NPDES Permitting – Start to Finish

GBMc & ASSOCIATES
STRATEGIC ENVIRONMENTAL CONSULTING
501.847.7077 | WWW.GBMCASSOC.COM | 219 BROWN LANE, BRYANT, AR 72022

Shon Simpson

A Brief History

- 1972 Federal Water Pollution Control Act Amendments
  - Eliminate the discharge of pollutants
  - Prohibit discharge of toxic pollutants in toxic amounts
  - Established Section 402 – The National Pollutant Discharge Elimination System

A Brief History

- 1977 Clean Water Act
  - NRDC Consent Decree Incorporation (EPA to develop requirements for toxic pollutants and primary industries)
  - Clarified that federal facilities are subject to state permitting programs
  - Authorized localized pretreatment programs

A Brief History

- 1987 Water Quality Act
  - Brought in stormwater permitting requirements
  - Renewed emphasis of controlling toxics
  - Enhanced focus on attaining water quality standards

40 CFR 122.1(b) Who needs an NPDES permit ?

- The NPDES program requires permits for the discharge of “pollutants” from any “point source” into waters of the US.
  - **A point source is** any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft from which pollutants are or may be discharged.
  - **Pollutant** means dredged spoil, solid waste, incinerator residue, filter backwash, 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.**

Classes of Pollutants

- Conventional
  - TSS, pH, bacteria, BOD, oil and grease
- Toxics – 126 priority pollutants
  - metals
  - organics
- Non-conventional (most everything else)
  - ammonia, phosphorus, chlorine

NPDES Application Process

- For existing dischargers:
  - DEQ will notify you about a year before your current permit expires.
  - You are required to submit an administratively complete application 180 days prior to current permit expiration.
  - On time application submittal is critical.

NPDES Application Process

- Basic Steps:
  1. Determine which forms apply to your facility.
  2. Determine which parameters your facility is required to sample.
  3. Complete the necessary sampling.
  4. Complete the required forms and other requested information (maps, diagrams, flow balance, etc.).
  5. Review the forms using DEQ and EPA's checklists for NPDES applications.
  6. Submit the completed application to DEQ.

Renewal Permit Development Process: Initial Steps

- DEQ will receive the application and determine if the application is administratively complete.
- A permit engineer will be assigned to work on the renewal.
- Once deemed complete, notification that an application has been received will be public noticed (10 business days).
- The application will then be reviewed for technical completeness.
- Once technical completeness is determined the permit engineer will begin work on the permit.

Renewal Permit Development Process

- Existing permit limits
- Applicable technology based effluent guidelines
- Reasonable potential screen for water quality based limits
- Applicable TMDLs
- BPJ
- Updates to other permit conditions

Technology-Based Effluent Limits

Technology-Based Effluent Limitations

- Major strategy of the Clean Water Act was to require limits based on the capabilities of the technologies available to control the discharge of pollutants.
- Aim to prevent pollution by requiring a minimum level of effluent quality.
- Developed independently of potential impact of a discharge on the receiving stream.

NPDES – Technology Based Effluent Limits

National Technology Based Standards

- POTW – Secondary Treatment Standards.
- Non-POTWs – Effluent Limitation Guidelines (ELGs).

Best Professional Judgment

- BPJ
- Requirements based on a case-by-case basis in the absence of national standards.

Focus of this presentation will be on Non-POTWs.

Effluent Limitations Guidelines and Standards

Definition

- ELGs
- National standard developed by EPA
- Prescribed allowable discharge of pollutants from industrial point source categories.

Scope

- Established for most primary and some secondary industries.

Regulations

- 40 CFR Parts 405-471

Point Source Categories and 40 CFR Reference

Aluminum Forming	467	Meat and Poultry Products	432
Asbestos Manufacturing	427	Metal Finishing	433
Battery Manufacturing	461	Metal Molding and Casting	464
Canned and Preserved Fruits and Vegetable Processing	407	Metal Products and Machinery	438
Canned and Preserved Seafood Processing	408	Mineral Mining and Processing	436
Carbon Black Manufacturing	458	Nonferrous Metals Forming and Metal Powders	471
Cement Manufacturing	411	Nonferrous Metals Manufacturing	421
Centralized Waste Treatment	437	Oil and Gas Extraction	435
Coal Mining	434	Ore Mining and Dressing	440
Coil Coating	465	Organic Chemicals, Plastics, and Synthetic Fibers	414
Concentrated Animal Feeding Operations (CAFOs)	412	Paint Formulating	446
Concentrated Aquatic Animal Production	451	Paving and Roofing Materials (Tars and Asphalt)	443
Copper Forming	468	Pesticide Chemicals	455
Dairy Products Processing	405	Petroleum Refining	419
Electrical and Electronic Components	469	Pharmaceutical Manufacturing	439
Electroplating*	413	Phosphate Manufacturing	422
Explosives Manufacturing	457	Photographic	459
Ferroalloy Manufacturing	424	Plastic Molding and Forming	463
Fertilizer Manufacturing	418	Porcelain Enameling	466
Glass Manufacturing	426	Pulp, Paper, and Paperboard	430
Grain Mills	406	Rubber Manufacturing	428
Gum and Wood Chemicals	454	Soaps and Detergents Manufacturing	417
Hospitals	460	Steam Electric Power Generating	423
Ink Formulating	447	Sugar Processing	409
Inorganic Chemicals	415	Textile Mills	410
Iron and Steel Manufacturing	420	Timber Products Processing	429
Landfills	445	Transportation Equipment Cleaning	442
Leather Tanning and Finishing	425	Waste Combustors	444

ELGs Establish 6 Types of Standards

- Best Practicable Control Technology Currently Available (BPT)
  - First level of control
  - Applies to all pollutant types (Conventional, Nonconventional, and Toxic)
  - Average of the best performance of facilities based on cost, age, size, processes, etc. for conventional, toxic, and nonconventional pollutants.

- Best Conventional Pollutant Control Technology (BCT)
  - Additional levels of effluent reduction for conventional pollutants considering a two-part “cost reasonableness” test.

ELGs Establish 6 Types of Standards

- Best Available Technology Economically Achievable (BAT).
  - EPA's second level strategy for controlling toxic and nonconventional pollutants.
  - Represents the best available economically achievable performance of facilities in an industry category.
- New Source Performance Standards (NSPS)
  - Best Available Demonstrated Control Technology (BADCT) that addresses all pollutants.
  - Considers costs, non water quality environmental impacts, and energy requirements.
  - BAT = NSPS
- Pretreatment Standards for Existing (PSES) and New Sources (PSNS)
  - Applicable to discharges to a POTW

Effluent Limitations Guidelines and Standards

- ELGs can include:
  - Numeric Limitations – Mass or Concentration Based
  - Non-Numeric/Narrative Limitations
    - Best Management Practices (BMPs)
    - Pollution Prevention Practices

Calculating TBELS using ELGs

Calculating TBELS Using ELGs

- Applicable ELG Categories and Subcategories are determined based on:
  - Application
  - Existing Permit
  - Applicability Section in Regulation
  - ELG Development Documents

- Once these has been determined, and discharge flow and / or production is determined, Technology Based Effluent Limitations can be calculated.

Flow-Normalized Effluent Guidelines

- Mass limits are calculated based on ELGs expressed as concentrations.
- 40 CFR Part 423.12(b)(s) for BPT requirements for low volume waste sources at a Steam Electric Power Generating Plant

(3) The quantity of pollutants discharged from low volume waste sources shall not exceed the quantity determined by multiplying the flow of low volume waste sources times the concentration listed in the following table:

	BPT effluent limitations	
Pollutant or pollutant property	Maximum for any 1 day (mg/l)	Average of daily values for 30 consecutive days shall not exceed (mg/l)
TSS	100.0	30.0
Oil and grease	20.0	15.0

Production-Normalized Effluent Guidelines

- Mass limits are calculated based on ELGs expressed in terms of production.
- 40 CFR Part 407.12 for BPT requirements for apple processing wastewater at a Canned and Preserved Fruits and Vegetables Processing Plant

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)	
BOD*5*	0.60	0.30
TSS	0.80	.40
pH	([1])	([1])
	English units (pounds per 1,000 lb of raw material)	
BOD*5*	0.60	0.30
TSS	0.80	.40
pH	([1])	([1])

Production-Normalized Effluent Guidelines Example

- Canned and Preserved Fruits and Vegetables Processing 40 CFR Part 407
  - Subpart A: Apple Juice Subcategory
- Given: Existing Point Source
- Production: 200,000 lbs of raw material per day.
- Calculate BPT Average Monthly and Daily Maximum Limitations for BOD5

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)	
BOD*5*	0.60	0.30
TSS	0.80	.40
pH	(1)	(1)
	English units (pounds per 1,000 lb of raw material)	
BOD*5*	0.60	0.30
TSS	0.80	.40
pH	(1)	(1)

1) Verify production units (i.e. lbs/day) and determine which set of limitations to use.

2) Multiply the production rate by the value in the table for BOD5.

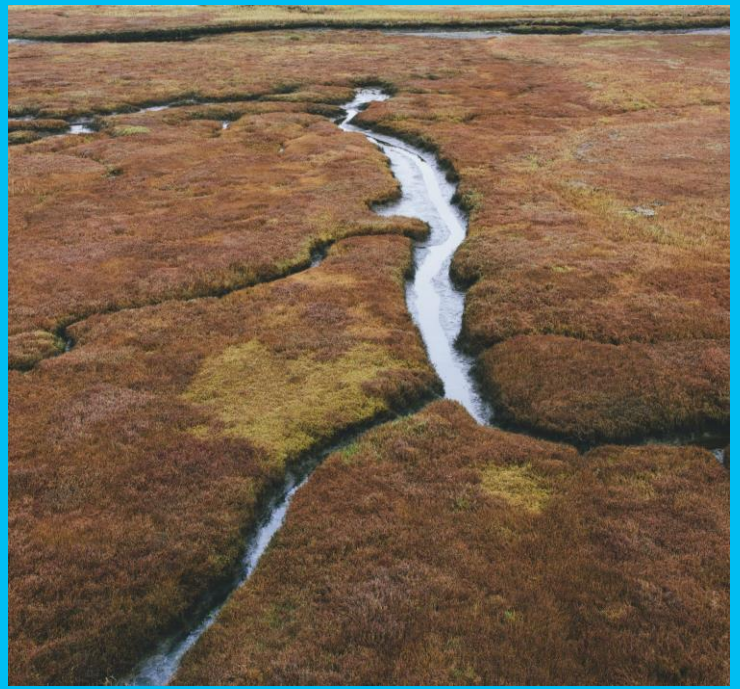
$$BOD5\ Monthly\ Average\ Limit = \frac{200{,}000\ \text{lbs apples}}{\text{day}} * \frac{0.3\ \text{lbs BOD5}}{1{,}000\text{lbs apples}} = 60\frac{lbs}{day}\ BOD5$$

$$BOD5\ Daily\ Maximum\ Limit = \frac{200{,}000\ \text{lbs apples}}{\text{day}} * \frac{0.6\ \text{lbs BOD5}}{1{,}000\text{lbs apples}} = 80\frac{lbs}{day}\ BOD5$$

Where Calculating TBELS Using ELGs Gets Complicated

- A facility could have:
  - Multiple processes within the same ELG category or subcategory
  - Waste streams with more than one applicable ELG.
  - Unregulated wastewater streams commingling with regulated waste streams prior to the final discharge point.
- All ELGs must be addressed.
- Some ELGs will supersede others.
- Must account for a common treatment system
  - Building block approach for mass limits
  - Accounting for unregulated pollutants and waste streams.

Water Quality-Based Effluent Limits



NPDES Permitting and Water Quality Criteria

- WQ Based NPDES Limits are designed to meet instream water quality criteria (Numeric & Narrative)
  - Chemical Specific
    - Aquatic Life
    - Human Health
  - Whole Effluent Toxicity
  - Bacteria
  - Others

NPDES Permitting and Water Quality Criteria

- Methods for Determining Permit Limits
  - Water Quality Models (Cormix, Streeter-Phelps, Qual2K) – Ammonia & CBOD
  - Numeric Criteria Straight from the Regulations - pH and fecal coliform
  - Mass Balance Calculation for determining wasteload allocations - some toxics / metals

NPDES – Water Quality Based Effluent Limits: Information Needed

- Background Permitting History
- Effluent Characterization
- Receiving Stream Characterization

Effluent Characterization

- Effluent Discharge Flow
  - Industrial effluents are permitted upon the highest average monthly flow over the previous two years
  - Municipal effluents are permitted based upon their design flow
- Effluent Pollutant Data
  - Effluent Monitoring Data
    - DMR Data (previous two years)
    - Permit Renewal Application Data (PPS, Form 2C, Form 2F, etc.)
    - DEQ requests for other analytical data

Receiving Stream Characterization

- Regulatory Background Flow
  - For aquatic life criteria:
    - 7Q10 (lowest 7-consecutive day flow with 10% probability of occurrence each year)
- Background Pollutant Data
  - Data for pollutant being permitted (if it exists)
  - Hardness (some metals)
  - Temperature
  - pH

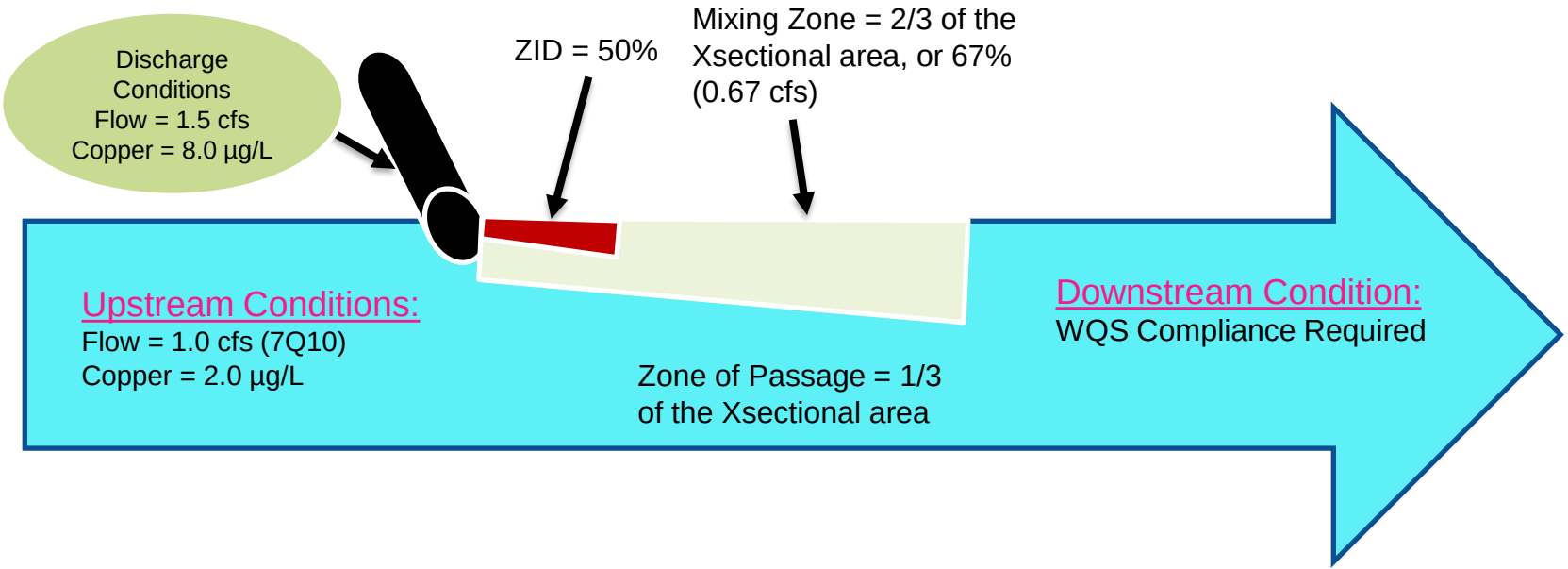
Calculating WQBELS

NPDES – Water Quality Based Effluent Limits

General WQBEL process for aquatic life criteria

- Step 1. A reasonable potential calculation, if RP exists – Step 2
- Step 2. Calculate a wasteload allocation (WLA)for the situation
- Step 3. Convert WLA to a long-term average (LTA) using a statistical approach
- Step 4. Convert LTA to maximum daily and average monthly permit limits
- EPA TSD and Arkansas CPP

NPDES – Water Quality Based Effluent Limits



Step 1. Reasonable Potential Screen Copper Example

What do you need to know?

- Water quality criteria for copper from Reg 2 (chronic copper criterion example)
  - Chronic = e [0.8545(ln(31).0]-1.465 * 0.960 = **4.17 µg/L** (at Gulf Coast hardness of 31 mg/L)
- Receiving stream 7Q10 (and background copper if available)
- Effluent flow (highest monthly average previous two years)
- Effluent concentration (varies depending on amount of data available)
- Mass balance equation used to determine the instream concentration after mixing, if no RP done, if RP go to step 2

Step 2. Determine the Wasteload Allocation (WLA)

What do you need to know?

- Everything from the reasonable potential screen in Step 1, except for the effluent copper criteria
- The same mass balance equation is run except it is solved for effluent concentration, which is the WLA
  - $WLA = \{[WQS \times (Q_d + Q_b)] - (Q_b \times C_b)\}/Q_d$
- The WLA is the mass (concentration x flow) that can be discharged while maintaining the water quality standards

Step 3. Convert the WLA to a Long-Term Average

- The long-term average uses a coefficient of variation to evaluate effluent variability as a percentage probability, normally usually a 95^{th} or 99^{th} percentile probability basis.
- For example, at a CV of 0.6 using a 99^{th} percentile probability:
  - LTA = WLA * 0.527
  - $LTA = WLA \times \exp(0.5 \sigma_4^2 - z \sigma_4)$

Where:

$\sigma_4^2 = \ln(CV^2/4 + 1)$

$CV = 0.6$

$\sigma_4^2 = \ln(0.6^2/4 + 1) = 0.08617$

$\sigma_4 = 0.2935$

$z = 2.326$ for 99th percentile probability basis

Step 4. WQBEL – Calculating the Permit Limits

Convert the LTA to average monthly and maximum daily permit limits (AML and MDL)

- This is also a probability-based step and considers the percentage probability for the maximum limit and for the average monthly limit, the number of samples collected per month is also considered.
- The equations look about like those from the previous step, from the look up tables:
  - MDL = LTA * 3.11, which is the value for the 99th percentile at a CV of 0.6.
  - AML = LTA *1.55, which is the value for the 95th percentile, CV of 0.6 and a monitoring frequency of 4 samples per month.
  - These values are from tables in EPAs Technical Support Document for Water Quality Based Toxics Control (EPA, March 1991)

NPDES Permit Finalization

- DEQ will evaluate and select the most stringent limits from:
  - The current permit limits
  - Technology based effluent limits (Including any BPJ based limits)
  - Water quality-based effluent limits

Steps in Issuing the Permit

- Courtesy draft review
- EPA review (if applicable – all majors and permits with ELGs)
- Public notice and comment period

Draft Permit Review

- Review your permit thoroughly!
- Limits v. data you have.
- Has something changed?
- Review the fact sheet or statement of basis.
- Ask questions or seek clarification.
- Comment if needed.

THANKS!

Questions?

You can find me at:

- ssimpson@gbmcassoc.com
- 501-847-7077