# Technology-Based Effluent Limitations: How They're Calculated

Michael A. Redda
May 2023

# Technology-Based Effluent Limits (TBELs)

- Technology-based treatment requirements under CWA Section 301(b) represent the minimum level of control that must be imposed in a permit [§ 125.3(a)].
- Performance-based
- Provide equity among dischargers within category

# Technology-based Effluent Limitations

- National technology-based standards
  - Secondary treatment standards for POTWs
  - Effluent guidelines for certain categories of non-POTWs (industrial dischargers)
- In absence of national standards (non-POTWs)
  - Technology-based requirements developed on a case-by-case basis

# Effluent Limitation Guidelines & Standards (Effluent Guidelines)

- Definition
  - CWA required EPA to develop effluent guidelines and national standards.
  - Prescribe allowable discharges of pollutants from industrial point source categories corresponding to various levels of treatment control
- Scope
  - Established for most primary and some secondary industries
- Regulations

  40 CFR Parts 405-471

# Development of ELGs

- available pollution control technologies and pollution prevention practices
- technical feasibility and effectiveness of applying these practices
- non-water quality effects of applying these practices, such as energy costs
- best treatment processes or pollution control technologies (model technology)

# CWA Performance Standards

- Direct Dischargers
  - Existing Source Standards (CWA section 301 and 304)
    - Best Practicable Control Technology Currently Available (BPT)
    - Best Conventional Pollutant Control Technology (BCT)
    - Best Available Technology Economically Achievable (BAT)
  - New Source Performance Standards (CWA section 306)
- Indirect Dischargers (CWA section 307)
  - Pretreatment standards for existing and new sources (PSES and PSNS standards)

# Steps to Implementing Effluent Guidelines

| | |
|---|---|
| Step 1 | Determine proper category and subcategory |
| Step 2 | Calculate numeric limitations |
| Step 3 | Incorporate narrative requirements |
| Step 4 | Account for multiple sets of requirements |
| Step 5 | Apply additional regulatory considerations |
| Step 6 | Document decisions |

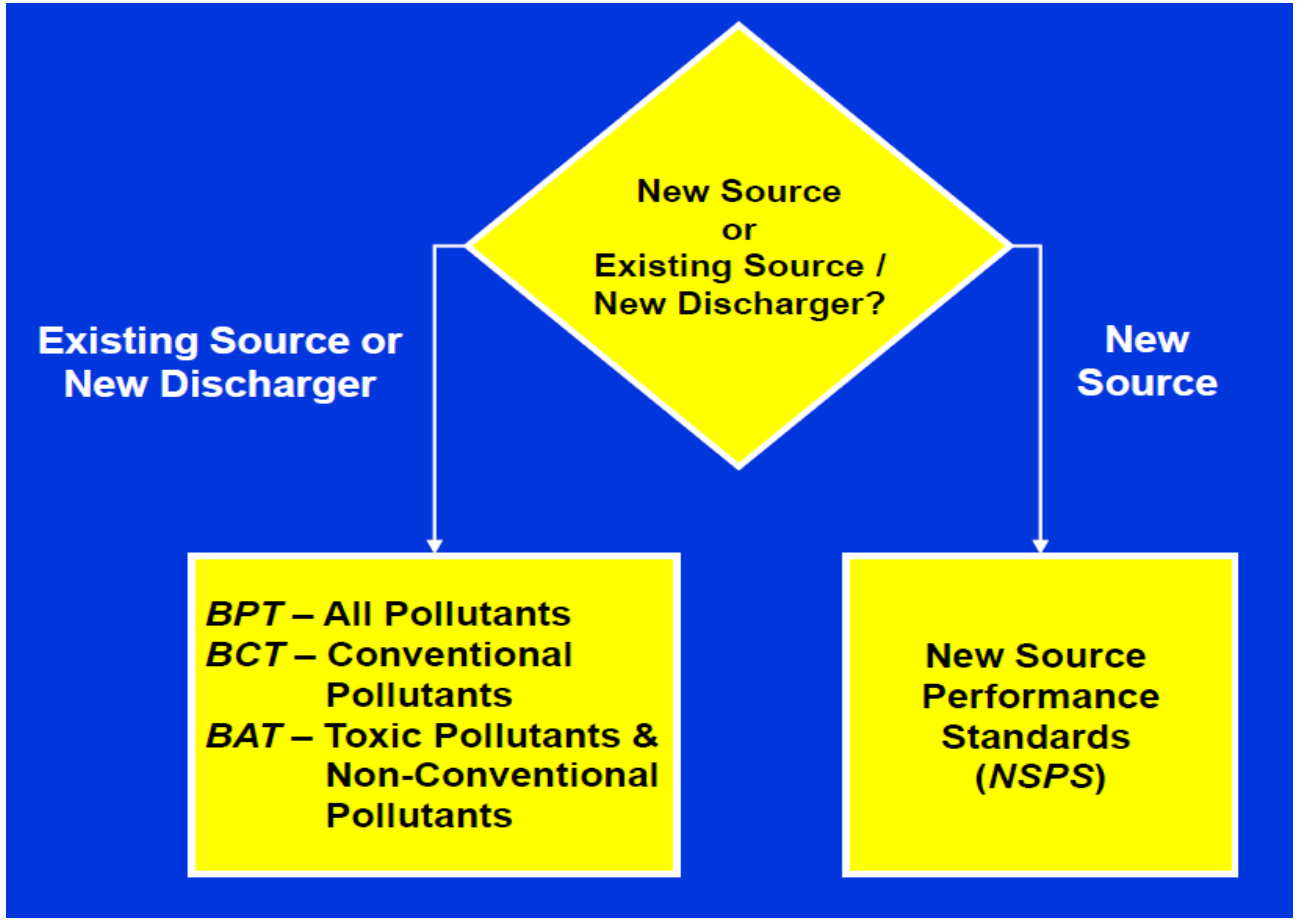
# Step . Determine Category and Subcategory

- application supplemental information
- existing TPDES permit
- applicability section of the effluent guideline
- SIC code for the facility (e.g., Copper Forming =3351)
- preamble to the ELGs promulgation in the Federal Register
- development documents
- EPA's ELGs program contacts

# Step 2. Calculate Numeric Limitations

- Mass- or concentration-based numeric standards
  - Concentration-based (Example #1)
  - Mass-based, production normalized (Example #2)
  - Mass-based, flow normalized (Example #3)
  - Zero discharge of pollutants
- Other numeric standards (e.g., pH and temperature)

# Step 2. Determine Required Performance Standards



# Step 2. Calculate Numeric Limitations

- Determine the appropriate measure of production or flow at the facility.
- Calculate numeric limits for all regulated processes and pollutants.
- Include both maximum daily and average monthly limitations for non-POTWs.
- Express as mass limitations unless guideline allows concentration limitations (e.g., metal finishing effluent guidelines).

# Step 2. Concentration-Based Calculation Example# 1

- Metal Finishing: 40 CFR Part 433
  - Subpart A: Metal Finishing Subcategory
- Given: existing source
- Example Problem:
  - Calculate the BAT maximum daily limitations (MDLs) and average monthly limitations (AMLs) for total copper.

# Step 2. Concentration-Based Calculation Example# 1

**§ 433.14 Effluent limitations representing the degree of effluent reduction attainable by applying 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 applying the best available technology economically achievable (BAT):

BAT Effluent Limitations

Expand Table

| Pollutant or pollutant property | Maximum for any 1 day | Monthly average shall not exceed |
|---|---|---|
| | Milligrams per liter (mg/l) | |
| Cadmium (T) | 0.69 | 0.26 |
| Chromium (T) | 2.77 | 1.71 |
| Copper (T) | 3.38 | 2.07 |
| Lead (T) | 0.69 | 0.43 |
| Nickel (T) | 3.98 | 2.38 |
| Silver (T) | 0.43 | 0.24 |
| Zinc (T) | 2.61 | 1.48 |
| Cyanide (T) | 1.20 | 0.65 |
| TTO | 2.13 | |

Example:
Calculate the BAT limitations for total copper (assuming that there is no mixing with wastewater streams not addressed by effluent guideline)

AML= 2.07 mg/L

MDL = 3.38 mg/L

# Step 2. Mass-based Calculation Example #2

- Example (production-normalized)
- Industry:
  - Canned and Preserved Fruits and Vegetables Processing 40 CFR Part 407
    - Subpart A: Apple Juice category
- Given
  - Existing source
  - Assume production is 200,000 pounds per day.
- Problem:
  - Calculate BPT Average Monthly Limitations (AMLs) for BOD5, TSS, and pH

# Step 2. Mass-based Calculation Example #2

**§ 407.12 Effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best practicable control technology currently available.**

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

| Effluent characteristic | Effluent limitations | |
|---|---|---|
| | Maximum for any 1 day | Average of daily values for 30 consecutive days shall not exceed - |
| | Metric units (kilograms per 1,000 kg of raw material) | |
| BOD5 | 0.60 | 0.30 |
| TSS | 0.80 | .40 |
| pH | (1) | (1) |
| | English units (pounds per 1,000 lb of raw material) | |
| BOD5 | 0.60 | 0.30 |
| TSS | 0.80 | .40 |
| pH | (1) | (1) |

[1] Within the range 6.0 to 9.0.

Example 2:
Verify production units
200,000 pounds
of raw material per day
Multiply (200,000 / 1,000) × each value from the table
BOD5 = 0.30 lbs/1000 lbs
TSS = 0.40 lbs/1000 lbs

# Step 2. Mass-based Calculation Example #2

- Production Measure
  - Determining appropriate measures of production §122.45(b)(2)
    - Use reasonable measure of actual production.
    - Account for planned changes.

# Step 2. Mass-based Calculation Example #2

Assume production is 200,000 pounds per day

$$\text{BODs}\ \left(\frac{200{,}000\ lbs\ raw\ material}{day}\ X\ \frac{0.30\ lbs}{1{,}000\ lbs\ raw\ materials}\right) = 60\ lbs/day$$

$$\text{TSS}\ \left(\frac{200{,}000\ lbs\ raw\ material}{day}\ X\ \frac{0.40\ lbs}{1{,}000\ lbs\ raw\ materials}\right) = 80\ lbs/day$$

pH within the range of 6.0 to 9.0 standard units

# Step 2. Mass-Based Calculation Example #3

- Example (flow-normalized)
- Industry:
  - Organic Chemicals, Plastics, and Synthetic Fibers 40 CFR Part 414
    - Subpart F: Commodity Organic Chemicals
    - § 414.64 New source performance standards (NSPS).
- Given
  - New source; therefore § 414.64 applies
  - Assume permitted flow of 1.42 MGD
- Problem:
  - Calculate NSPS Average Monthly Limitations (AMLs) for BOD5, TSS, and pH.

# Step 2. Mass-Based Calculation Example #3

**§ 414.64 New source performance standards (NSPS).**

(a) Any new source that uses end-of-pipe biological treatment and is subject to this subpart must achieve discharges in accordance with § 414.91 of this part, and also must not exceed the quantity (mass) determined by multiplying the process wastewater flow subject to this subpart times the concentrations in the following table.

(b) Any new source that does not use end-of-pipe biological treatment and is subject to this subpart must achieve discharges in accordance with § 414.101 of this part, and also must not exceed the quantity (mass) determined by multiplying the process wastewater flow subject to this subpart times the concentrations in the following table.

pand
able

| Effluent characteristics | NSPS[1] | |
|---|---|---|
| | Maximum for any one day | Maximum for monthly average |
| BOD5 | 80 | 30 |
| TSS | 149 | 46 |
| pH | (2) | (2) |

[1] All units except pH are milligrams per liter.

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

Example 3:
Multiply each value from the table by flow (1.42 MGD) and a conversion factor (8.345)
BOD5 = 80 mg/L
TSS = 149 mg/L

# Step 2. Mass-Based Calculation Example #3

BOD5 & TSS ALLOCATIONS

Commodity Organics Process Wastewater – 40 CFR 414.64

BOD5= [80 mg/L] x [1.42 MGD] x [8.345 lbs/gal]= **945.06 lbs/day**

TSS= [149 mg/L] x [1.42 MGD] x [8.345 lbs/gal]= **1,760.18 lbs/day**

# Step 3: Incorporate Narrative Requirements

- Incorporate all narrative requirements from the effluent guidelines such as:
  - best management practices
  - treatment practices
  - monitoring, reporting, and compliance requirements
- Example: § 451.11 establishes BPT requirements for Concentrated Aquatic Animal Production Facilities as management practices for
  - solids control
  - materials storage
  - structural maintenance
  - record keeping
  - training

# Step 4: Account for Multiple Sets of Requirements

- A single facility could include:
  - multiple processes within the same category or subcategory
  - production or services in more than one category or subcategory
  - both new and existing sources
  - wastewater streams not containing the regulated pollutant
  - unregulated wastewater streams

# Step 4: Account for Multiple Sets of Requirements

- For a facility with multiple sets of requirements:
  - Address all applicable effluent guidelines.
  - Recognize that some guidelines supersede others.
  - Account for common treatment systems.
    - building-block approach for mass limits
    - flow-weighting for concentration limits
    - BPJ for non-regulated pollutants and waste streams
  - Use internal outfalls where appropriate.
  - Be aware of inconsistent expressions of limits (units).

# Step 5: Apply Additional Regulatory Considerations

- Tiered (or alternative) limitations
  - Account for anticipated variability of production/flow (e.g., seasonal).
  - Significant variation is > 20%.
  - requires careful examination of production/flow data
  - requires special reporting requirements
    - notification of changed production/flow
    - reporting of production/flow data

# Step 6: Document Decisions

- The fact sheet or statement of basis documents:
  - statutory and regulatory citations
  - how which effluent guidelines apply was determined
  - how the facility's production, flow, or other measures used to apply the effluent guidelines were determined
  - how calculated effluent limitations (mass or concentration or both) were determined

# Case-by-Case Technology-based Effluent Limitations

§ 125.3(c) states that technology-based treatment requirements may be imposed through one of the following three methods:

1. application of EPA-promulgated effluent limitations developed under section 304 of the Act to dischargers by category or subcategory;
2. on a case-by-case basis under section 402(a)(1)(B) of the Act, to the extent that EPA-promulgated effluent limitations are inapplicable; or
3. through a combination of the methods in 1 and 2.

# Authority for Case-by-Case Limitations

- "… Promulgated effluent limitations are inapplicable…"when
  - EPA has not developed effluent guidelines that apply to the discharge (i.e., to the industry or to the type of facility) being permitted
  - there is an applicable effluent guideline, but pollutants or processes are present that were not considered when the effluent guideline was developed

# How are Case-by-Case Limits Developed

- Case-by-case technology-based limits are developed using Best Professional Judgment (BPJ).

- The permit writer uses the criteria for developing technology-based standards as required in § 125.3(d) to establish BPJ limits.

# BPJ Considerations – § 125.3(d)

- Establish appropriate level of performance on a case-by-case basis considering:
  - the appropriate technology for the class or category of point sources;
  - any unique factors related to the facility; and/or
  - discharge monitoring reports.

# Questions?


**Michael “Doc” Redda, PhD.**
**Water Quality Division**
**(512) 239-4631**