

## WQBELs Part I: Identifying the Applicable Water Quality Standards



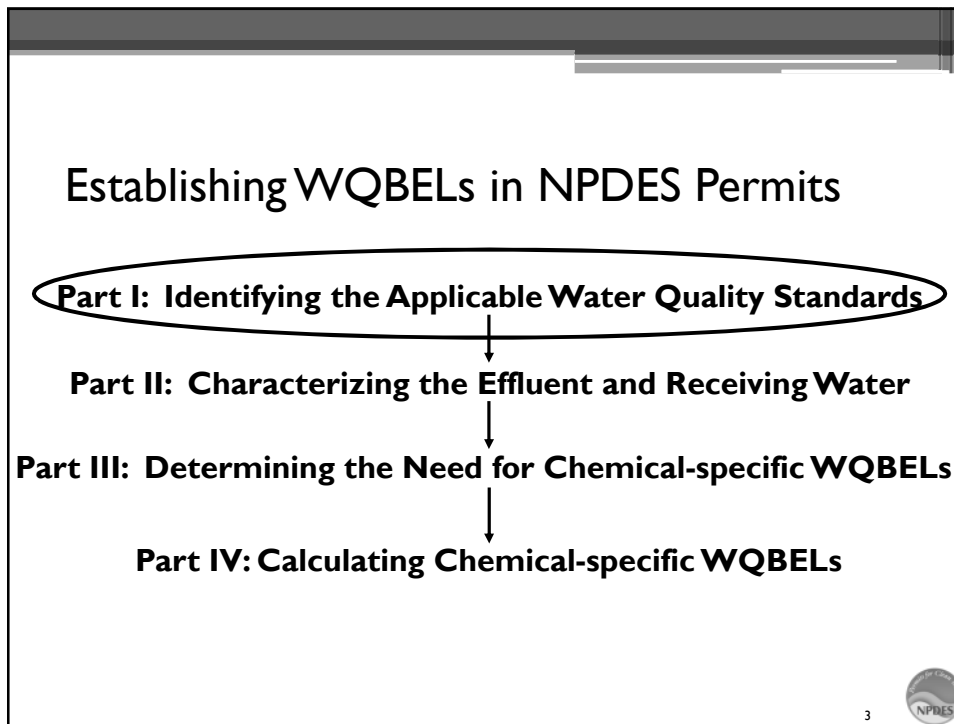
NPDES Permit Writers' Course  
Online Training Curriculum



## Presenters

- *David Hair*  
Environmental Engineer  
US Environmental Protection Agency  
Washington, DC
- *Greg Currey*  
Environmental Engineer  
Tetra Tech, Incorporated  
Fairfax, Virginia





### Technology- and Water Quality-based Effluent Limitations

	Technology-based Effluent Limitations (TBELs)	Water Quality-based Effluent Limitations (WQBELs)
→ <b>Goal or Policy:</b>	<ul style="list-style-type: none"> <li>▪ Zero Discharge of Pollutants</li> </ul>	<ul style="list-style-type: none"> <li>▪ Fishable and Swimmable Waters</li> <li>▪ No Toxics in Toxic Amounts</li> </ul>
→ <b>Standards:</b>	<ul style="list-style-type: none"> <li>▪ Technology</li> </ul>	<ul style="list-style-type: none"> <li>▪ Water Quality</li> </ul>
→ <b>NPDES Regulations:</b>	<ul style="list-style-type: none"> <li>▪ 40 CFR 122.44(a), (e)</li> <li>▪ 40 CFR 125.3</li> </ul>	<ul style="list-style-type: none"> <li>▪ 40 CFR 122.44(d)</li> </ul>

Develop **TBELs** (derived from technology standards) for all applicable pollutants of concern. Develop **WQBELs** where TBELs are not adequate to meet water quality standards in the receiving water.

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## Implementing Water Quality Standards (WQS) in NPDES Permits

- Water quality standards and their implementing procedures (including NPDES requirements) specify how to:
  - identify applicable water quality standards
  - characterize effluent and receiving water
  - determine the need for WQBELs
  - calculate WQBELs
- Where can these methods be found?
  - state regulations, policies, guidance
  - state water quality management plans
  - past practices
- What methods are used in this online training?
  - USEPA *Technical Support Document for Water Quality-based Toxics Control*



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## Water Quality Standards: Clean Water Act Requirements

- Section 101(a) (2), and (3)
  - establishes fishable and swimmable goal and no toxics in toxic amounts policy
- Section 303(c)
  - establishes framework for water quality standards program
  - requires states to establish water quality standards
- Section 304(a)
  - requires EPA to develop and publish recommended water quality criteria
- Section 301(b)(1)(C)
  - requires compliance with effluent limitations necessary to meet water quality standards

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## Adopting and Approving WQS – 40 CFR Part 131

- States, territories, and tribes are responsible for adopting water quality standards for all waters of the United States [§ 131.4]
  - water bodies
  - segments of water bodies
- Standards are to be reviewed at least once every three years [§ 131.20]
- EPA has oversight authority
  - review and approval [§§ 131.5, 131.6, 131.21]
  - standards not effective until EPA approves [§ 131.21]
  - federal promulgation [§ 131.22]

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## What is a Water Quality Standard?

- A water quality standard defines the water quality goals of a water body
  - designating the use or uses to be made of the water
  - setting criteria necessary to protect the uses

### § 131.2 Purpose.

A water quality standard defines the water quality goals of a water body, or portion thereof, by designating the use or uses to be made of the water and by setting criteria necessary to protect the uses. States adopt water quality standards to protect public health or welfare, enhance the quality of water and serve the purposes of the Clean Water Act (the Act).

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## Components of Water Quality Standards

- Components of water quality standards include:

- Designated uses [§131.10]
- Water quality criteria [§131.11]
- Antidegradation policy [§131.12]
- General policies [§131.13] (optional)



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## Designated Uses – § 131.10

- Water quality standards must specify appropriate uses to be achieved and protected
- Common use categories
  - aquatic life protection and propagation
  - wildlife protection and propagation
  - recreation
    - primary contact
    - secondary contact
  - public water supply
  - agricultural water supply
  - industrial water supply
  - navigation



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## EPA Water Quality Criteria

- EPA is responsible for establishing guidance and procedures (CWA Section 304(a))
  - establish and publish scientifically derived ambient criteria [CWA Section 304(a)]
    - 1968 Green • 1980 Toxics
    - 1973 Blue • 1986 Gold
    - 1976 Red
  - establish procedures for deriving criteria

<http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm>

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## Water Quality Criteria – § 131.11

- Numeric criteria
  - Chemical- or parameter-specific
    - Aquatic life
    - Human health
    - Others (e.g., wildlife)
  - Whole effluent toxicity (WET)
  - Biological
- Narrative criteria

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## Chemical / Parameter-Specific Criteria – Aquatic Life Criteria

- Designed to protect aquatic organisms, including animals and plants
- Typically two types of aquatic life criteria
  - acute
  - chronic
- Developed based on tests measuring effects on aquatic life



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## Aquatic Life Criteria Components

- Typically, aquatic life criteria have three components:
  - **magnitude** (concentration of concern of the pollutant)
  - **duration** (time period that aquatic organisms would be exposed to the pollutant at the concentration of concern)
  - **frequency** (how often aquatic organisms would be exposed to the concentration of concern for the duration of concern)

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## Example: Numeric Aquatic Life Criteria for Cadmium

- **Cadmium (dissolved)**—Except possibly where a locally important species is very sensitive, freshwater aquatic organisms and their uses should not be affected unacceptably if:
  - the 4-day average concentration (in  $\mu\text{g/L}$ ) does not exceed the numerical value given by  $e^{(0.7409[\ln(\text{hardness})]-4.719)} (1.101672-[(\ln \text{hardness})(0.041838)])$  more than once every three years on average
  - the 1-hour average concentration (in  $\mu\text{g/L}$ ) does not exceed the numerical value given by  $e^{(1.0166[\ln(\text{hardness})]-3.924)} (1.136672-[(\ln \text{hardness})(0.041838)])$  more than once every three years on average

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## Example of Factors Affecting Criteria Magnitude

- Metals
  - hardness
  - dissolved or total recoverable form
    - effluent limitations generally must be in total recoverable form [§ 122.45(c)]
- Ammonia
  - pH
  - temperature
  - types of aquatic life present (for some acute values)

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## Chemical / Parameter-Specific Criteria (continued)

- Human Health Criteria

- Toxic Pollutants

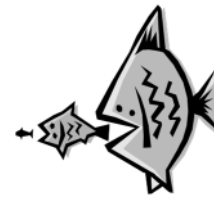
- single expression of the highest pollutant concentration not expected to pose significant long-term risk to human health

- consider chronic exposure via:

- consumption of aquatic life
      - consumption of aquatic life and water

- Other Pollutants

- generally shorter-term exposure (e.g., bacteria)



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## Whole Effluent Toxicity (WET) Testing

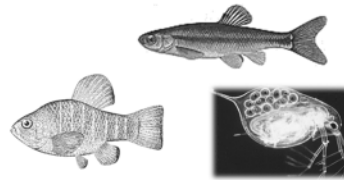
- Measures the aggregate toxic effect of effluent
  - exposes aquatic test organisms directly to an effluent
  - measures lethal and sub-lethal effects
  - uses standard EPA test methods
    - freshwater
    - saltwater



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## Whole Effluent Toxicity



- Acute Tests
  - $LC_{50}$ 
    - concentration of effluent (% effluent) that is lethal to 50 percent of the exposed test organisms
- Chronic Tests
  - Inhibition Concentration ( $IC_p$ )
    - a point estimate of the effluent concentration (% effluent) that would cause a given percent reduction (p) in a non-lethal biological measurement of the test organisms
  - No Observed Effect Concentration (NOEC)
    - the highest concentration of an effluent (% effluent) at which no adverse effects are observed on the aquatic test organisms

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## Additional Information on WET



- EPA methods manuals
- EPA WET guidance
- EPA websites
  - <http://cfpub.epa.gov/npdes/wqbasedpermitting/wet.cfm>
  - <http://water.epa.gov/scitech/methods/cwa/wet/>
  - Society of Environmental Toxicology and Chemistry (SETAC) [www.setac.org](http://www.setac.org)

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## Biological Criteria

- Quantitative expressions of the desired condition of the aquatic community
- Derived using data from sites representing the least impacted attainable condition for a specific water body type within an ecoregion or watershed
- Traditionally use benthic invertebrate and fish sampling
- <http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/biocriteria/>



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## Water Quality Criteria – § 131.11

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## Narrative Criteria

- Statements that describe the desired water quality goal, often expressed as **free from** statements
  - All waters must be **free from** toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life
  - Waters must be **free from** discoloration of human origin, that causes nuisance or adversely affects designated uses
  - All waters must be **free from** substances in quantities that would produce undesirable or nuisance aquatic life



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## Components of Water Quality Standards

- Components of water quality standards include:

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- General policies [§ 131.13] (optional)



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## Antidegradation Policy – § 131.12

- An **antidegradation policy** is a required policy that:
  - ensures that once a use is achieved it will be maintained
  - protects high quality waters
  - protects Outstanding National Resource Waters
- Each state, territory, or tribe is required to adopt an antidegradation policy as part of its water quality standards and to adopt a **method of implementation**



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## Antidegradation Policy – Three Tiers

- Tier I: ensures level of quality necessary to protect **existing uses** (uses attained on or at any time after November 28, 1975)
- Tier II: protects actual water quality where water quality exceeds levels necessary to protect fish and wildlife propagation and recreation on and in the water (protection of **high quality waters**)
- Tier III: special protection of waters designated as **Outstanding National Resource Waters** (ONRWs)



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## Implementing Antidegradation Policies in NPDES Permits

- Determine which “*tier*” the receiving water falls under
  - water body
  - parameter-by-parameter
- When determining effluent limitations, conduct appropriate analysis for the applicable tier
- **Document** all decisions

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## General Water Quality Standards Policies – § 131.13

- States, territories, and tribes may include in their standards, at their discretion, policies affecting **water quality standards application and implementation**, such as
  - mixing zones
  - low flows
  - variances



<http://water.epa.gov/scitech/swguidance/standards/>

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## Relationship Between WQS and Effluent Limitations

- **Water quality standards** apply throughout the water body (or segment of a water body) as defined by the state, territory, or tribe
- **Effluent limitations** apply at the compliance point established in the permit (generally “end of pipe”)



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## Relationship Between WQS and Effluent Limitations

### Water Quality Criteria

- Apply in the receiving water and could include:
  - magnitude
  - duration
  - frequency



### Effluent Limitations

- Apply “end-of-pipe” and include:
  - magnitude
  - averaging period

- Calculate **end-of-pipe WQBELs** where necessary to ensure that **water quality standards** are attained in the receiving water
- Use water quality standards implementation procedures

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## Role of the Permit Writer



- Role of the permit writer is to implement water quality standards in NPDES permits by:
  - knowing the current water quality standards, including any recent changes
  - being familiar with water quality standards implementation policies
  - using procedures adopted by the permitting authority to establish limitations as stringent as necessary to attain water quality standards

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## Feedback and Other Presentations

Questions or comments?

[npdeswebtraining@tetrattech.com](mailto:npdeswebtraining@tetrattech.com)

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