simple dilution, currents, and storms...
>
> API's suggestion that the dynamic ocean environment would never result in the extended exposure to drilling mud contemplated by the 96-hour LC-50 test commends itself to common sense. On the other hand, API concedes that test to be perhaps the most widely accepted benchmark for toxicity evaluations by EPA. Therefore, EPA has not selected a patently irrational methodology to measure the relative toxicity of generic Mud No.1. Under such circumstances, we are required to resist API's attempts to substitute our judgment for that of the agency...and must sustain its choice.[Citations omitted.]

The court in *American Petroleum Institute,* supra, used the approach which Ecology believes defines the criteria for determining if receiving environment is appropriate. These criteria are: (1) Are the test(s) required in the permit or as part of the permit application being imposed for an allowable purpose under state law or under 33 U.S.C. § 1318 (that is, to carry out some objective of the Clean Water Act)? Typically these purposes are to require the permittee to monitor for information for permit development or to demonstrate the discharge is not causing harm. (2) Are the specific test methods "reasonable," in that they have scientific support?

The permit writer should be clear these questions are answered in the fact sheet when requiring receiving environment monitoring.

Common Monitoring Requirements

The two most common reasons to consider and require receiving environment monitoring are:

- To attain data on ambient conditions in receiving waters for use in calculating effluent limits, and;
- To determine flows and dilution in the vicinity of the discharge (i.e., field verification of mixing zone models).

By far the most common reason to require receiving environment monitoring is to provide background data to use when permit limits are calculated. These data can be required upon application, or can be specified in the preceding permit as a special study. Both options have advantages and disadvantages. Requesting ambient data upon application, especially if the request is not specific as to detection limits, QA/QC, and sampling locations and depths, can result in submittal of data that are not appropriate to use in limit calculation. Requiring background data within a permit can result in an additional work-load for the permit manager if study plans need review and approval. The recommended approach is to require a special study as a permit requirement. Ideally, as many of the data reporting requirements as possible should be incorporated into the requirement. Studies should address the most necessary types of data needed for effluent limit calculation, including temperature, hardness, and/or toxins measures. Copies of all data and reports should be submitted to the Basin Planning and Standards Section for incorporation into statewide reports.

There are two general ways to place receiving water studies in permits, permit applications, and enforcement orders. The first method is to describe the sampling program in detail in the permit. In many cases this is the best method for simple studies that will be conducted by the permittee (e.g., measuring copper concentration at one ambient background site to determine the concentration of copper in ambient water during critical flow conditions, or, estimating dilution near the discharge point). When using this method, the permit manager should specify any applicable sampling and analytical protocols to be used, as well as sample location and timing. *The specific protocols for these simple studies, for different environmental media, can be found in the media-specific sections at the end of this chapter.*

The second method is to specify the study objectives and to allow the permittee to submit draft and final study plans, acceptable to Ecology, within a specified time period (e.g., within 90 days of permit issuance). It is important to note that discussing the need to conduct receiving monitoring studies with the discharger and other interested parties during the permitting process can help to formulate survey objectives early-on, and will help the discharger by giving them early warning that they must start to budget for a sampling program. This is the best approach for studies that are conducted by a consultant for the permittee. If the permit manager requires the permittee to submit a sample plan, the qualifications of the people doing the work should be submitted for approval. The study plan should address the variables and information needs associated with fulfilling the objective. All study plans must be approved by Ecology. When the second method of requiring a study is used, the permit manager should discuss the specific problem, the study objectives, and any constraints of the study with the Program Development Services Section (or other appropriate headquarters group) and EAP. Experts on commercial laboratory and permittee analytical capabilities are in the Quality Assurance Section in the EA Program.

Infrequent Monitoring Requirements

The third and least common reason to consider requiring receiving environment monitoring is to determine whether the permitted discharge is causing a detrimental impact to the environment in the vicinity of the discharge (i.e., environmental assessment).

Effluent data are often the first indicator that a receiving environment may be undergoing damage due to discharges, thus effluent quality should be characterized before a receiving environment study is required. Environmental monitoring should focus on effects that could be caused by chemicals and other properties that are present in the effluent. In some cases biological or chemical effects may already be identified in a receiving water (e.g., abnormal blooms or die-off of algae, deleterious concentrations of toxins in wildlife, or, exceedances of state standards and associated ambient toxicity). If any of these occur, the main focus of a receiving water survey will be to gather data to assist Ecology to identify the cause(s) of the impact. Studies that can determine cause and effect in natural systems are generally difficult to design, and expensive to finance. Studies to determine complex cause and effect issues should always be discussed with the PSMS and the EILS Program in order to clarify objectives and determine the most effective sampling design. In addition, the permit writer may wish to consult the following documents when planning and considering a monitoring program: *Guidelines and Specifications for Preparing Quality Assurance Plans*, (Ecology, 1991a) and, *Technical Guidance for Assessing the Quality of Aquatic Environments in Washington State*, (Ecology, 1990a)

A general process for deciding whether to require a receiving environment study to determine impacts consists of the following steps (Baker and Wolff, 1987):

- Define and clarify the problem (what is the major concern you are interested in?) (Section 6.1.1)
    - Specify objectives and constraints (Section 6.1.2)
    - Develop alternative strategies (solutions) that address objectives and constraints (alternative sample designs including parameters to be monitored, sampling locations, methodologies for sample collection and analysis, and timing and frequency of sampling) (Section 6.1.3)
    - Evaluate the alternative sampling designs (Section 6.1.4)
    - Choose the best sampling design (Section 6.1.5)

This process is discussed in more detail below (Sections 6.1.1 through 6.1.5).

6.1.1 Define and Clarify the Problem

For our purposes, an environmental study is a way of addressing a problem with one or more effluents. Defining the specific problem you are concerned with is critical to the success of the project. Some examples of problems you may find include:

- High levels of fecal coliform in publicly used shellfish beds near a municipal discharge point.
- Detectable mercury concentrations in an effluent that discharges to a quiescent and organic-rich environment, leading you to suspect sediment or organismal accumulation.
- You do not have background data to use when calculating effluent limits for copper and nickel.
- Repeated acute toxicity violations lead you to suspect that ambient effects are occurring outside the mixing zone for acute toxicity.
- You discover that effluent conveyed through a storm drain is directly entering a rocky intertidal area at low tide, and you wish to determine the areal extent of the effluent in the intertidal zone.
- Fish kills or other events occur downstream of a discharge.
- Dredge spoils from a ditch contain elevated concentrations of certain pollutants.
- Contamination that is characteristic of dairy farms is found in a drinking water well located downgradient from a large dairy.

Sampling should focus directly on the suspected or observed problems. Sampling of surface waters and sediments is discussed below. More details on sampling these and other media can be found in sections 6.3 through 6.6.

The decision to require the permittee to monitor the receiving environment should be based on a knowledge or indication that the discharge may be adversely affecting the receiving environment. This knowledge or indication will generally come from effluent monitoring data or from observable impairment of the environment. The following are cases for which receiving environment monitoring could be considered:

- **Problem:** The facility discharges to a 304(1) water body.

  Comment: Point source discharges that contribute to Water Quality Standards violations will be identified in technical reports being prepared for each of the water bodies on the 304(l) short list. The "short list" is comprised of water bodies that do not meet the Water Quality Standards due to point source discharges of toxins. Facilities that discharge to these water bodies, and especially those facilities identified as contributing to these standards violations, could be required to perform receiving environment monitoring that is focused on effects caused by the toxin of concern. This could include ambient toxicity testing, water chemistry, bioaccumulation studies, and others. When deciding if impact assessment is necessary, the permit writer should consider whether monies spent on addressing the listing are better spent in clarifying the problem (monitoring) or on reducing discharges of problem pollutants.

- **Problem:** The facility discharges chemicals that meet technology- and water quality-based limits but is suspected of causing problems because of the high sensitivity of an indigenous species in the receiving environment.

  Comment: A facility may be meeting technology- and water quality-based limits but be discharging to a receiving water which traditionally serves as a spawning habitat for a species which is particularly sensitive to a component of the effluent. If environmental surveys are proposed, monitoring may be concentrated on seasons in which resident organisms are particularly sensitive to effluent. With this particular problem, however, it may be possible to satisfy concerns with the receiving water by doing toxicity tests with species that are closely related (e.g., same genus and habit) to the indigenous species of concern, instead of trying to identify impacts in the receiving environment. Although toxicity tests are costly, environmental monitoring programs that adequately address both physical and biological variability in a natural system (i.e., the data is good enough to answer the original question instead of yielding an ambiguous result because of high variability) can be much more expensive.

- **Problem:** The facility is associated with periodic spills or the discharge of high concentrations of toxins.

  Comment: The purpose of sediment and water column monitoring in this case would be to determine whether degradation of the receiving environment has occurred due to occasional discharge of highly concentrated contaminants. Permits issued for combined sewer overflows and storm drains would fall into this category. The timing of receiving water sampling is critical for detecting effects from storm events. Of particular interest are violations of acute criteria associated with stormwater in well flushed areas, and violations of chronic criteria that last days, weeks, or longer in poorly flushed areas (e.g., estuarine areas removed from major flushing currents or lacking significant riverine inflow).

- **Problem:** Facility expansions, production increases, or process modifications are proposed that may result in new or substantially increased discharges of pollutants or a change in the nature of the discharge.

  Comment: Permittees in this category are required to submit a new application or supplement to the previous application. The information submitted with the application or supplement should indicate expected changes in effluent quality or quantity. Permit managers will use that information to determine if the change in the facility could result in discharge of effluent that could potentially impact the environment. The proper receiving environment data collected before and after the proposed change occurs could help to identify environmental impacts caused by the change. If an environmental survey is required, the sampling program should focus on effects that are expected to occur due to the changes in effluent. In many cases the use of dilution information and ambient background data to calculate effluent limits will provide enough reassurance to reduce the need for impact assessment.

- **Problem:** A facility is suspected of discharging effluent that may be causing or contributing to observed environmental impacts such as recurring algae blooms or fish kills. A facility is discharging to a water body on the 305(b) list or suspected of contributing to violations of water quality standards in the receiving environment.

  Comment: When trying to draw cause and effect relationships (e.g., fish kill caused by a specific effluent discharge) it is critical to gather as much operational data on the discharge as possible. Review of operational data may indicate periodic presence of toxins in effluent that are not caught by self-monitoring (e.g., filter backflush and disinfection that has not been dechlorinated prior to discharge), and review of monitoring data may indicate levels of chemicals that could drive receiving water to develop toxic conditions during critical periods or in certain downstream areas (e.g., depletion of oxygen caused by excessive BOD). This information can sometimes lower the cost of environmental surveys by focusing the objectives toward the effects most likely to occur.

- **Problem:** A facility's discharge is a source of ongoing public concern regarding the actual or potential effects on the biota of the receiving environment.

  Comment: When the concern is due to the location of the discharge in or near a sensitive receiving environment, benthic biota, sediment, bioaccumulation, or water column studies may be appropriate. If the public is concerned, the permit manager should try to clarify the specific concerns of the public (e.g., mercury uptake and toxicity to wildlife; uptake of toxins by fish and shellfish that may cause a hazard to human health; public believes the environment in the area of discharge does not get any flushing, and consequently toxins may be accumulating to levels dangerous to either humans or other biota). In some cases, these fears may be allayed by reviews of existing information. Sometimes a review of existing information will prompt the permit manager to suspect that the public concerns are based on realities, or will bring up other concerns with the area. In that case environmental surveys should be required. Because of the environmental and political complexities associated with surveys prompted by widespread public involvement, the permit manager should confer with the Program Development Services Section, EAP, and any applicable resource agencies before formulating specific sampling objectives.

Complex receiving environment monitoring should not be required of facilities that discharge effluents that have little potential to impact the environment and do not fall under a category listed above. For example, facilities that discharge into areas with strong currents would have no accumulated bottom sediments. However, even these facilities may be required to sample background water chemistry to establish data on which to base permit limits, or to measure bioaccumulation of toxins, or to perform other specific studies.

6.1.2 Specify Monitoring Objectives and Constraints

Specific monitoring objectives state the variables that are to be observed, and the time frame or time period during which the observations should occur. Several objectives may develop from thoughtful consideration of the initial problem. Clearly expressed and specific objectives are critical to proper sampling design and use of data. In addition, when you define monitoring objectives and constraints, it is important to determine what the regulatory outcome of the monitoring will be. ***If the data you gather is intended to result in modification of a discharge permit, then you should clearly define the result that will trigger a permit modification.*** Examples of objectives include:

- To determine the concentrations of priority pollutant metals in the receiving water before a new facility commences discharging.
- To determine if concentrations of lead and zinc in the receiving water are exceeding water quality criteria during low flow months.

The following is an example of a specific monitoring objective to determine compliance with sediment quality standards:

- To determine if the concentrations of cadmium, lead, zinc and mercury in sediments near the outfall are exceeding the sediment quality standards during year four of the issued permit.

Other constraining factors can limit the way in which specific objectives are addressed and may be both scientific and operational (Baker and Wolff, 1987). An example of an objective and some discharge-specific constraints are illustrated in the following example:

Objective

- Determine a background copper concentration in ambient waters to use when calculating an effluent limit.

Constraints

- Sampling must occur during critical conditions (low flow).
- Data must be collected and analyzed using ultra-clean techniques.
- Preconcentration of samples must be done if copper concentrations are below the levels of detection using graphite furnace AA.
- Because of time constraints, the permit manager is willing to calculate the limit based on samples collected over one summer that occurs during a drought period.

In some cases you will address problems that deal with more than one environmental media, such as assessing sediments and water in the same area, or determining sediment toxicity and sediment chemistry. If more than one media is being tested, be sure to formulate your objectives and constraints in such a way as to best address all media. In many cases you will use data from one media to interpret the data from another media (sediment chemistry data can help interpret causes of sediment toxicity). In such cases try to coordinate the sample sites, sampling times, and choice of parameters for measurement to make them as useful and comparable as possible.

6.1.3 Develop Alternative Sampling Strategies that Address Objectives and Constraints

When the problem has been defined, and the objectives and their constraints have been clearly and precisely set out, alternative sampling strategies to address the objectives and constraints should be developed. In effect, this means that several different ways of answering the same question may exist, and these should be developed and designed in detail. If you require the discharger to submit a sampling plan, they will submit one or more of the potential sampling designs. In most cases you will first consider the ***chemical and physical parameters*** you want to sample, the analytical methods to measure them, and then the general ***location*** of the sample sites. Are you interested in sediment toxicity caused by cadmium accumulation in sediments? Is the area subject to dredging, currents, navigation, or high winds? Can the area be safely sampled? Are there rip tides, can divers be used, or can benthic grabs be safely used in the area? What are the windows of safety for sampling (not at maximum tidal exchange, not during afternoon high winds, etc.)? What is the direction and speed of groundwater flow? In other words, how will you ***design your sampling program*** to fit the environment and environmental compartment you are interested in (i.e., determine its statistical design to fit your specific sampling objectives)? Some of these concerns are discussed below:

Chemical and Physical Parameters

The choice of the appropriate physical and chemical parameters to sample for in a particular study ***are directly dependent*** on the problem, objectives, and constraints that have been previously defined. It is important that sampling be focused in order to (1) produce data adequate to answer the question you are asking, and (2) to minimize the amount of useless or ambiguous data collected in the study. It is also important to enhance the comparability of the data that is collected with data collected in other sampling programs. In order to enhance data comparability, there are specific chemical and physical measurements that should be taken with each sample that you collect. Lists of required analyses for each sampling media (receiving waters on surface, receiving waters in subsurface, sediments, etc.) are described in sections 6.2 through 6.6. In some cases the parameter you are monitoring will be included in the list of required analyses. At other times the usefulness of the data you are interested in will be enhanced by collecting data on all parameters in the required list of analyses.

Sampling and Analytical Methods

After you decide on the parameters you wish to measure in the samples, decide the specific methods to be used for sample collection and chemical analysis. These include preparation of sampling containers, detailed field protocols, and specifying analytical methods. Specific protocols have been developed for most media (e.g., *Recommended Protocols for Measuring Metals in Puget Sound Water, Sediment and Tissue Samples,* Tetra Tech, Inc., 1986a***). The protocols that should be used for specific types of receiving environment monitoring are described in sections 6.2 through 6.6.*** In some cases you may want to use different methods than those in the specified sampling protocol (e.g., ultra-clean sampling for metals in surface waters, preconcentration of metals in order to yield lower detection limits). In those cases the analytical methods you wish to use should be referenced. The practical aspects of finding labs that can perform alternative analytical methods should be discussed with the PDS section and the EA Program. In other cases you may wish to specify changes in sample replication or collection methods to fit the particular media, site, and statistical analysis of a particular survey. Any changes in sample collection methods should be clearly described.

Sampling Locations

In most cases, such as sampling for background data, it will ***not*** be difficult to choose sampling sites. The sites will be in "clean" areas of water bodies (or other media), or they will be at the edge or just outside of a designated mixing zone. The size of the mixing zone will be determined during effluent limit calculation. In many cases the study you require may be a field verification of a mixing zone model that has been used to calculate limits. These types of studies have straight-forward survey designs. However, some surveys will address more complex objectives, in which case the design should always be discussed with the PDS Section (or other appropriate sections at headquarters) and with the EA Program. In many cases those groups will help formulate or review alternative test designs for the permit manager.

Consider the Statistical Analyses

In some cases no statistical analyses will be necessary, as in cases where one sample is being collected for direct comparison of chemical concentrations in the environment with state standards.

If you are considering a complex monitoring survey, the sample locations you choose, and the spatial configuration of those sites, will in large part depend on the statistical analysis you choose to use. For example, if you are comparing a far-field station to a near-field station, you might choose to use the Student's t-test to distinguish between stations. If you are interested in looking at a larger area with numerous stations, you might choose to use one of the many analysis of variance tests, followed by multiple comparison testing, and your station locations would be set up with proper replication and siting. A consideration of which statistical analyses to use will force you to define a testable hypothesis (e.g., mercury concentrations in sediment are elevated at the discharge point as compared to surrounding "clean" areas at the p=0.05 level), and choose the proper statistical procedure to interpret the data you collect (e.g., T-test, parametric two-way ANOVA for use with random box design). **Specific design considerations for each media (surface waters, ground waters, sediments, etc.) are discussed in sections 6.2 through 6.6**. (Note: You may wish to refer to a statistical text when determining a sample design. Sokal and Rohlff, 1981, *Biometry*, Second Edition, has good coverage of most statistics you will be interested in.) **Remember that complex designs should always be discussed with the EA Program, and the headquarters section that addresses the media you are sampling. In many cases these groups will assist you to formulate and review test designs.**

Your consideration of statistical analyses will include review of other similar studies whose data may indicate the likely distributions or variability of data in certain areas. For instance, you may discover from looking at USGS sediment monitoring data from an area you are interested in that (1) mercury data are log normally distributed, (2) that mercury concentrations should be normalized for organic carbon, and (3) that three replicates of superficial sediments per station will adequately assess variability so that station to station differences can be determined. Existing data can prove invaluable when designing sampling programs. In most cases, however, existing data will not be available for you to use, in which case you will have to decide how to handle the unknown variability of the parameter you are measuring.

Variability

Variability can be caused by several factors, including variability introduced during sampling and sample analysis, and by temporal and spatial components.

Sources of temporal variability include cyclic flow patterns of municipal treatment plants, tidal cycles, seasonal cycles, El Nino southern oscillation cycles, and dredging schedules. Spatial variability occurs over small (e.g., within one scoop of sediment) to large (e.g., within Puget Sound) distances, with both vertical and horizontal components.

When dealing with sources of variability it is best to minimize the variability by controlling (equalizing) as many factors as possible. Variability introduced during sampling and analysis can be controlled to a large degree by standardizing the sampling and analytical techniques used within and among sampling surveys. Use of the Puget Sound Protocols will help to reduce variability and enhance comparability of data. Reducing variability can also take the form of including temporal controls (e.g., collect all samples at high slack tide on the same day or on consecutive days) or spatial controls (e.g., sample unpolluted reference sites to determine "background " conditions, take enough replicates to characterize each station, and only collect oxidized sediment layer). These types of controls will all result in more useful data by limiting variability and enhancing comparability. Ideally, your sampling design will control for as many variables as possible. In the long run, a thorough consideration of sources of variability and ways to try to minimize variability is likely to save money, either by pointing out effective ways to sample, or by pointing out that some problems may be too complex to affordably answer. Sample replication is frequently a point of controversy when designing surveys.

Sample replication is often necessary to adequately characterize the variability at a site and is often expensive, thus it is a source of controversy. Remember that reducing the number of replicates can lead to collection of data that yields ambiguous interpretations, and is frequently useless for regulatory decisions. If it turns out that a monitoring program that can adequately answer a question is too costly to consider, then the permit manager should rethink the original problem and objectives. At this point communication with other parties is particularly important. The permit manager should consider discussion with the EA Program, the appropriate headquarters section, other state and federal regulatory agencies, state and federal resource agencies, academia, and any other interested party. Brainstorming with other persons can lead to new perspectives on how to address a question, or can lead to solutions that could be found more easily in other environmental compartments, or at less cost. In many cases other monitoring options may exist that can adequately respond to the concern.

6.1.4 Examine the Alternative Sampling Designs

After generating detailed sampling designs, the permit manager should evaluate the effectiveness and cost of the different designs, whether submitted by a discharger or developed by Ecology. It is critical at this point to first weed out any designs that appear to have a likelihood of yielding ambiguous data (i.e., that may not give you enough data to answer the question you are asking). Secondly, consider cost. Will two studies yield equally useful data on which to base a decision, but one is much less costly than the other? If so, recommend the one of lesser cost. In most cases (e.g., gathering background ambient data to use in the calculation of permit limits) cost will not be prohibitive. However, if the cost of the survey that will yield useful data is out of proportion to the magnitude of the problem being addressed, try to find another way to "ask the question" (e.g., can less frequent tissue accumulation studies be substituted for frequent water column monitoring for mercury?), and generate sampling designs for use with the new question. Can a less expensive study be done in a lab that will also address the real problem being considered? And will the public, resource agencies, and Ecology feel comfortable with the data generated? Ecology has a regulatory mandate, as part of their NPDES delegation, to fulfill the pertinent requirements of the Clean Water Act and to assure compliance with permit limits, and Ecology must ensure that it has appropriate data to make regulatory decisions that will be protective of water quality and beneficial uses.

6.1.5 Choose the Best Sampling Design

At this point in the five-step process of planning/reviewing an environmental survey, the permit manager should have already examined the problem thoroughly, developed precise and well thought out objectives and criteria, evaluated effluent quality and operations, and be familiar with the advantages and disadvantages of alternative sampling designs. The permit manager, after conferring with the EA Program and the appropriate Ecology headquarters section, should choose the best study design, and require that study as part of a permit application, as a permit requirement, or in an enforcement order.

6.2 Surface Water Monitoring

6.2.1 Parameters

When requiring receiving water monitoring, ***all samples*** should be measured for the following characteristics:

- Temperature
- Dissolved oxygen
- Conductivity if freshwater or, salinity if estuarine/marine
- Turbidity or light transmittance at depths
- pH
- Salinity or Hardness

These data will add to the comparability of data collected in monitoring programs conducted throughout the state. Other parameters that you choose for measurement should be directly related to the objective and the specific conditions of the study. These may include the following:

- Nutrients
- Fecal coliform
- Chlorophyll-a
- BOD_5, COD or TOC
- Water column profiles
- Ambient toxicity tests
- Toxic pollutants (metals, volatile organics, priority pollutants, other)
- Water column dilution, currents, etc.
- Others

In many cases receiving water studies will be required to determine if the Water Quality Standards are being met in the water column. Each water body classification has water quality standards for the following parameters:

- Temperature
- Dissolved oxygen
- pH
- Turbidity
- Fecal coliform
- Total dissolved gas

In addition, water quality standards based on aquatic toxicity have been developed for the following toxic substances:

Aldrin/Dieldrin	Heptachlor
Ammonia	Lindane
Cadmium	Lead
Chlordane	Mercury
Chlorine	Nickel
Chloropygifos	Parathion
Chromium 3+	PCBs
Chromium	Pentachlorophenol
Copper	Selenium
Cyanide	Silver
DDT & metabolites	Toxaphene
Endosulfan	Zinc
Endrin	

All water body classifications are required to meet standards based on aquatic toxicity. Human health-based criteria for 91 toxic compounds have been issued to the state by the EPA. If those chemicals are detected in effluent at concentrations that merit concern, either tissue bioaccumulation or water column studies may be required. Guidance on setting limits based on human health is given in Chapter 7.

Ambient toxicity should be measured with organisms that tolerate the natural salinity of the water body. This will allow a truer measure of toxicity in the water column than if samples undergo salinity modification. For example, ambient brackish waters should be measured with organisms tolerant of brackish salinities, instead of requiring addition of artificial salts to enable use of a marine organism not tolerant of brackish salinities. Always choose the test organism that will require the smallest amount of sample modification.

6.2.2 Sampling Locations

Water quality criteria apply at the end-of-pipe unless a mixing zone is established. If a mixing zone is established, its spatial boundaries will be specified in the permit. The mixing zone boundary can be set between the discharge point and the distance limits specified in WAC 173-201A. If the objective of the receiving water survey is to determine background concentrations of toxins (or other characteristics) to use in the calculation of effluent limits, locate the sampling station as near to the discharge as possible, but in an area not affected by the discharge of any effluents. In most circumstances this will be an easy and straightforward task. However, the task may become complex in poorly flushed areas of estuarine circulation (tidal cycles that dilute effluent with previously discharged effluent from the same source), or where multiple effluents are discharged into the same water body. In complex areas, waste-load allocations may be necessary to allocate discharge capacity to numerous discharges. If this type of situation exists, contact the Program Development Services Section at headquarters.

In order to accurately set sampling station locations that address the survey objectives, it may be necessary to field-verify computer models of mixing and dilution in receiving waters. Typical situations where this could occur are in shallow areas affected by both tidal currents and regularly occurring strong winds (e.g., wind may move effluent plume into areas that are not predicted by models), in rivers with "side bank" discharges, or in areas where accumulation of toxins in sediments does not match the pattern of effluent flow predicted by models. A dilution study can include use of floats, dyes, salts, and other devices, can include samples from all depths, and can last from hours to weeks (or longer). A natural component of the effluent may be used if the differential between the concentration in the effluent and receiving water is large. In most cases, however, a dye is added to the effluent in proportion to the effluent flow. The specific type of study you choose to require will depend directly on the types of questions you plan to ask in any future receiving water surveys, and on the physical characteristics of the discharge area. The EA Program should be contacted before specific dilution study methods are determined. The information from dilution studies will prove useful when used to locate sampling stations.

Depending on the specific objectives of the receiving water survey, the following sampling location considerations may apply:

Rivers

Reference or control stations may be located upstream from the discharge point, but downstream from other sources of pollutants or dilution (e.g., other discharges or tributaries). Data from reference or control stations can be compared to data collected from stations at or below the point of discharge, or for calculating effluent limits.

Stations chosen to assess the effectiveness of effluent limits (i.e., whether or not Water Quality Standards are being exceeded) are generally located downstream of the discharge point, in an area where complete mix of the effluent occurs. The boundaries of the mixing zone used in setting effluent limits will be specified in the permit and fact sheet. Sampling this area is important when determining whether narrative criteria, as measured by ambient toxicity, are being met.

Stations located downstream from the discharge point and mixing zone can provide data to assess the instream effects caused by discharges. Your list of considerations when selecting downstream sampling stations and depths might include the following:

- The different densities of the wastewater constituents, such as floating oils, or settling suspended solids.
- The distribution of the wastewater constituents in the receiving water, resulting from either poor mixing or stratification (for example, vertical distribution patterns which may need to be determined).
- Public beaches, shellfish beds, eelgrass beds or other biologically productive areas that may be affected by the discharge of pollutants.
- Chemical or biological reactions, such as growth of algae in upper layers of the water which may cause changes in pH, or exertion of a BOD sag miles downstream of the discharge.
- The convenience and accessibility for sampling the area.

These types of information will help focus your choice of sampling site to a particular place and time that best address the objectives and constraints of the survey. In general, only complex receiving water surveys will require the use of sample stations located downstream of mixing zones.

Marine or Estuarine Systems

Sampling tidally influenced environments is almost always more complex than sampling unidirectional-flow river systems. In most cases the selection of sampling stations for marine or estuarine receiving waters will follow the same general riverine principles of control stations and full mix station, with practices adapted to the tidal marine environment. Additional factors to consider include tidal cycles, current patterns, bottom currents and counter-currents, stratification, climatic conditions, seasonal fluctuations, dispersion of discharges, wind induced surface currents, and multi-depth sampling. If a problem develops that may be caused by a marine/estuarine discharger, and that problem can only be addressed by a complex receiving water survey, it is appropriate to perform a dilution study prior to choosing sample sites.

Water current and chemical data for some areas of Puget Sound exist. It would be worthwhile to consult any studies conducted by the Coast Guard, the Corps of Engineers, NOAA, USGS, universities, or private research done in areas you are focusing on. That data can help you determine whether initial surveys (preliminary surveys that will give you enough information to set up the real receiving water survey) are necessary. The EA Program may be able to provide references. Marine and estuarine sampling will require some kind of station positioning method.

Considerable stratification can occur in estuaries because of the differing densities of saltwater and freshwater. Freshwater flows enter estuaries as point source discharges, as sheets of stormwater runoff, and in rivers and other smaller tributaries. Freshwater is more buoyant than salt water, and will rise to the surface unless it is entrained in a current underneath a salt water layer. It is essential to determine the extent of stratification when starting a survey of an unknown estuarine area. This can be done by determining salinity at different locations and depths over tidal cycles and over seasons. Because stratification is important to know about when calculating effluent limits and when designing a field survey, it should always be considered during survey design. Stratification is not difficult to measure, but the field time and gear needed to measure stratification can be expensive. If data indicating the extent of stratification is not available, the permit writer should require the discharge to provide the information only for times of maximum concern.

It is possible for stratification to occur in one part of an estuary and not in another. A wedge of fresh river water overriding more dense saltwater is a specific mechanism of stratification commonly seen at and in the vicinity of river mouths. In that situation, when the discharge of pollution is in the saltwater layer, the contamination will be concentrated near the bottom of the freshwater wedge at the flood tide. Where stratification is suspected, samples at different depths will be needed to measure vertical distribution. Dilution studies will generally be needed to determine plume movement and dispersion during times of stratification. These studies should generally be conducted under the perceived "worst case" dilution conditions (e.g., time of least flushing flows, accounting for low slack tides and ebb tides).

6.2.3 Specify Methods for Sample Collection and Analysis

The general sampling methods for receiving water surveys conducted within Puget Sound are detailed in the *Puget Sound Protocols*. **The analytical methods chosen for a specific survey should, as far as possible, be consistent with both the Puget Sound Protocols and the Ambient Monitoring Program.** In some cases other methods may be more appropriate to address the survey's objective.

The choice of specific field methods and equipment used to collect samples will in large part be determined by the type of representative sample required to address the survey objectives, and the chosen analytical methods. In almost all cases grab samples will be collected because of the limited availability, expense, and vandalism problems associated with in-situ composite samplers. Determine the depth of sampling based on the position of the plume and the particular chemicals or physical properties you are interested in. Equipment preparation and type should follow the guidance in the Puget Sound Protocols. If you are planning to measure many different constituents of the sample, make sure that the sample collection gear fulfills the specifications of all the different analyses. This might mean collecting more than one sample per station. In all cases, parameters that are subject to change during storage (dissolved gases, residual chlorine, soluble sulfide, temperature and pH) should be determined in the field.

Unless a special data need arises, samples collected from Puget Sound for metals determinations should follow the sample collection, analytical methods and the QA/QC procedures outlined in the *Recommended Protocols for Measuring Metals in Puget Sound Water, Sediment and Tissue Samples* (1986a). The sample collection methods for water column samples provides guidance for using water bottle samplers that also applies to sampling the water column of fresh waters. In general, water column samples collected for analysis of toxins have not been collected with replication. This has in large part been due to cost considerations. In situations where water column concentrations are compared to the Water Quality Standards, lack of replication may not be particularly important. However, in more complex surveys the statistical design of the survey will drive any data interpretation. An estimate of the sample variance is frequently needed for a statistical test powerful enough to yield useful data, and more than one sample is needed to estimate the sample variance. The needed replication cannot accurately be known without a characterization of the variability of the constituent of concern in the water body, which can be a prohibitively expensive task. Additionally, other sources of variability that affect the system are often uncharacterized (e.g., local currents). The Permit Manager should be aware that small-scale spatial variability of toxins in waters are not well characterized, and studies conducted without replication lack an estimate of the sample variance of the parameter, which can hinder interpretation of sampling results. **Always discuss the design of complex receiving water studies with the EA Program and the appropriate headquarters unit**.

Dilution studies should be conducted using methods referenced in Appendix C.

6.2.4 Specify the Timing and Frequency for Sampling

Predictable variations in the quantity and quality of effluent, as well as seasonal variations in the receiving water, will help to establish the timing and frequency for a receiving water sampling program. In most cases a "worst case" scenario will be of interest, which for the majority of river dischargers will be at low summertime flows. For estuarine dischargers worst case could correspond to times of minimum flushing and maximum stratification.

Some data interpretation difficulties may occur when determining compliance with water quality standards that were developed with toxicity test exposure periods ranging from instantaneous maximum (silver) to 4-day averages (e.g., zinc). If you collect one grab sample on one day, is that sufficient to determine compliance with a standard that was developed with a 4-day average exposure? In general, because one-time grab samples are the type of data which is most practical and least expensive to collect, those data will be directly compared to Water Quality Standards to assess compliance. If the discharger is not willing to use one sample to measure water body compliance, the discharger should be allowed and encouraged to sample multiple times over an appropriate time period to collect data that is even more representative for comparison to the Water Quality Standards.

6.3 Sediment Monitoring

The protocols for sediment monitoring, as well as when sediment monitoring is necessary, are discussed in Section 7 below.

6.4 Crop/Soil/Vadose Monitoring

The Criteria for Sewage Works Design states that for land treatment, background soil samples sufficient to characterize the field area shall be tested prior to land treatment. Additional soil samples shall be collected and retained permanently to allow the original soil to be physically compared with the soil after application begins. The depth to the permanent ground water table shall be determined.

Chemical data on the soil will be analyzed on an annual basis for a possible build-up of heavy metals, salts, a pH change, or any other parametric change that may indicate a reduction in soil renovation capacity or fertility.

6.5 Groundwater Monitoring

See Chapter 8

6.6 Biological Surveys

Some of the various types of surveys commonly used to assess effects of pollution on biota include ambient water and sediment toxicity testing, analyses of benthic infaunal populations and communities, measures of bioaccumulation in resident or transplanted organisms, analyses of fish populations, and a variety of sub-lethal physiological, histopathological, and biochemical biomarkers (e.g., production of metallothionein and metal binding proteins, or, lesions in skin, ovary, liver, or other organs). The types of monitoring commonly encountered in NPDES monitoring programs include toxicity testing, benthic infaunal surveys, and measures of bioaccumulation.

Guidance for monitoring sediment toxicity and benthic infaunal populations and communities is given in the *Sediment Source Control Users Manual*, Ecology, 1993. Guidance addressing bioaccumulation testing will be addressed during an upcoming rule-making on human health-based water quality criteria. Bioaccumulation testing guidance for purposes other than to address human health are currently being developed, and will be inserted in this section when they are complete. Before that time, if characteristics of an effluent lead to the conclusion that problems exist that can most efficiently be addressed using bioaccumulation testing, the permit writer should contact the Program Development Services Section to discuss appropriate sample designs and organisms.

6.7 Data Compatibility

As required in the 1991 Puget Sound Water Quality Plan, monitoring data shall be gathered using the "*Puget Sound Protocols* (Tetra Tech, 1986b) when available." In addition, dischargers shall use data formats compatible with EIM.

7. Sediment Monitoring

This section discusses the monitoring associated with the protection of aquatic sediments from waste water discharges. Specifically this section discusses:

- The general types of monitoring that may be conducted in support of the sediment source control process
- The different types of monitoring data that are applicable to the sediment source control process and their differing objectives
- Methods for the collection of monitoring data
- Factors to be considered in the development of appropriate monitoring requirements
- Interpretation of the monitoring results in light of the monitoring objectives.

Permit managers who have permittees which require sediment impact zones (SIZ) should review the *Sediment Source Control Standards User Manual* for more detail on monitoring associated with sediment impact zones.

7.1 General Types of Monitoring in the Sediment Source Control Process

There are four general types of monitoring that may be conducted in support of the sediment source control process:

- **Baseline monitoring:** Conducted prior to authorization of a SIZ to collect information that will be used in determining whether such an authorization is likely to be necessary.
- **SIZ application monitoring:** Conducted to collect information to support application of the SIZ models.
- **Maintenance monitoring:** Conducted during the term of a permit that includes an authorized SIZ, with the intent to determine whether the SIZ should be renewed, reduced, or eliminated; to determine whether areas of special importance have been adversely impacted by the discharge; and to determine the conditions for SIZ reauthorization.
- **Closure monitoring:** Conducted following closure of a SIZ to demonstrate successful restoration of sediment quality.

Baseline monitoring, SIZ application monitoring, maintenance monitoring, and closure monitoring are the responsibility of the discharger. The need for and extent of each of these types of monitoring will vary depending on discharge- and site-specific characteristics. In certain cases, it may be possible for the discharger to use data previously collected in other monitoring programs in lieu of conducting baseline monitoring.

In addition to these four general types of monitoring conducted in support of the sediment source control process, there are other situations in which additional monitoring may be appropriate. For example, Ecology or an interested third party may conduct additional monitoring to assess discharge or receiving environment conditions independent of the assessment provided by the discharger. In the event Ecology determines that modification of the conditions of the SIZ authorization is necessary, the discharger may also conduct additional monitoring to rebut the conclusions of Ecology's determination.

7.2 Monitoring Objectives

Monitoring objectives vary with the type of monitoring being conducted. The objectives for the four general types of monitoring are described below.

7.2.1. Baseline Monitoring

The primary objective of baseline monitoring is to collect information to confirm a best professional judgment decision of the potential to violate the SQS. The data will be used in determining whether a SIZ authorization is likely to be necessary. Such data may be used for:

- Application of simple screening tools (e.g., information on the nature of the wastewater to be discharged, based either on knowledge of the type of facility or on actual chemical analyses of the wastewater).
- Definition of baseline environmental conditions in the vicinity of the discharge (e.g., chemical or biological characteristics of the sediments).

Baseline monitoring data can also be used to identify other potential contaminant sources in the area or to relieve the discharger from liability for sediment contamination contributed by other permitted or unpermitted (and possibly historical) discharges.

7.2.2. SIZ Application Monitoring

The objective of SIZ application monitoring is to collect the necessary data to support the use of generalized or site-specific models to predict future sediment conditions under specific discharge scenarios (e.g., more detailed information on characteristics of the wastewater as well as on physical and chemical conditions in the receiving environment). In cases where an existing, permitted point source has been discharging at a similar flow and wastewater quality for a sufficiently long period (e.g., 10 years), there is reason to believe steady-state contaminant concentrations may have been reached. In such cases, existing sediment conditions alone may indicate whether there is a need for a SIZ in the absence of detailed modeling.

7.2.3 Maintenance Monitoring

The objectives of maintenance monitoring are to collect data necessary to:

- Determine whether the SIZ should be renewed, reduced, or eliminated.
- Determine whether areas of special importance have been adversely impacted by the discharge.
- Determine the conditions for SIZ reauthorization.

Such monitoring may include chemical and/or biological assessments of conditions within the SIZ to demonstrate that the maximum allowable contaminant concentrations and/or biological effects levels have not been exceeded within the SIZ. Assessments of chemical and/or biological conditions in areas beyond the SIZ may also be used to demonstrate that the spatial limits of the authorized SIZ have not been exceeded.

7.2.4. Closure Monitoring

For instances of SIZ closure that involve active cleanup, the objective of closure monitoring is to demonstrate that the cleanup was successful at restoring sediment quality to acceptable levels (i.e., to contaminant concentrations and/or biological effects levels below SQS) within the SIZ. For instances of SIZ closure that involve natural recovery of the sediments, the objective of closure monitoring is to verify predictions regarding the efficacy of natural processes in restoring sediment quality to acceptable levels within the SIZ.

7.3 Types of Monitoring Data

There are several types of monitoring data that are applicable to the sediment source control process:

- Physical data on the receiving environment
- Chemical data on the receiving environment
- Biological data on the receiving environment
- Physical data on the wastewater discharge
- Chemical data on the wastewater discharge
- Whole-effluent toxicity test data

Some types of monitoring data may be useful for only one phase of the sediment source control process. For example, physical monitoring of the receiving environment may be required to provide input for the SIZ models used to determine whether a SIZ should be authorized for a given discharge, but may not be necessary after a SIZ is authorized. Other types of monitoring data may be useful for all phases of the sediment source control process. For example, chemical or biological monitoring of the receiving environment may be required to determine whether a SIZ should be authorized, to demonstrate compliance with conditions of an authorized SIZ, or to document successful remediation of sediment contamination following SIZ closure. The various types of monitoring data and the potential uses of the data are described in greater detail below.

7.3.1. Physical Data on the Receiving Environment

Data on physical conditions in the receiving environment may be useful in determining whether sediment impacts are likely to occur. For example, physical evidence of a high-energy, nondepositional receiving environment in the vicinity of the discharge would suggest that sediment impacts are unlikely to occur.

Data on physical conditions in the receiving environment are also collected to support application of the SIZ models. The types of physical data that may need to be collected include vertical profiles of the density of the receiving water (generally calculated from the temperature and salinity of the receiving water), water depth, bottom topography, ambient current velocities, particulate concentrations in the water column, ambient sedimentation rates, and physical characteristics of the sediments (e.g., sediment grain size). The SIZ models can be run with varying degrees of site-specific data. In some cases, default values for many of the model input parameters can be used, while in other cases, detailed site-specific data are required to run the models. Guidance on the appropriate data requirements for various types of SIZ model runs is provided in the *WASP Application Guidance Manual* (Ecology, in preparation).

7.3.2. Chemical Data on the Receiving Environment

The collection of sediment chemistry data may be important for several reasons. Data on contaminant concentrations in the sediments around an existing discharge that are collected during baseline monitoring can be compared with the SQS numerical criteria to determine whether there is a need for a SIZ. If none of the contaminants exceed the SQS numerical criteria, and there has been neither a substantial change in the wastewater composition or flow over the past several years nor an expected change in the next 10 years, then it is unlikely that a SIZ will be needed. Exceedances of the SQS numerical criteria, however, suggest the need for further analyses to determine whether a SIZ will be required. Exceedances of the SQS numerical criteria would not necessarily require authorization of a SIZ because:

- The exceedances of SQS numerical criteria may be historical or otherwise unrelated to the discharge in question.
- Modeling may indicate that sediment contaminant concentrations are expected to be below SQS numerical criteria within 10 years.
- The discharge may not be eligible for a SIZ.

In the event that site-specific data are needed for running the SIZ model(s), it will likely be necessary to measure existing sediment contaminant concentrations.

In certain circumstances, it may be appropriate to collect data on subsurface as well as surface sediment quality conditions. Contaminant concentrations in subsurface sediments may be used to investigate changes associated with increases or decreases in contaminant loading over time, and may be important in establishing sedimentation rates that may be used in evaluating the efficacy of natural recovery.
Sediment chemistry data will also be useful for both maintenance and closure monitoring. The contaminant concentrations in sediments within an authorized SIZ will be monitored to determine whether there are any exceedances of applicable limits (i.e., SIZ_{max} or other limits established specifically for that SIZ). Contaminant concentrations in sediments beyond the authorized SIZ will also be monitored to determine whether there are any exceedances of SQS numerical criteria. Finally, contaminant concentrations in the sediments following SIZ closure will be monitored to evaluate whether the predicted reductions in contaminant concentrations following natural recovery, or the target contaminant concentrations following active restoration, are achieved.

7.3.3. Biological Data on the Receiving Environment

Biological monitoring data, which consist of information on the abundances of naturally occurring benthic infaunal organisms and the results of sediment bioassays, are used for two basic purposes in the sediment source control process. First, WAC 173-204-315 allows for the use of acute and chronic effects biological tests to confirm designation of Puget Sound marine sediments using the procedures described in WAC 173-204-310(2). Sediments that have either passed or failed the initial designation procedures based on compliance with the SQS numerical criteria may be subject to confirmatory designation using these biological tests. The results of these biological tests may override the initial designation based on sediment chemistry alone. Hence, confirmatory testing using these biological tests may be important in determining the potential need for a SIZ. If the sediments around a wastewater discharge have one or more chemicals that exceed the criteria of WAC 173-204-320(2), these sediments would be designated as failing the SQS and the discharge would be considered for authorization of a SIZ, unless the results of the biological tests indicate the absence of adverse effects. Conversely, even if the sediments pass the chemical criteria of WAC 173-204-320(2), there may be reason(s) to conduct biological tests on the sediments (e.g., if there are potentially toxic chemicals known to be present in the sediments for which there are no SQS numerical criteria). Failure of one or more of the biological tests would result in the designation of the sediments as failing the SQS, and the discharge would be considered for authorization of a SIZ.

Second, biological tests are used in the sediment source control process to identify the maximum biological effects level that may be authorized within a SIZ. The SIZ_{max} biological effects levels can be established using one of two methods (see Table 22). While designation of sediments as failing the SQS requires only one of the biological tests of WAC 173-204-315 to be failed by the criteria of WAC 173-204-320(3), the SIZ_{max} biological effects level is exceeded when any two of the biological tests exceed the criteria of WAC 173-204-320(3). Alternatively, the SIZ_{max} biological effects level is also considered to be exceeded when any one of the biological tests exceeds the criteria of WAC 173-204-420(3), each of which requires a greater biological effect than the corresponding criteria of WAC 173-204-320(3).

7.3.4. Physical Data on the Wastewater Discharge

The collection of physical data on the wastewater discharge will likely be necessary to provide input for the SIZ models. The types of physical data likely to be needed include:

- The flow of the discharge (to estimate total loading to the receiving water),
- The density of the wastewater (generally calculated from the measured or estimated temperature of the wastewater if the salinity of the wastewater approximates that of fresh water, or from both the temperature and salinity if it does not), and
- The concentration of suspended solids in the wastewater. Physical processes such as flocculation and coagulation may affect the concentration of suspended solids following discharge to the receiving environment, but these processes are not presently addressed in the SIZ models.

As previously indicated, the SIZ models can be run with varying degrees of site-specific data. In some cases, default values for many of the model input variables can be used, while in other cases, detailed site-specific data are required to run the models. Guidance on the appropriate data requirements for various types of SIZ model runs is provided in the *WASP Application Guidance Manual* (Ecology, in preparation).

7.3.5. Chemical Data on the Wastewater Discharge

Data on the chemical characteristics of the wastewater may be used for several purposes. Data on the concentrations of chemical contaminants in the wastewater that are routinely collected as part of NPDES monitoring may be used in simple screening tools to determine whether the discharge has the potential to cause exceedances of the SQS numerical criteria. The data required for this purpose include the concentrations of any of the contaminants in the wastewater for which there are SQS numerical criteria, as well as the concentration of suspended solids in the wastewater. These data may also be used in the SIZ models to evaluate the need for a SIZ. Data on the concentrations of chemical contaminants in the wastewater may also be used to verify that the discharge is achieving AKART or some other level of required treatment defined on the basis of achievable wastewater concentrations. Finally, data on the concentrations of chemical contaminants in the wastewater may be used to identify contaminants that may be targeted for investigation in monitoring of the receiving water or sediments.

7.3.6. Whole-Effluent Toxicity Test Data

Data on whole-effluent toxicity may be useful for assessing the likelihood of adverse biological effects in the sediments. This is especially true when the same organisms (e.g., bivalve larvae) were used in the whole-effluent toxicity tests as would be used in assessing sediment impacts. If a toxic effect was demonstrated in a whole-effluent toxicity test, this may suggest the need for biological testing of the sediments in the vicinity of the discharge, especially if the cause of the toxicity is not apparent.

7.4 Methods for Collecting Monitoring Data

This section briefly describes the methods appropriate for collecting various types of monitoring data. In cases where the methods have been described in other documents, appropriate references to those documents are provided. For methods that are not well documented, additional details are provided, although the level of detail is necessarily brief.

7.4.1. Physical Monitoring of the Receiving Environment

Data on physical conditions in the receiving environment collected to support application of the SIZ models may include vertical density profiles, ambient current velocities, ambient suspended particulate matter concentrations, sedimentation rates, sediment grain size, water depth, and bottom topography. Methods for collecting these data are described briefly in the following sections.

Vertical Density Profiles

Vertical density profiles, which may be necessary for detailed discharge modeling, are typically generated from temperature and salinity data. Temperature and salinity (or conductivity) are generally measured electronically using submersible probes (e.g., conductivity-temperature-depth devices, or CTD) lowered from a boat. In some cases, temperature may be measured using reversing thermometers, and salinity may be determined by returning the samples to the laboratory for measurement with a salinometer. Recommended procedures for measuring temperature and salinity are described in PSEP (1991b). Measurements should be made over the entire water column at the site of the discharge and at sufficient intervals to provide representative data for periods of maximum and minimum stratification.

Ambient Current Velocities

Ambient current velocities are typically measured using current meters. Multiple current meters are usually arrayed along a taut-line mooring, which is deployed in the immediate vicinity of an outfall. Records of currents are typically made over periods of several weeks; the period of monitoring should take into account the possible effects of variations in both tidal influences and nontidal influences (e.g., wind-induced currents), and should be scheduled to include periods of both spring and neap tides.

Ambient Suspended Particulate Matter Concentrations

Determination of ambient suspended particulate matter concentrations normally entails collection of water samples from the water column and analysis for TSS. Sample collection and analytical procedures are described in PSEP (1991b). If ambient TSS data are required, the sampling strategy should address the temporal and spatial variability of this variable, which is likely to be high.

Sedimentation Rates

The most common method of estimating sedimentation rates is through the use of sediment traps, which are cylinders, closed at the bottom, that are placed vertically in the water column to collect settling particulate matter (see U.S. GOFS [1989] and Norton [1990] for descriptions of sediment trap design and use). Sedimentation rates (i.e., the rate at which particulate matter settles out of the water column) should not be confused with sediment accumulation rates (i.e., the rate at which sediments accumulate on the bottom after accounting for loss functions such as resuspension and biodegradation). Because sediment traps are routinely left in place for up to 3 months and occasionally for up to 6 months, they are useful for characterizing average loadings of suspended solids from an intermittent or variable source, such as a storm drain, as well as for characterizing local area sedimentation rates. The advantage of sediment traps is that they collect particulate matter settling out of the water column before it is commingled with sediments on the bottom. The primary disadvantage is that the particulate matter collected is from all sources, both natural and anthropogenic, and not just from the discharge of interest.

Sediment traps should be used in areas that do not receive heavy boat traffic. The traps should be placed close to the source, far enough above the bottom that sediment resuspension will not substantially dilute the particulate matter from the source that is found in the trap. Traps are typically poisoned with sodium azide, mercuric chloride, or salt to minimize biotransformation of organic chemicals. However, a poison should be selected that does not interfere with the analytes of interest. To minimize preservation concerns, valves that prevent entry of zooplankton into the traps have been incorporated into recent sediment trap designs.

Sediment Grain Size

Determination of sediment grain size may be important in assessing the potential for sediment deposition and in modeling sediment resuspension. Sample collection and analysis procedures are described in PSEP (1986). The sampling strategy should take into account spatial differences in sediment grain size, as well as temporal differences that may occur, especially in areas with seasonal differences in flow regime.

Water Depth and Bottom Topography

In cases where relatively detailed bathymetric charts exist for the vicinity of a discharge, sufficient information on water depth and bottom topography may already be available. In other cases, it may be necessary to conduct a bathymetric survey, generally using echosounding equipment, to provide such information.

7.4.2. Chemical Monitoring of the Receiving Environment

Chemical monitoring of the receiving environment may be used to evaluate existing sediment quality, to provide input for the SIZ models, to evaluate historical changes in contaminant loading, and to use for both maintenance and closure monitoring. Chemical monitoring includes conventional sediment variables, sediment contaminant concentrations, and concentrations of contaminants associated with suspended particulate matter. Methods for the collection of these data are described briefly in the following sections.

Conventional Sediment Variables

Measurement of conventional sediment variables is valuable to help interpret the concentrations of sediment contaminants. TOC, for instance, should be measured whenever the concentrations of nonionizable organic compounds are to be measured, because the SQS numerical criteria for those compounds are TOC-normalized. Acid-volatile sulfides (AVS) should be measured whenever the concentrations of metals are to be measured, because AVS data are useful for interpreting the toxicity of metals in sediments. Analysis of ammonia is also potentially useful for interpreting bioassay results. Guidelines for the collection of sediment samples and for the analyses of conventional sediment variables are provided in PSEP (1986).

Sediment Contaminant Concentrations

To determine whether sediment samples contain any contaminants at concentrations above the SQS or to use contaminant concentrations for input to the SIZ models, the sediments should be analyzed for all contaminants for which there are SQS numerical criteria and for all contaminants that are either known or suspected to be present in the wastewater of a subject discharge. There may be other potentially toxic contaminants known or suspected to be in the subject wastewater for which there are presently no criteria (i.e., “other toxic, radioactive, biological, or deleterious substances,” see WAC 173-204-320(5)). These contaminants should also be analyzed for, using methods to be determined on a case-by-case basis, because their presence in the sediments may necessitate the assessment of the concentration below which they would have no adverse effects.

Guidelines for the collection of sediment samples are provided in PSEP (1986). Metals should be analyzed according to the guidelines provided in PSEP (1989a), and organic compounds should be analyzed according to the guidelines provided in PSEP (1989b). Recommended sample preparation methods, cleanup methods, analytical methods, and detection limits for sediments are presented in Table 44. It is important that subsamples of sediment samples analyzed for nonionizable organic compounds be analyzed for TOC as well in order to normalize the resulting concentrations by their TOC contents. It is also important that the analytical laboratory be instructed to employ all necessary methods to attempt to achieve the recommended detection limits.

Concentrations of Contaminants Associated with Suspended Particulate Matter

It is expected that it will rarely be necessary to directly measure the concentrations of contaminants associated with suspended particulate matter in the receiving environment. This information might be necessary in cases where it is not practical to directly measure the concentrations of contaminants in wastewater suspended solids and the information is needed for the application of screening procedures or modeling techniques. If such information is necessary, the use of filtration or continuous centrifugation may be considered to collect the suspended solids, although neither method may be practical because of the large volumes of water that must be filtered or centrifuged. Alternatively, concentrations of contaminants associated with suspended particulate matter in the receiving water may be measured using sediment traps to collect the particulate matter; these methods have been successfully employed in Commencement Bay waterways by Norton (1990).

Table 43. Recommended Sample Preparation Methods, Cleanup Methods, Analytical Methods and Detection Levels for Sediments

Chemical	Recommended Sample Preparation Methods[a]	Recommended Sample Cleanup Methods[b]	Recommended Analytical Methods[c]	Recommended Detection Limits[d] (µg/kg)
Metals				
Arsenic	*PSEP*	*--*	*7060/7061*	*100*
Cadmium	*PSEP*	*--*	*7130/7131*	*100*
Chromium	*PSEP*	*--*	*7190/7191*	*5,000*
Copper	*PSEP*	*--*	*7210*	*100*
Lead	*PSEP*	*--*	*7420/7421*	*100*
Mercury	*--[e]*	*--*	*7471*	*10*
Silver	*PSEP*	*--*	*7760*	*100*
Zinc	*PSEP*	*--*	*7950*	*200*
Nonionizable Organic Compounds				
LPAH Compounds				
Naphthalene	*3540/3550*	*3640/3660*	*8270/1625C*	*10*
Acenaphthylene	*3540/3550*	*3640/3660*	*8270/1625C*	*10*
Acenaphthene	*3540/3550*	*3640/3660*	*8270/1625C*	*10*
Fluorene	*3540/3550*	*3640/3660*	*8270/1625C*	*10*
Phenanthrene	*3540/3550*	*3640/3660*	*8270/1625C*	*10*
Anthracene	*3540/3550*	*3640/3660*	*8270/1625C*	*10*
	3540/3550	*3640/3660*	*8270/1625C*	*10*
HPAH Compounds				
Fluoranthene	*3540/3550*	*3640/3660*	*8270/1625C*	*10*
Pyrene	*3540/3550*	*3640/3660*	*8270/1625C*	*10*
Benz[a]anthracene	*3540/3550*	*3640/3660*	*8270/1625C*	*10*
Chrysene	*3540/3550*	*3640/3660*	*8270/1625C*	*10*
Total	*3540/3550*	*3640/3660*	*8270/1625C*	*10*
Benzo[a]pyrene	*3540/3550*	*3640/3660*	*8270/1625C*	*10*
	3540/3550	*3640/3660*	*8270/1625C*	*10*
	3540/3550	*3640/3660*	*8270/1625C*	*10*
	3540/3550	*3640/3660*	*8270/1625C*	*10*
Chlorinated Benzenes				
1,2-Dichlorobenzene	*3540/3550*	*3640/3660*	*8270/1625C/8240*	*10*
	3540/3550	*3640/3660*	*8270/1625C/8240*	*10*

Chemical	Recommended Sample Preparation Methods[a]	Recommended Sample Cleanup Methods[b]	Recommended Analytical Methods[c]	Recommended Detection Limits[d] (µg/kg)
	3540/3550	3640/3660	8270/1625C/8240	10
Hexachlorobenzene	3540/3550	3640/3660	8270/1625C	10
Phthalate Esters				
Dimethyl phthalate	3540/3550	3640/3660	8270/1625C	10
Diethyl phthalate	3540/3550	3640/3660	8270/1625C	10
Di-n-butyl phthalate	3540/3550	3640/3660	8270/1625C	10
Butyl benzyl	3540/3550	3640/3660	8270/1625C	10
	3540/3550	3640/3660	8270/1625C	10
Di-n-octyl phthalate	3540/3550	3640/3660	8270/1625C	10
Miscellaneous Extractable Compounds				
Dibenzofuran	3540/3550	3640/3660	8270/1625C	10
	3540/3550	3640/3660	8270/1625C	10
	3540/3550	3640/3660	8270/1625C	10
PCBs				
PCB Aroclors	3540/3550	3620/3640/3660	8080	1
Ionizable Organic Compounds				
Phenol	3540/3550	3640/3660	8270/1625C	10
2-Methylphenol	3540/3550	3640/3660	8270/1625C	10
4-Methylphenol	3540/3550	3640/3660	8270/1625C	10
2,4-Dimethylphenol	3540/3550	3640/3660	8270/1625C	10
Pentachlorophenol	3540/3550	3640/3660	8270/1625C	50
Benzyl alcohol	3540/3550	3640/3660	8270/1625C	50
Benzoic acid	3540/3550	3640/3660	8270/1625C	50
Other Analyses				
Ammonia	--[g]	--	Plumb (1981)	100
Grain size	--[g]	--	Plumb (1981)	1%
Organic carbon,	--[g]	--	9060	0.1%
Sulfides, acid	--[g]	--	U.S. EPA (1991)	0.1 µmole/g
Sulfides, total	--[g]	--	Plumb	100
Oil and grease	--[g]	--	PSEP	10,000
Total solids	--[g]	--	PSEP	0.1% (wet wt)
Total volatile solids	--[g]	--	PSEP	0.1%

[a] Recommended sample preparation methods are:

- PSEP - Puget Sound Estuary Program (PSEP 1989a)
- Method 3500 series - sample preparation methods from SW-846 (U.S. EPA 1986) and updates.

[b] Recommended sample cleanup methods are:

- Method 3600 series - sample cleanup methods from SW-846 (U.S. EPA 1986) and updates.

[c] Recommended analytical methods are:

- Method 7000, 8000, and 9000 series - analytical methods from SW-846 (U.S. EPA 1986) and updates
- Method 1625C - isotope dilution method (U.S. EPA 1989)
- Plumb (1981) - U.S. EPA/U.S. Army Corps of Engineers Technical Report EPA/CE-81-1
- PSEP - Puget Sound Estuary Program (PSEP 1986)
- Acid volatile sulfide method for sediment (U.S. EPA 1991).

[d] In order to achieve the recommended detection limits for organic compounds, it may be necessary to use a larger sample size (approximately 100 g), a smaller extract volume for gas chromatography/mass spectrometry analyses (0.5 mL), and one of the recommended sample cleanup methods, as necessary, to reduce interference. Detection limits are on a dry weight basis unless otherwise indicated.

[e] The sample digestion method for mercury is described in the analytical method (Method 7471, SW-846 [U.S. EPA 1986] and updates).

[f] Total benzofluoranthenes represent the sum of the b, j, and k isomers.

[g] Sample preparation methods for sediment conventional analyses are described in the analytical methods.

7.4.3. Biological Monitoring of the Receiving Environment

Biological testing to assess existing sediment quality, to establish the maximum biological effects level within an authorized SIZ, or to assess compliance with the SIZ authorization may include the conduct of sediment bioassays or the assessment of the naturally occurring community of benthic infauna in sediment samples. Methods for conducting these biological tests are described briefly in the following sections.

Sediment Bioassays

Four of the biological tests that can be applied to assessments of marine sediment quality in the sediment source control process are sediment bioassays, including:

Acute Effects Tests

- Amphipod: A 10-day acute sediment bioassay that assesses mortality of the amphipod *Rhepoxynius abronius*
- Larval: Any one of several acute sediment bioassays that assess mortality and/or abnormality of larvae of the following organisms:
    - Pacific oyster, *Crassostrea gigas*
    - Blue mussel, *Mytilus edulis*
    - Purple sea urchin, *Strongylocentrotus purpuratus*
    - Sand dollar, *Dendraster excentricus*

Chronic Effects Tests

- Juvenile polychaete: A 20-day sublethal sediment bioassay that assesses decreases in growth of the juvenile polychaete *Neanthes arenaceodentata*
- Microtox® saline extract: A 15-minute bioassay that assesses decreased bioluminescence of

the bacteria *Photobacterium phosphoreum* exposed to a saline extract of the sediment sample. Although conducted for a relatively short period of time and therefore generally considered to be an acute test, the Sediment Management Standards consider the Microtox® bioassay to be a surrogate chronic test because of its high sensitivity.

Guidelines for the collection of sediment samples and for the conduct of these bioassays are provided in PSEP (1991a).

In addition to the chronic sediment bioassays listed above, the assessment of benthic infaunal abundance (see below) is also considered to be a chronic biological test.

For confirmatory designation of marine sediments, WAC 173-204-310(2)(a) requires that the sediments be tested using two of the acute effects biological tests and one of the chronic effects biological tests. For establishing the SIZ_{max} biological effects level, WAC 173-204-420(3)(a) also requires that the sediments be tested using two of the acute effects biological tests and one of the chronic biological effects tests. In establishing the SIZ_{max} biological effects level, however, the only applicable chronic effects tests to choose from are the benthic infaunal abundance and juvenile polychaete tests.

Assessment of Benthic Infauna

As indicated above, the fifth biological test that can be applied to assessments of sediment quality in the sediment source control process is assessment of the naturally occurring community of benthic infauna in samples of the sediment of interest. This chronic effects test assesses statistically significant alterations in the abundances of the following major taxa: Crustacea, Mollusca, and Polychaeta. Guidelines for the collection and analysis of benthic infaunal samples are provided in PSEP (1987b).

7.4.4. Physical Monitoring of the Wastewater

Physical data on the wastewater to be collected to support application of the SIZ models may include the concentration of suspended solids in the wastewater, discharge flow, and wastewater density. Methods for collecting and analyzing these data are described briefly in the following sections.

Concentration of Suspended Solids in the Wastewater

The concentration of suspended solids in the wastewater may be needed for the use of simple screening tools and as input to the SIZ models. It is typically reported as the TSS content. The collection of samples for analysis of TSS should reflect knowledge of discharge conditions that are likely to result in temporal variability of the TSS content of the wastewater. Multiple samples are recommended to gain some idea of the variability of TSS content, which for some types of discharges may be extremely high. The analysis of TSS is conducted by filtering a sample of the wastewater, drying the filter, and weighing the filter by standard methods (APHA 1989; Method 209C).

Discharge Flow

Information on the flow of the discharge is needed to estimate contaminant loading to the receiving environment and for use in the SIZ models. Flow is typically monitored and reported for most permitted wastewater discharges, regardless of whether they are under consideration for authorization of a SIZ. Flow can be measured *in situ* using a variety of methods. There are two major categories of methods for measuring flow: direct-discharge and velocity-discharge (Metcalf & Eddy 1979). The direct-discharge methods are used most frequently, and relate the rate of discharge to one or two easily measured variables, employing devices such as weirs, Parshall flumes, Venturi meters, and magnetic flow meters. Flow should preferably be measured downstream of all treatment processes, although flow measurements upstream of the treatment processes are common for municipal wastewater treatment plants and may be used in the absence of downstream measurements. The most useful flow measurements are those made continuously and recorded automatically because they provide a temporal record of flow variations.

Wastewater Density

Wastewater density is needed as input for the modeling of initial dilution (e.g., in PLUMES or CORMIX). Although wastewater density could be measured directly, it is more typically calculated based on the temperature of the wastewater, assuming the salinity of the wastewater approximates that of fresh water. Unless the characteristics of an individual discharge suggest otherwise (e.g., for a brine discharge), wastewater density may be calculated based on temperature alone. Temperature may be measured using either a thermometer or a thermistor. Methods are discussed in APHA (1989; Method 212). Measurements of temperature should take into account any temporal variability that is likely to occur (e.g., based on seasonal changes or changes in treatment processes).

7.4.5. Chemical Monitoring of the Wastewater

Data on the chemical characteristics of the wastewater may include both contaminant concentrations in whole wastewater samples as well as contaminant concentrations in wastewater suspended solids. Such data may be used in simple screening procedures, as input to the SIZ models, as verification of achievement of specific wastewater treatment levels, or as evidence of contaminants that should be investigated in the receiving environment. Methods for the collection of these data are described briefly in the following sections.

Contaminant Concentrations in Whole Wastewater Samples

Contaminant concentrations in whole wastewater samples may be used in simple screening tools (see Chapter 4) or to estimate contaminant loading to the receiving environment. Routine analyses of EPA priority pollutant metals and organic compounds are included as monitoring requirements for many permitted discharges, regardless of whether they are under consideration for authorization of a SIZ. Wastewater samples may be collected as grabs, or as time-averaged or flow-weighted composites; the latter are generally preferred because they integrate variations in contaminant concentrations over short time scales (e.g., 24 hours). If there is likely to be substantial variability in wastewater quality over a longer time period (e.g., because of seasonal variations in stormwater runoff), it may be desirable to sample at various time intervals to gain an understanding of the range of wastewater quality. Methods for the analysis of EPA priority pollutant metals are presented in U.S. EPA (1987); methods for the analysis of EPA priority pollutant organic compounds are presented in U.S. EPA (1988a).

Contaminant Concentrations in Wastewater Suspended Solids

If data are needed on the contaminant concentrations associated with wastewater suspended solids, sufficient solid sample must be collected to analyze for the contaminants of interest, and this may represent a technical challenge if the concentration of suspended solids is relatively low. One method under development for obtaining a sample of suspended solids from a wastewater sample is to pass the water through a high-speed, continuous centrifuge. This method is capable of retaining all the suspended solids present in the water. The use of a centrifuge will normally require continuous collection at the discharge facility for greater than a 24-hr period. Because this procedure would involve collection of suspended solids over a relatively short time period, its best use would be to characterize sources that are continuous and relatively stable. Alternatively, a periodic monitoring program could be employed. Use of a continuous centrifuge for the collection of wastewater suspended solids is still under development by Ecology, and there is currently no approved protocol for this procedure.

A less costly method of obtaining suspended solids from wastewater is filtration. However, compared to the centrifuge method, filtration is time consuming, technically difficult, and may not be appropriate for use when a large water sample is needed to collect the required amount of solids for analysis. A discussion of the relative merits of the centrifuge and filtration methods can be found in Horowitz (1986). Methods for analysis of suspended solids samples are discussed in Tetra Tech (1986). Ecology (1991a) provides details on collection and analysis of suspended solids using a centrifuge.

7.5 Development of Appropriate Monitoring Requirements

This Section describes the factors to be considered in the development of baseline, SIZ application, maintenance, and closure monitoring requirements.

Pursuant to WAC 173-204-400(5), Ecology is authorized to specify in discharge permits the locations and methods for collection and analysis of representative samples of wastewater, receiving water, and sediments that will be required of the discharger. In determining the appropriate monitoring requirements, WAC 173-204-400(6) requires Ecology to consider the following factors as they relate to the potential for the discharge to violate the SQS:

- Discharge suspended solids characteristics
- Discharge contaminant concentrations, flow, and loading rates
- Sediment chemical concentrations and biological effects levels
- Receiving water characteristics (e.g., vertical density profiles, ambient current velocities)
- The geomorphology of sediments
- Cost mitigating factors such as the available resources of the discharger
- Other factors determined necessary by Ecology.

General issues to be considered in the development of monitoring requirements for all permitted discharges are discussed in other sections of this chapter.

The process for establishing monitoring requirements described in the other sections applies to all permitted discharges, whether or not they have the potential for impacting sediments or they are being considered for authorization of a SIZ. Certain aspects of the monitoring requirements pertinent to the sediment source control process overlap with aspects of the monitoring requirements for permitted discharges in general, and, in fact, certain information needs in the sediment source control process may already have been filled through the collection of monitoring data under an existing permit. In other cases, the information needs of the sediment source control process may be distinct and therefore require the collection of new and/or different types of monitoring data.

7.5.1. Development of Baseline Monitoring Requirements

The development of baseline monitoring requirements is the responsibility of the permit manager, with guidance and assistance from the SMU, as necessary. The baseline monitoring requirements should be described in detail in the discharge permit, or, in some cases, in a companion order.

If the result of the narrative and technical evaluations (Chapter 9) is a judgment that the discharge does not have the potential for causing sediment impacts, collection of baseline monitoring data may not be necessary. For discharges identified by the narrative and technical evaluations as having the potential for sediment impacts, there is expected to be a range of required baseline monitoring. In some cases, although there may be a potential for sediment impacts, the combination of discharge and receiving environment characteristics (e.g., a relatively small discharge with low levels of most priority pollutants, discharging to an environment not known to have sediment impacts, in the absence of other nearby discharges) is such that any sediment impacts would not likely be severe or widespread. In such cases, the only required baseline monitoring may be chemical analyses of sediments in the immediate vicinity of a marine discharge, or chemical analyses of sediments and sediment bioassays in the immediate vicinity of a freshwater discharge. In cases where sediment impacts might be expected to be more severe or widespread (e.g., a relatively large discharge with high levels of a number of priority pollutants, discharging to an environment known to have water and/or sediment quality problems, in the presence of other nearby discharges), more extensive baseline monitoring may be required.

Under certain circumstances, the need for baseline monitoring data may already have been satisfied by previous studies. In such cases, the evaluation of the need for a SIZ can proceed without further data collection. In other cases, the collection of additional baseline monitoring data will be necessary to confirm whether there are exceedances of SQS in the vicinity of the discharge. If the data needs are relatively minor (e.g., collection and chemical analysis of a few surface sediment samples), the discharger may be required to collect the data prior to evaluation of the need for a SIZ. If, however, the data needs are extensive, the baseline monitoring requirements should be specified in the renewed permit (in the case of previously permitted discharges) or in the initial permit (for previously unpermitted discharges). By including the baseline monitoring requirements in the permit, issuance of the permit will not be unnecessarily delayed while an evaluation of the need for a SIZ is conducted. Authorization of a SIZ, if deemed appropriate, can then occur at a later time after the baseline monitoring data become available and are evaluated.

In developing baseline monitoring requirements for an individual discharge, it is important to understand that the intent is only to determine whether currently there are exceedances of SQS in the vicinity of the discharge, and whether they appear to be caused by the discharge. Baseline monitoring is not intended to accurately delimit the area over which there are exceedances of SQS, or to definitively tie those exceedances to the discharge. Baseline monitoring should therefore be able to detect exceedances of SQS near the discharge and then to determine whether such exceedances are of greater magnitude near the discharge or of a more general, area wide nature, which might suggest contaminant inputs from other local sources.

For small discharges with only a low likelihood of sediment impacts, an array of only six stations may suffice if they are located along a transect extending from the point of discharge to a point downstream (in the direction of predominant current flow) sufficiently far away from the discharge to be beyond likely effects of the discharge. If flow is unidirectional (e.g., in a river), it may suffice to have one station of the transect upstream of the discharge to define ambient conditions. If flow is bidirectional (e.g., as in many Puget Sound marine environments where tidal currents predominate), the six stations might be arranged along a transect spanning the discharge along the axis of predominant current flow. Given the diversity of possible discharge scenarios, it is not appropriate to give generic guidance on the appropriate spacing of the stations along a transect. However, the spacing should take into account both the volume of the discharge and the velocity of currents in the vicinity of the discharge.

For larger discharges with a high likelihood of sediment impacts, or for discharges to more complex receiving environments, it may be necessary to have two to three transects, each with six stations extending out from the point of discharge. Once again, it is not appropriate to give generic guidance on the appropriate spacing of the stations along a transect, but the spacing should take into account both the volume of the discharge and the velocity of currents in the vicinity of the discharge.

Selection of appropriate baseline monitoring parameters is dependent on the nature of the discharge. For most marine discharges, it will be appropriate to collect surface sediment samples and analyze them for the contaminants for which there are SQS numerical criteria. Depending on how thoroughly the effluent has been characterized, it may be appropriate to analyze the surface sediments for additional contaminants, especially any known to be present in the effluent and considered potentially toxic to aquatic life. The sediment samples from the various stations should be analyzed individually and not composited with those from other stations, so that it will be possible to investigate contaminant gradients as evidence of the source of the contaminants.

If chemical analysis of the sediments in the vicinity of a marine discharge reveals exceedance(s) of the SQS numerical criteria, consideration should be given to requiring biological testing, because the results of biological tests may override a decision based on sediment chemistry alone. Biological testing may also be appropriate for marine discharges if there are potentially toxic chemicals in the effluent for which there are no SQS numerical criteria. In Puget Sound marine environments, the biological testing should include two acute tests and one chronic test (see Part 7.4.3) for the available tests to choose from). In non-Puget Sound marine environments, it may be appropriate to use the same tests as for Puget Sound marine environments, but this decision should only be made on a case-by-case basis, with guidance from the SMU. In freshwater environments, baseline monitoring should always include biological testing with the *Hyalella azteca* and Microtox® sediment bioassays. Appropriate biological tests for low-salinity environments have not been identified, but may be selected by the SMU on a case-by-case basis.

7.5.2. Development of SIZ Application Monitoring Requirements

The development of SIZ application monitoring requirements is the responsibility of the SMU. A detailed description of the SIZ application monitoring requirements will be provided to the permit manager by the SMU, to be forwarded to the discharger.

7.5.3. Development of Maintenance Monitoring Requirements

The development of maintenance monitoring requirements is the responsibility of the SMU. A detailed description of the maintenance monitoring requirements will be provided to the permit manager by the SMU for inclusion in the permit.

7.6 Interpretation of Monitoring Results

This section describes procedures for interpreting monitoring results for various purposes in the sediment source control process.

7.6.1. Evaluation Criteria for Designation of Sediments as Passing or Failing the Sediment Quality Standards

Initial designation of sediments as passing or failing the SQS is made on the basis of chemical contaminant concentrations (WAC 173-204-310(1)). Sediments with chemical contaminant concentrations equal to or less than all the applicable chemical and human health criteria are designated as not having adverse effects on biological resources or posing a significant threat to human health. Sediments having one or more chemical contaminants at concentrations greater than the applicable chemical or human health criteria are designated as having adverse effects on biological resources or posing a significant threat to human health.

Whether the sediments pass or fail the initial designation based on chemical criteria alone, they are potentially subject to confirmatory designation (see WAC 173-204-310(2)) using the applicable biological testing procedures of WAC 173-204-315. To confirm the designation of these sediments, they should be tested using two of the acute effects biological tests and one of the chronic effects biological tests (for brief descriptions of these tests, see Part 7.4.3 above). The biological test results for control and reference sediments must meet the performance standards of WAC 173-204-315(2). A sediment sample is determined to have an adverse effect on biological resources, and therefore is designated as failing the SQS, when any one of the biological tests demonstrates the results listed in the SQS column of Table 22, notwithstanding the initial designation based on sediment contaminant concentrations alone. If the sediment sample does not demonstrate any of the results listed in the SQS column of Table 22, it is designated as passing the SQS, notwithstanding the initial designation based on sediment contaminant concentrations alone.

For marine sediments containing other toxic, radioactive, biological, or deleterious substances, Ecology will identify appropriate test interpretation standards for initial and confirmatory designation. Because these procedures have not yet been developed by Ecology, they are not currently discussed in this manual.

7.6.2. Evaluation Criteria for SIZ_{max} Biological Effects Level

The maximum sediment contaminant concentrations allowed within an authorized SIZ as a result of a permitted or otherwise authorized discharge are presented in Table 22, and are referred to as SIZ_{max}. Biological effects within an authorized SIZ are also not to exceed a "minor adverse effects level," which is defined on the basis of the results of biological tests. To determine compliance with the SIZ_{max} biological effects criteria, the sediment should be tested using two of the acute effects biological tests and one of the chronic effects biological tests (see Part 7.4.3). The biological tests employed for demonstrating compliance with the SIZ_{max} biological effects criteria of WAC 173-204-420(3) are the same as those used in biological testing for confirmatory designation, except that the Microtox® test is omitted as one of the options for a chronic test. The biological test results for control and reference sediments must meet the performance standards of WAC 173-204-315(2). The sediments are determined to exceed the SIZ_{max} biological effects criteria when any two of the biological tests exceed the criteria of WAC 173-204-320(3) or when any one of the tests demonstrates the results shown in the SIZ_{max} biological effects criteria column of Table 22.

If, in a given area, the nonanthropogenically affected (i.e., natural background) sediment quality is of a lower quality (i.e., having higher contaminant concentrations, causing an adverse biological response, or posing a greater threat to human health) than allowed within an authorized SIZ, the existing sediment chemical and biological quality criteria will be identified on an area wide basis, as determined by Ecology, and used in place of the SIZ_{max} criteria of WAC 173-204-420.

8. Summary Checklist

Monitoring Program Checklist

1. Have all the possible sampling matrices been considered?
   - Influent
   - Internal waste streams
   - Treated process wastewater (effluent)
   - Particulates
   - Nonprocess wastewater
   - Sludge
   - Stormwater
   - Receiving environment
     - Water
     - Sediment
     - Biota
     - Groundwater
   - CSOs
   - Bypasses

2. Are there any water-quality based limits or considerations?
   - Numerical criteria
   - Narrative criteria (toxicity)
   - Beneficial uses (fishable, swimmable)

3. Where do the process wastes end up?
   - Surface waters
   - Land (application)
   - Ground water
   - Underground injection
   - Landfills

4. Is there sufficient data to characterize the effluent? Are any special studies needed?
   - For statistical comparisons (temporal and spatial)?
   - To establish sampling frequencies?
   - Are all constituents characterized?
   - How variable is the effluent?

5. Is there sufficient data to characterize the potential impact on the receiving environment?
   - Is there existing ambient data?
   - Is data needed for modeling?

6. Specify parameters to be monitored
   - To meet limits
   - To create baseline data
   - For surveys

- Indicators
- Evaluate acute/chronic toxicity

7. Specify in permit:
    - Sampling locations
    - Timing and frequency for sampling
    - Sample collection and analytical methodologies
    - QA/QC
    - Data reporting requirements.

8. Will any of the monitoring data be used to trigger an action?
    - Effluent biomonitoring
    - Survey results
    - Receiving environment monitoring
    - Local limits policy
    - Tiered sampling
        - Increase/decrease -monitoring frequency
        - Add/eliminate parameters from sampling program

9. What is the size, treatment technology and compliance history of the facility?

10. Does the facility discharge into Puget Sound?
    - Plan elements for majors

Chapter 14. Fact Sheets and Documentation

This chapter discusses the regulatory requirements for fact sheets.

As in any process of complex decisions and calculations, documentation is valuable. In the permit process the documentation occurs in a fact sheet. A fact sheet sets forth the principal facts and the significant legal, procedural and policy decisions considered in preparing the permit. Some of the content of fact sheets is directed by federal and state regulation and some content is dictated by good project management.

1. Federally Required for Selected Permits

The federal NPDES regulations (40 CFR 124.8, 124.56) require a fact sheet for every:

- Major NPDES facility or activity,
- Draft permit that incorporates a variance or requires an explanation under 124.56(b),
- Draft permit which is the subject of widespread public interest or raises major issues,
- Class I sludge management facility,
- Permit that includes a sewage sludge land application plan, and for
- Permit that includes a variance.

2. State Requirements for All Permits

The State regulations for surface discharge (WAC 173-220-060) are much simpler - every permit must have a fact sheet.

The state regulation requires that fact sheets at a minimum will summarize all of the following:

- The type of facility or activity which is the subject of the application.
- The location of the discharge in the form of a sketch or detailed description.
- The type and quantity of the discharge, including at least the following.
    - The rate or frequency of the proposed discharge,
    - For thermal discharges, the average summer and winter temperatures, and
    - The average discharge in pounds per day, or other appropriate units, of any pollutants which are present in significant quantities or which are subject to limitations or prohibition by state or federal regulation;
- The conditions in the proposed permit.
- The legal and technical grounds for the draft permit determination, including an explanation of how conditions meet both the technology-based and water quality-based requirements of state and federal law.
- The effluent standards and limitations applied to the proposed discharge.

- The applicable water quality standards, including identification of the uses for which receiving waters have been classified.
- How the draft permit addresses use or disposal of residual solids generated by wastewater treatment.
- The procedures for the formulation of final determinations (in more detailed form than that given in the public notice) including:
    - The 30-day comment period required by WAC 173-220-050(2);
    - Procedures for requesting a public hearing and the nature thereof; and
    - Any other procedures by which the public may participate in the formulation of the final determinations.
- RCW 90.48.520 requires the control of toxicants (specific chemicals and overall toxicity) in permits. This should be discussed in the fact sheet.

3. Puget Sound Plan Requirements

The Puget Sound Water Quality Management Plan (11/90) requires that in the fact sheet accompanying each draft major permit to address the following:

> "Ecology shall clearly explain how the draft permit fulfills the goal of reducing and eventually eliminating harm from toxic contaminants in Puget Sound, including a summary of the information used to determine which limits on specific toxicants and/or overall effluent toxicity should be included in the permit."

The plan also requires a discussion in the fact sheet of five types of monitoring;

- Sediments in the vicinity of every significant outfall,
- Particulate fraction of the effluent,
- Acute and chronic toxicity of the effluent and sediments near the outfall,
- Biota surveys in the vicinity of each significant outfall,
- Water quality at the boundary of the dilution zone.

The plan requires a discussion of why these five monitoring requirements were not included if applicable.

4. Federally Required Details

The Federal Regulations also require:

- The name and telephone number of a person to contact for more information
- Any calculations or other necessary explanation of the derivation of specific effluent limitations and conditions, including a citation to the applicable effluent limitation guideline and the reasons why they are applicable or an explanation of how the alternate effluent limitations were developed.

- An explanation of the reasons for including any of the following conditions in a permit:
  - Limitations to control toxic pollutants
  - Limitations on internal waste streams
  - Limitations on indicator pollutants
  - Limitations set on a case-by-case basis
- For every permit to be issued to a treatment works owned by a person other than a State or municipality, an explanation of the decision on regulation of the users (whether to issue a separate permit)
- For every permit that includes a sewage sludge land application plan, a brief description of how each of the required elements of the land application plan are addressed in the permit.

5. Fact Sheet Considerations

The fact sheet serves a legal requirement and informs a new permit writer of the history of the permit. Since the fact sheet is a summary, the permit writer may also wish to submit an internal memorandum to the file on some issues too lengthy or not appropriate for the fact sheet but which may be useful in the next permitting period. Ecology often spends a considerable amount of time debating a permit issue which then becomes an assumption upon which the permit conditions are based. Documenting the decision process may prevent a repeat of the debate in five years when the permit is up for reissuance.

EPA is required to maintain an administrative record on their permits to document the decision process. This type of procedure is useful for all permit writers. The permit writer should document every permit as if it were going to an appeal hearing and as if someone new would be reissuing the permit in five years.

The time of writing the fact sheet is an individual preference. Some experienced permit writers write a fact sheet before actually drafting the permit conditions, others do it after drafting the permit.

The permit writer should use language in the fact sheet that is understandable to a non-technical person. Public and permittee support for Ecology's permitting actions is increased if the issues are clearly presented in the fact sheet.

Significant comments made on a draft permit in writing or by comment at a public hearing must receive a response. The response is presented in a document called a Response to Comments. The Response to Comments becomes an addendum to the fact sheet. The original fact sheet may or may not be modified to reflect permit changes as a result of comment. If the writer modifies the fact sheet after the draft comment period, clearly indicate this in the modified section(s).

6. Fact Sheet Formats

The Permit Workgroup maintains model fact sheets for NPDES and State permits. These are available on SharePoint.

Chapter 15. Public Involvement

The permit writer must allow the public to observe and influence the decision-making process involved in developing a permit. The timing of public involvement was discussed in Chapters 2 and 3. Some of the mechanisms for public involvement are the State Environmental Policy Act (SEPA), public notice of permits, and public hearings. The public involvement processes may be difficult and time-consuming but the permit writer is a public representative and the process is an opportunity to demonstrate that we are doing a good job of representing the public interest. Some public involvement tasks are required by law.

1. SEPA

A permit writer may become involved in the SEPA process and may occasionally become the lead for new dischargers. SEPA requirements are given in Chapter 43.21C RCW and Chapter 197-11 WAC.

State law exempts the issuance, reissuance or modification of any wastewater discharge permit from the SEPA process as long as the permit contains conditions no less stringent than federal effluent limitations and/or state rules and regulations. The exemption applies only to existing discharges, not to new source discharges. .

The environmental review process under SEPA generally begins when someone submits a permit application to an agency or when an agency proposes some activity, policy, plan, ordinance, or regulation. A typical situation for a new discharger is to submit a request for a building permit to a municipality or county. That municipality or county then becomes the lead agency on SEPA. However, if they feel the environmental issues are too complex, they may request some other agency such as Ecology to take the SEPA lead. Most small projects are covered by a checklist and a Determination of Nonsignificance. These projects go into a review list circulated by the SEPA office. Large projects may require an Environmental Impact Statement.

If a discharger moves into an existing facility and doesn't need a building permit, the permit writer may become the lead on SEPA. If the only environmental issue is a proposed wastewater discharge which is controlled by treatment, there should not be a need for an environmental impact statement. The permit applicant will complete an environmental checklist and determination of nonsignificance. The signatory authority on the determination of nonsignificance is the person responsible for signing the permit. For multi-program situations in the regional offices, the regional director may be the lead and signatory. The permit writer should consult the intranet here: Ecology as SEPA Lead Agency for more information on the SEPA process when Ecology is lead.

2. Public Notice of Permit Actions

Ecology uses a common public involvement process for NPDES permits, new state wastewater discharge permits, and renewal of state wastewater discharge permits for facilities with an increase in volume or change in nature of the wastewater.

Public notices of permit actions will be widely circulated to increase public awareness and encourage public participation early in the permit process.

Ecology assumes that costs associated with public notifications of permit actions and other costs of administering the public involvement procedures constitute a portion of the total costs incurred to administer the water quality permit program and are, therefore, fee eligible expenses.

Ecology will administer all public notices and advertisements to ensure that they are published in a timely and consistent manner.

Public notices of application and of draft permit may be done on a batch basis for applications and permits associated with basin permitting.

3. Public Notice of Application (PNOA)

RCW 90.48.170 requires that certain applications be made known through a public notice in a news publication.

> …Upon receipt of a proper application relating to a new operation, or an operation previously under permit for which an *increase in volume of wastes or change in character of effluent* is requested over that previously authorized, the department shall instruct the applicant to publish notices thereof by such means and within such time as the department shall prescribe. The department shall require that the notice so prescribed shall be published twice in a newspaper of general circulation within the county in which the disposal of waste material is proposed to be made and in such other appropriate information media as the department may direct. …

Based on the above law, the following process has been adopted for PNOAs:

PNOA is required for:

- **New** NPDES and State Waste Discharge Permits and
- Renewal of NPDES permit and State Waste Discharge permit if **an increase in the volume of waste or change in character** is requested.

To assess whether there has been an increase in volume, the permit writer must confirm that the current flows are consistent (within 10%) with those used in the reasonable potential calculation performed for the previous permit.

PNOA is ***not*** required for:

- Renewal of NPDES and State Waste Discharge permit when **no increase in volume of waste or change in character** is requested.

When PNOA is required, PNOAs will be published by Ecology as:

- A legal classified advertisement, to be published at least once each week for 2 consecutive weeks, and as
- Mailings of PNOAs sent to persons on the general mailing list who have indicated an interest in receiving such information.
- A PNOA may also be a display advertisement, to be published one time, concurrent with the first legal classified advertisement, for permits likely to have a high degree of public interest.

PNOAs will use consistent wording and format to identify the types of information that Ecology would like to receive from the public and is able to consider in permit decision-making.

In addition to public notice, Ecology is required to notify the director of the Department of Fisheries and Wildlife and the secretary of Department of Social and Health Services of the application for a permit.

4. Permittee Review

Ecology must send the preliminary draft permit and fact sheet to the permittee for comment. Ideally, Ecology will allow the Permittee 30 days to review the documents before the public notice of draft (PNOD) period begins. Ecology must specify a date by which comments are due and notify the Permittee that the permit issuance process will not be delayed if the date is not met. Ecology must notify the Permittee that the draft permit conditions could change as a result of the public review process.

If the draft permit is substantially different than the existing permit, Ecology should offer the Permittee an opportunity to meet. The purpose of the meeting would be to explain the new or changed requirements, accept comments from the Permittee on factual content, and to discuss the practicality of the monitoring requirements and compliance schedules. If the permittee requests substantial changes beyond factual comment and the permit writer agrees with those requests, the permit writer should document the discussion and his/her decision in the fact sheet.

5. Public Notice Of Draft Permit (PNOD)

A public notice of draft is required for:

- All NPDES permits (including reauthorizations)
- Renewed state permits which have an increase in volume of discharge or a change in the characteristics of the discharge and for
- All new state permits.

Ecology will publish PNODs as legal classified advertisements at least once in the same major paper in which the PNOA was published.

PNODs will also be distributed by mail to "parties of record." Parties of record are those persons who responded to the PNOA or who have otherwise requested that they be informed about the development of a specific permit.

Ecology may also issue news releases and other informational materials to announce the availability of the draft permit for public review.

The comment period following a PNOD will normally be 30 days from the date of the latest notice. The comment period can be extended any time the permit section supervisor determines that an extension of the comment period will result in greater or more meaningful public input, or in any other circumstances the permit section supervisor deems appropriate. Ecology will notify parties of record when a comment period is extended and will add the new end date to the public calendar.

6. Distribution of Draft and Final Permit Materials

Ecology will mail one copy of the draft permit, final permit, and fact sheet to parties of record or to any other party requesting such information. One copy of the application will be mailed upon request.

Draft and final permits, fact sheets, and other permit-related information will be made available for public review and copying at the Ecology office from which the draft or final permit was issued.

- Draft permits will normally be retained in the permit file and made available for review and comment only until the Final Permit has been issued.

Ecology will bear the cost of copying and mailing draft or final permits and accompanying fact sheets to parties of record or others requesting copies of the same as part of its public outreach/education program on a 1-copy-per-requestor basis only. Additional copies will be supplied as specified in Ecology Policy 10-30, *Requests for Ecology Records*. Free copies are available only for permits which are being developed or considered for renewal.

- Copies of permit-related information other than draft or final permits and accompanying fact sheets will be made available for viewing and copying at the Ecology regional office which developed the permit. Copies of permit-related materials will be provided by mail as long as requests clearly specify the materials desired.

Draft and final permits and fact sheets and other permit-related materials will also be made available, at the discretion of the permit section supervisor, at repositories in appropriate public buildings (e.g., libraries, town hall) for the duration of the comment period.

7. Public Informational Meetings and Workshops

Informational meetings or workshops will be held any time the permit section supervisor deems them appropriate to inform the public about a permit or permit-related issues, to facilitate public discussion of permit issues, and to generate more informed, more pertinent public comment on permit issues.

Holding discretionary informational meetings neither precludes the need for formal hearings, nor creates a demand that formal hearings be held.

- Informational meetings are not required permit procedures. Therefore, informational meetings require no extension of the public comment period. However, the comment period can be extended at the discretion of the permit section supervisor.

7.1 Informational Meetings Preceding Hearings

Informational meetings are required prior to holding public hearings.

- Meetings should be held at least one week prior to a hearing to allow the public time to study the information provided in meetings and to allow the public time to prepare well-considered formal comments or responses.
- A brief meeting should also be held immediately prior to a hearing to answer questions and address unresolved issues prior to accepting formal testimony, including those hearings for which informational meetings are held at an earlier date.

7.2 Public Notice of Informational Meetings

Public Notices of Informational Meetings will normally be included within Notices of Public Hearing. However, when a Public Hearing is not planned or when inclusive notices are not practical, a Public Notice of Informational Meeting will be:

- Published at least one time in a major newspaper with circulation in the geographic area of the discharge, and
- Distributed to parties of record by mail.

The content and format of Public Notices of Informational Meetings will be essentially the same as that used to advertise Notice of Public Hearing.

8. Hearings

Ecology will hold formal public hearings whenever the permit section supervisor deems that there is sufficient interest and a likelihood of meaningful public comment on a permit to warrant hearings. (Note that regulations may require public hearings under some circumstances.)

8.1 Public Notice of Hearing

A Public Notice of Hearing will be published at least once in a major newspaper with circulation in the geographical area of the discharge. The public notice will be published at least 30 days prior to the hearing.

The Notice of Hearing will also be mailed to parties of record at least 30 days prior to the hearing.

Notices of Hearing will use a standard format and language which will, at a minimum

- Outline permit issues to be discussed,
- Establish time and place of hearings,
- Include the name of a contact person at Ecology who can supply information or assistance,
- Clearly state that testimony can be considered only if it pertains to the conditions of the named permit,
- Outline the extent of Ecology's authority and interest in the permit, and
- Instruct interested parties on getting their issues placed on the hearing agenda.

Whenever practical, a second Notice of Hearing should be issued l0-l4 days prior to the meeting to encourage greater participation.

8.2 Hearing Officer

A hearing officer will be appointed by the permit section supervisor for each hearing. It will be the hearing officer's responsibility, in cooperation with the permit manager, to prepare the agenda, and conduct the meeting according to the agenda and the established procedures for holding a hearing (distributed by the Ecology Office of Governmental Relations – see: http://partnerweb/sites/GR1/publicHearings/SitePages/Home.aspx).

9. Public Notice of Permit Issuance

Notices of issuance will be mailed by Ecology to parties of record.

9.1 Issuance and Effective Dates

Ecology typically provides time between the issuance date and the effective date of permits and will provide at least 30 days if comments on the permit are received. The effective date should be set for the first of a month after the issuance date to avoid the practical problems with implementing monthly limits for periods of time less than a month.

Expiration dates should be five years from the effective date, not the issuance date (e.g. permit issued December 1, 2009, effective January 1, 2010, expires December 31, 2015).

10. Public Notices of Other Actions

Notices of appeals of permits will be mailed to parties of record, as will decisions on appeals.

Major modification, suspension (state permits), and revocation (for cause other than cessation of discharge), of a wastewater discharge permit each require public review and comment. Therefore:

- Ecology will publish a notice of intent to modify, suspend, or terminate (except as noted below) a permit as a legal classified advertisement in a major newspaper with general circulation in the geographical area of discharge.
- Terminations where the entire discharge is permanently terminated by elimination of the flow or by connection to a POTW (but not by land application or disposal into a well) do not require public notice and are terminated by notice to the permittee. If the permittee objects within 30 days, a notice of intent to terminate will be published as described above.
- Ecology will notify parties of record, by mail, of the department's intent to make a major modification to, or to suspend or revoke a permit.
- All subsequent public notification will be implemented using the same procedures as outlined for new discharges and permit renewals in the previous sections. This includes notice of draft major modifications and may include informational meetings or public hearings and notice of resolution of the permit action taken.

11. When to Go Back to Public Notice with a Revised Draft Permit

There are no regulations requiring Ecology to repeat public notice on a draft permit after it has been revised. However, to meet the intent of public notice requirements a revised draft permit should go back to public notice under either of the following conditions:

1. When a significant revision to the draft originally public noticed has taken more than 9 months to complete and there were comments from the first public notice. The draft should also go back to EPA for approval if the permit is a major. or

2. If new information causes the effluent limits or loading to increase.

If an issue is discussed in the first draft and new information submitted by the public causes changes in the permit conditions, then another public notice is not necessary. However, if the change is lower limitations, the permit writer should inform the permittee before issuing the permit.

Chapter 16. Appeals And Variances

A wastewater discharge permit is an administrative action of the Department of Ecology and is subject to both state administrative hearings and court appeals.

Variances are exceptions within the law.

1. Appeal of the Final Permit to the Pollution Control Hearings Board (PCHB)

1.1 The PCHB

The PCHB is an independent agency of the state of Washington, composed of three members appointed by the governor for terms of 6 years. The members are qualified by experience or training in environmental matters. At least one member is a lawyer, and not more than two members are of the same political party.

The function of the board is to hear appeals of permit actions (issuance, modification, denial), orders, rules, or regulations of Ecology or the air pollution control board. The regulatory requirements of the PCHB are given in Chapter 371-08 WAC.

1.2 Appeal Process

A permit writer may be involved in PCHB appeals of permits, orders, and penalties.

The general process of appeal is:

1. The permit, order, or penalty is issued by the Department
2. The recipient has 30 days to appeal to the PCHB with a copy served to Ecology
3. Upon receipt of a correct appeal the board will set a hearing date. The hearing date is usually 4 to 6 months from the time of appeal. The filing of an appeal does not stop the requirements of the permit or order. However, the appealing party may also request a stay of the requirements of the permit or order until the time the appeal is decided. The PCHB will ask Ecology to respond to the request for stay and may schedule a separate hearing on the request. The PCHB has the option of moving the appeal hearing date up and hearing both issues.
4. The hearing is held and a decision is issued.

1.2.1 AG Cooperation

The Attorney General's office will assign an assistant AG to work on the appeal. The assistant AG is the state's representative in the appeal and the permit writer serves as the technical consultant. The permit writer should be aware that the assistant AGs have a very heavy case load and they work with a large body of federal and state laws in several programs. The permit writer may first have to convince the assistant AG of the technical and legal merits of the appealed permit. If the permit fact sheet and other decision documentation are done correctly (see Chapter 14) this should be an easy task. The attorney is the legal expert but you are the permit and water quality expert. The permit writer may have to teach the assistant AG about water quality in the process of justifying the permit. Preparation of a good permit fact sheet will save time here. The permit writer will also be responsible for preparing the submittals of evidence (documents and photos). A complete permit file will expedite this task.

1.2.2 Conferences Before the Hearing

Two types of conferences may be held before the hearing. One type is an optional informal conference in which a PCHB member is a facilitator. The purpose of the meeting is to see if an agreement can be reached before going to hearing. The outcome of the meeting may be a settlement, no settlement, or an agreement to continue settlement proceedings. The PCHB has the authority to order these meetings, but they usually do so only if requested by one of the parties.

If the case proceeds to hearing, a prehearing conference will be held to lay the legal ground rules for the hearing. This conference may be held at the end of an informal conference or by telephone.

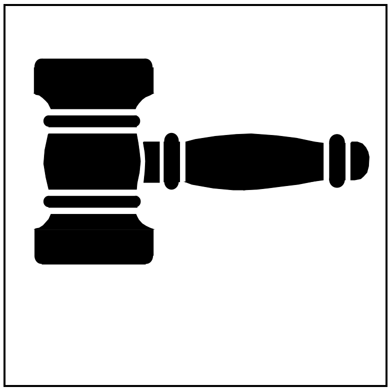
1.2.3 Deposition and Testimony

A permit writer may be required to give a deposition, in which the appellant attorney conducts the questioning that would otherwise occur in the hearing. The deposition is transcribed and presented as evidence. The appellant attorney may ask some of the same questions at the hearing.

After your deposition is transcribed, you'll have an opportunity to read it and make any corrections you believe are appropriate. It's extra work but worth the effort. There are no perfect transcripts and some are absolute disasters, especially if they concern technical matters. Never waive the right to read and sign your transcript.

During the hearing in front of the PCHB, the permit writer will be examined and cross-examined by the appellant attorney and the assistant AG.

The AG’s Office and the Program Development Services Section have material to assist you in depositions and hearings.



1.2.4 PCHB Determination

Sometime after the conclusion of the hearing the PCHB will issue a final determination and order. This may take up to a year. Either party in the hearing may then request a reconsideration of the final determination. After review of the case the PCHB will issue a decision and order. This decision and order may be appealed to a state superior court and thence appealed to the Federal Supreme Court, if necessary.

The PCHB has specific regulatory authority for wastewater discharge permits. If the PCHB determines, upon appeal, that a permit is invalid in any respect it will direct Ecology to reissue the permit in accordance with the directive and any applicable federal or state law.

1.2.5. Assistance

Staff in the Program Development Services Section have time allotted to assist in permit appeals.

2. Variances

2.1 The Federal Variances

The Clean Water Act provides a mechanism for modifying requirements of the Act in exceptional cases. These modifications are called variances. There are very specific provisions which must be met by an applicant before a variance may be granted. As the term implies, a variance is an exceptional situation. A permit writer might never work on a variance but should know what they are and the general procedure for handling them.

Variances are requested during the rulemaking period or during the first permit period after completion of the rulemaking.

2.1.1 Economic 301(c) (No guidance developed by EPA)

Section 301 (c) provides for a variance for non-conventional pollutants from BAT effluent guidelines due to economic factors. The variance may also apply to non-guideline limits (40 CFR 122.21(m)(2)(ii). The request for the variance from effluent limitations developed from BAT guidelines is normally filed by the discharger during the public notice period for the draft permit. Other filing time periods may apply as specified in 40 CFR 122.21(m)(2). The application for the variance must show that the modified requirements will

- Represent the maximum use of technology within the economic capability of the owner/operator, and
- Result in further progress toward the "no discharge goal".

The cost tests for evaluating this variance request are the same as given in the BPJ permitting for BAT. The applicant must pass these cost tests and, in addition, show compliance with BPT limitations and water quality standards.

2.1.2 Water Quality 301(g) (No guidance developed by EPA)

The CWA provides for a variance from BAT effluent guidelines for ammonia, chlorine, color, iron, and total phenols. The discharger must file a variance application which meets all of the following requirements:

- The modified requirements must result in compliance with BPT limits, pretreatment guidelines, or water quality standards of the receiving stream, whichever is applicable.

- No additional treatment will be required of other point or non-point source dischargers as a result of the variance approval.
- The modified requirements will not interfere with attainment or maintenance of water quality to protect public water supplies, protection and propagation of a balanced population of shellfish, fish, and wildfowl, and allow recreational activities in and on the water. Also, the modified requirements will not result in quantities of pollutants which may reasonably be anticipated to pose an unacceptable risk to human health or the environment, acute or chronic toxicity, or synergistic properties.

This variance request requires the discharger to perform water quality monitoring for toxicity, human health effects and dilution. It may also require the development of site-specific water quality criteria.

If a discharger wants both a 301(g) variance and a 301 c variance, the requests must be submitted and considered together.

2.1.3 POTW Discharge to Marine Waters 301(h) (40 CFR Part 125, Subpart G)

This section allows POTWs that discharge to marine waters a conditional exemption from secondary treatment. The variance is conditional upon meeting water quality standards, conducting receiving water monitoring, limiting the discharge of toxics through pretreatment of industrial wastes, and providing primary treatment.

2.1.4 Innovative Technology 301(k) (40 CFR Part 125, Subpart C)

This section provides an extension of the deadline for compliance with effluent guidelines for up to 2 years if the discharger meets the following criteria:

- Uses an innovative production process that will result in an effluent reduction greater than required.
- Installs an innovative control technique that is likely to reduce the effluent below required levels.
- Achieves the required BAT effluent limits with an innovative system which is expected to cost significantly less.
- This system must also have the potential for industry-wide application.

A process should have been used less than 5 years to qualify as innovative. Industry-wide application is defined as being applicable to two or more facilities in one or more industrial category.

2.1.5 Fundamentally Different Factors 301(n) (40 CFR Part 125, Subpart D)

This section provides for variances based upon fundamentally different factors (FDF). FDF variances for direct dischargers are available from effluent guidelines for BPT, BCT, and BAT if the individual facility is found to be fundamentally different from the factors considered in establishing the effluent guidelines. Approval of a FDF variance can result in an effluent limitation which is less stringent for a particular pollutant than would result from application of the national effluent guidelines. The FDF variance must be requested by the discharger within 180 days from the time an effluent limit is promulgated or revised. No FDF variance can be approved if it results in violations of water quality standards.

2.2 The State Requirements

The Clean Water Act allows state requirements to be more stringent than federal requirements. The State of Washington has language in its water pollution law which is technology-based (see discussion of all known, available, and reasonable treatment (AKART) in Chapter 4). This language may negate the use of the CWA variances in this state. A good example is the 301(h) variance for municipal discharges to marine waters. Several Puget Sound municipalities were preparing to apply for marine waivers (authorized by the 1977 amendments to the CWA) and were discharging to marine waters with primary treatment. In 1984, the Department of Ecology determined that primary treatment did not conform to state law, specifically, the discharges did not provide AKART. That decision was appealed by the cities to the PCHB. The PCHB ruled that AKART for municipal discharges was secondary treatment.

2.2.1 Variances in surface water quality standards

[STILL UNDER DEVELOPMENT. Please contact the Water Quality Standards unit or the permitting technical lead for guidance as implementation strategies may vary.   Future PWM updates will include revisions to this section.]

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Appendices

The Appendices are linked to this Manual as a separate file on the web:

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