

# Technology-based Effluent Limitations for Publicly-Owned Treatment Works (POTWs)

## 1. NPDES Permit Writers' Course Online Training Curriculum

### 1.1 Technology-based Effluent Limitations for Publicly-Owned Treatment Works (POTWs)



#### Notes:

Hello, and welcome to this presentation on technology-based effluent limitations in National Pollutant Discharge Elimination System, or NPDES, permits.

This presentation is one of two presentations on technology-based effluent limitations in a Web-based training series on the NPDES program sponsored by the Environmental Protection Agency's Water Permits Division.

This presentation focuses on technology-based effluent limitations for publicly-owned treatment works, or POTWs.

Before we get started with the presentation, I'll introduce our speakers and cover one important housekeeping item.

## 1.2 Presenters



### Presenters

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



### Notes:

Your speakers for this presentation are David Hair, an environmental engineer with the Water Permits Division of USEPA in Washington, DC, and me, Greg Currey, an environmental engineer with Tetra Tech, Incorporated in Fairfax, Virginia.

As far as that housekeeping item goes, I need to tell you that all the materials used in this presentation have been reviewed by USEPA staff for technical accuracy; however, the views of the speakers are their own and do not necessarily reflect those of USEPA. NPDES permitting is governed by the existing requirements of the Clean Water Act and USEPA's NPDES implementing regulations. These statutory and regulatory provisions contain legally binding requirements. The information in this presentation is not binding. Furthermore, it supplements, and does not modify, existing USEPA policy, guidance, and training on NPDES permitting. USEPA may change the contents of this presentation in the future.

Dave, why don't you get us started with an overview of technology-based effluent limitations before we take a look specifically at technology-based limits for POTWs?

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

**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.

**Notes:**

In a previous presentation in this series, we listed several goals and policies found in section 101(a) of the Clean Water Act, three of which are provided in the top row of the table on this slide.

The left side of the table outlines what we refer to as the technology-based approach to establishing effluent limits.

The Clean Water Act goal that drives this approach is that “the discharge of pollutants into navigable waters be eliminated by 1985.” To move us toward this goal, Congress, in the Clean Water Act, established required levels of performance for various types of point sources and established deadlines by which these standards had to be enforced. Under these Clean Water Act requirements, EPA has established national technology-based standards for many categories of facilities. These performance-based standards depend on the type of facility and the availability of treatment technologies or pollutant minimization techniques and are not driven by site-specific impacts on water quality.

The NPDES regulations require the implementation of these technology-based standards through effluent limitations developed from the standards. We refer to limits developed in this manner as technology-based effluent limits, or TBELs. Technology-based effluent limitations may also be developed on a case-by-case basis where EPA has not developed national standards for a category of point source discharger.


The other approach to developing effluent limits in permits is very different and is driven by the Clean Water Act goal and policy listed on the top right of the table: namely, that we attain water quality that supports fish, shellfish, and wildlife propagation and recreation in and on the water, and that the discharge of toxic pollutants in toxic amounts be prohibited.

This “water quality-based” approach to pollution control, relies on states and tribes to establish water quality standards to protect their waters.

The NPDES regulations then establish a requirement to develop water quality-based effluent limitations, or WQBELs if technology-based effluent limits will not ensure attainment of these water quality standards.



Because the Clean Water Act and the NPDES regulations establish these as two independent approaches for developing effluent limitations in an NPDES permit, a permit writer must consider limitations based on both. This presentation that follows, however, focuses exclusively on the technology-based approach.

## 1.4 Technology-based Requirements



### Technology-based Requirements

- Technology-based requirements:
  - establish performance-based level of pollutant controls
  - provide equity among dischargers within categories
- 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)]



The slide features a light blue background with a white border. On the left, there is a circular NPDES logo. The title 'Technology-based Requirements' is in a bold, black font. Below the title is a bulleted list of requirements. To the right of the text is a colorful illustration of a wastewater treatment plant with a river flowing through a green landscape. At the bottom right, the EPA logo is visible.

### Notes:


The technology-based approach to controlling point source discharges is driven by standards and requirements developed based on the actual demonstrated performance of a known technology. The specific levels of performance are established in the Clean Water Act and vary based on the type of discharger, the type of pollutant, technical considerations and, in most cases, the cost to implement various controls.

Once established, these technology-based requirements provide a degree of equity among dischargers within a specific category, providing geographic consistency and minimizing the economic incentive for dischargers to seek out locations where pollutant controls might be more lax.

While technology-based standards are based on a demonstrated “model” technology, the specific requirements that dischargers must meet are performance-based. In other words, dischargers are not obligated to use the technology



upon which the standards are based and can choose any treatment or pollutant control technologies so long as the controls achieve the required end result.

## 1.5 Technology-based Effluent Limitations



### Technology-based Effluent Limitations

- National technology-based standards
  - secondary treatment standards for POTWs
  - effluent guidelines for certain categories of non-POTWs (industrial discharges)
- In the absence of national standards
  - technology-based requirements developed on a case-by-case basis
- Technology-based requirements are implemented in NPDES permits through technology-based effluent limitations (TBELs)



### Notes:


The Clean Water Act directs EPA to develop national standards of performance for various types of point source dischargers. For publicly-owned treatment works (or POTWs), the standards of performance are referred to as the “secondary treatment standards.” For non-POTWs, the standards of performance are called “effluent limitation guidelines and standards” or “effluent guidelines” for short.

For direct dischargers, these technology-based standards are not self-implementing, by which we mean that standards can't be implemented or enforced unless they are properly incorporated into an NPDES permit.

It's critical, therefore, that permit writers be able to identify all applicable technology-based standards and translate these standards into effluent limitations or other permit conditions.




So with that quick overview to frame the basis and need for technology-based requirements, let's move on to the subject of this presentation, which is how we apply the secondary treatment standards to publicly-owned treatment works.

## 1.6 POTW and Non-POTW



### POTW and Non-POTW

- **POTWs** are treatment works owned by a state or municipality
  - include devices and systems used in the storage, treatment, recycling, and reclamation of municipal sewage or industrial wastes of a liquid nature
  - Definition at § 403.3(q)
- **Non-POTWs** include all other facilities and are often called “non-municipals” or “industrials”



### Notes:

We'll first consider what we mean by a publicly-owned treatment works, or POTW. A publicly-owned treatment works is defined in 40 CFR 403.3(q) as a treatment works owned by a State or municipality including any devices and systems used in the storage, treatment, recycling and reclamation of municipal sewage or industrial wastes of a liquid nature. In most cases, what we're referring to here is a municipal wastewater treatment plant that is treating predominately domestic wastewater.

As far as the statute and regulations are concerned, all other facilities are non-POTWs and are often referred to as “non-municipals” or “industrials.” Using this definition, the non-municipal or industrial categories would include dischargers such as privately-owned treatment works, federally-owned treatment works, drinking water treatment plants, concentrated animal feeding operations, and any manufacturing or commercial facility.

This presentation addresses only the technology-based standards applicable to POTWs.

## 1.7 Technology-based Requirements in NPDES Permits for POTWs



### Technology-based Requirements in NPDES Permits for POTWs

- Secondary treatment standards are found in **40 CFR Part 133**
- **§§ 122.44(a) and 125.3** require NPDES permits for **POTWs** to include technology-based effluent limitations based on secondary treatment standards



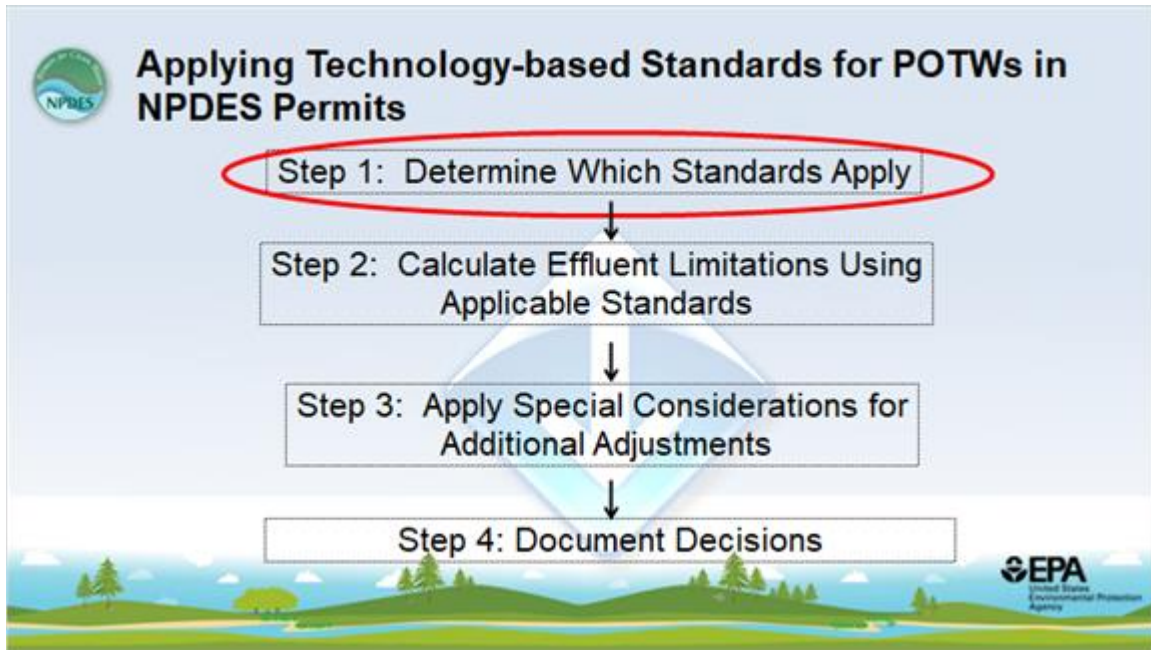
The slide features a light blue background with a white border. On the left, there is a circular logo with a green and blue design and the text 'NPDES'. To the right of the logo is the title 'Technology-based Requirements in NPDES Permits for POTWs'. Below the title are two bullet points. The first bullet point states 'Secondary treatment standards are found in 40 CFR Part 133'. The second bullet point states '§§ 122.44(a) and 125.3 require NPDES permits for POTWs to include technology-based effluent limitations based on secondary treatment standards'. To the right of the text is a photograph of a wastewater treatment plant's aeration tank, showing a concrete structure with a metal railing and a large volume of water with white foam. At the bottom of the slide is a decorative horizontal band with a green landscape, a blue sky, and the EPA logo on the right side.

### Notes:

Specifically, this presentation provides a discussion of the secondary treatment standards found in the regulations at 40 CFR Part 133 as well as the NPDES permitting regulations at 40 CFR 122.44(a) and 125.3 that require permit writers to implement these standards in NPDES permits.

Now let's take a look at the step-by-step process that will help guide us through these standards and regulatory implementation requirements.

## 1.8 Applying Technology-based Standards for POTWs in NPDES Permits



### Notes:

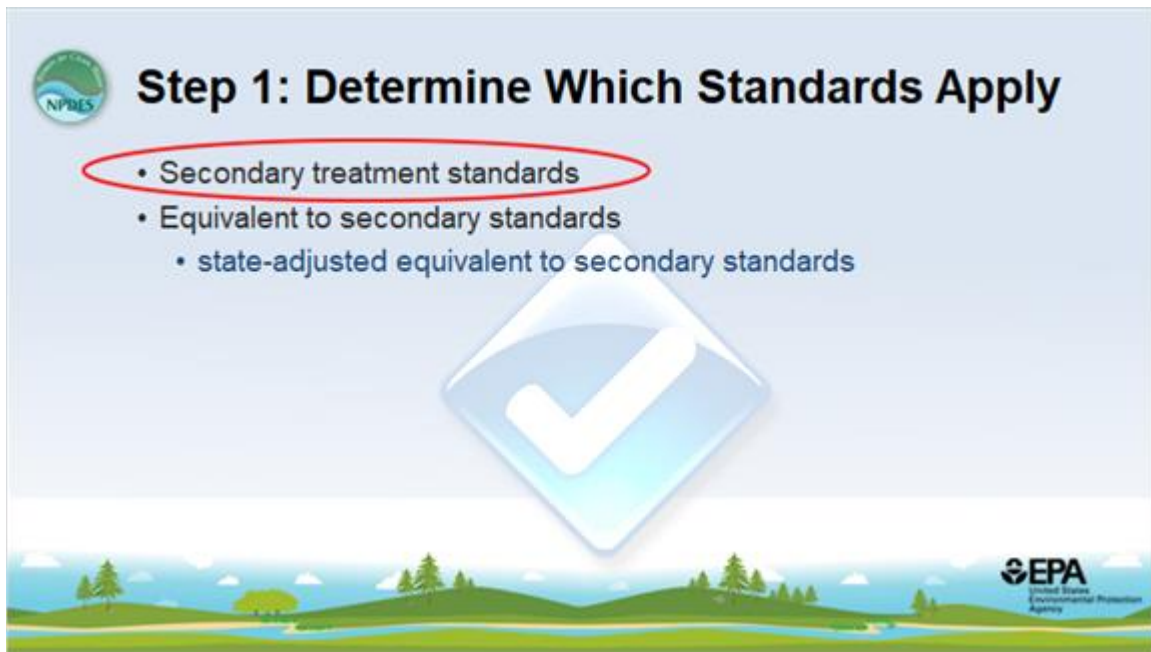
This slide breaks the process for applying the technology-based standards for POTWs into four basic steps.

The secondary treatment standards vary depending on the type of treatment system used by the POTW. So, in Step 1, we determine which standards apply. In Step 2, we calculate the technology-based limits using the applicable standard, and in Step 3, we make any appropriate adjustments allowed under the regulations. Finally, in Step 4, we discuss how the permit writer should document what he or she did in Steps 1 through 3.

Let's begin with Step 1 and determine which standards apply.



## 1.9 Step 1: Determine Which Standards Apply



The slide features the NPDES logo in the top left corner. The title "Step 1: Determine Which Standards Apply" is prominently displayed. A list of standards is shown, with the first item circled in red. A large, light blue checkmark icon is centered on the slide. The bottom of the slide shows a landscape with green hills, trees, and a blue sky, with the EPA logo in the bottom right corner.

- Secondary treatment standards
- Equivalent to secondary standards
  - state-adjusted equivalent to secondary standards

### Notes:

One of three possible variations of the technology-based standards for POTWs could apply to a specific facility.


These standards are provided in the secondary treatment regulations at 40 CFR Part 133. The regulations were originally promulgated by EPA in August 1973, and were significantly revised in September 1984. These regulations and standards establish EPA's performance expectations for "secondary treatment" for most POTWs, and "equivalent to secondary" treatment standards for certain types of plants and configurations.

Let's start by reviewing what we'll call the "baseline" secondary treatment standards, which apply to the majority of POTWs covered under the NPDES permit program.

"Secondary treatment" refers to the model technology identified by EPA for the treatment of municipal wastewater and is based upon the demonstrated performance of a properly designed and operated municipal biological wastewater treatment system. The biological portion of a municipal wastewater treatment system is typically referred to as "secondary treatment"--hence the name for this performance standard.

As I mentioned before, these are performance-based requirements, so a community today might decide to design and build a POTW using a new or emerging technology, completely different than the traditional biological municipal treatment plant considered by EPA when we set up the standards back in the early 1970s. That's fine, just as long as the new plant can meet the performance standards we're about to present.



## 1.10 Secondary Treatment Standards – § 133.102



### Secondary Treatment Standards – § 133.102

Parameter	30-Day Average	7-Day Average
5-Day Biochemical Oxygen Demand (BOD <sub>5</sub> )	30 mg/L (25 mg/L 5-day Carbonaceous BOD [CBOD <sub>5</sub> ])	45 mg/L (40 mg/L CBOD <sub>5</sub> )
Total Suspended Solids (TSS)	30 mg/L	45 mg/L
Removal	85% BOD <sub>5</sub> (or CBOD <sub>5</sub> ) and TSS	—
pH	Maintained within the limits of 6.0 – 9.0 standard units*	

\* Unless the POTW demonstrates that inorganic chemicals are not added to waste stream as part of treatment process and that contributions from industrial sources do not cause pH to be out of the specified range  
Note: Compliance deadline was 7/1/88



### Notes:

The baseline secondary treatment standards, summarized on this slide, are found in 40 CFR 133.102.

What do these secondary treatment standards require of POTWs? Well, they set numeric effluent requirements for 5-day Biochemical Oxygen Demand, or BOD<sub>5</sub>, Total Suspended Solids, or TSS, and pH, as listed on this table. The standards require that POTWs meet:

- a 30-day average of 30 mg/L, and a 7-day average of 45 mg/L for BOD<sub>5</sub> and TSS;
- maintain a pH between the range of 6.0 and 9.0 standard units; and
- demonstrate a minimum removal efficiency of 85% of BOD<sub>5</sub> and TSS on a monthly average basis.

You might also have noticed that there are alternative standards for 5-day Carbonaceous Biochemical Oxygen Demand, or CBOD<sub>5</sub>, but we'll discuss this a bit later in the presentation.

The task of the permit writer, then, is to take these regulatory standards, and develop effluent limits for the NPDES permit that will ensure that the POTW effluent meets these standards following treatment.

We should also note at this point that section 510 of the Clean Water Act allows states to set more stringent requirements than those under federal law, and some states have established more stringent technology-based performance standards for their POTWs.

Now let's move on and see where the "equivalent to secondary" standards apply. Greg, why don't you take it from here.

## 1.11 Step 1: Determine Which Standards Apply

The slide features the NPDES logo in the top left corner. The main title is "Step 1: Determine Which Standards Apply". Below the title, there is a list of three bullet points: "Secondary treatment standards", "Equivalent to secondary standards", and "state-adjusted equivalent to secondary standards". A red circle highlights the last two bullet points. In the center of the slide, there is a large, light blue diamond-shaped icon containing a white checkmark. The bottom of the slide shows a landscape illustration with green hills, trees, and a blue river, with the EPA logo in the bottom right corner.

**Step 1: Determine Which Standards Apply**

- Secondary treatment standards
- Equivalent to secondary standards
  - state-adjusted equivalent to secondary standards

### Notes:

Thanks, Dave.

As we've already seen, it seems to be the case that with all good regulations there are exceptions to the rules.


We want to turn our attention to some exceptions to the secondary treatment standards for some facilities that qualify for what are known as the "equivalent to secondary standards."

## 1.12 Equivalent to Secondary Standards – § 133.105



### Equivalent to Secondary Standards – § 133.105

- Federal regulations allow adjustments to the secondary treatment requirements for BOD<sub>5</sub> and TSS for **equivalent to secondary** facilities
- Facilities with certain types of treatment processes might qualify
  - **trickling filters**
  - **waste stabilization ponds**
- Facilities must meet the eligibility criteria in § 133.10(g)



### Notes:

Some POTWs, including many serving small or rural populations, provide biological treatment using trickling filters or waste stabilization ponds, which often are called lagoons.

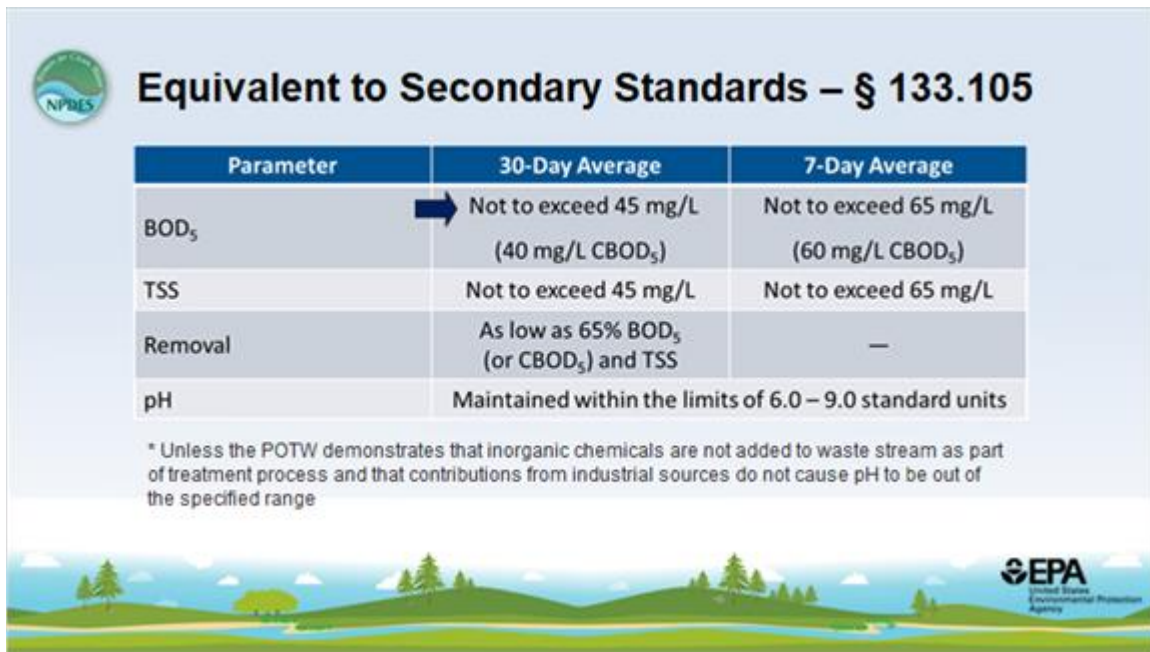
Congress recognized that these POTWs were not always going to be able to meet the secondary treatment standards.

Unless alternate standards were available, many small and rural communities would be forced to upgrade treatment systems that were providing biological treatment and performing as they were designed.

To address this situation, Congress included provisions in its 1981 amendments to the construction grants statutes requiring EPA to account for these alternative biological treatment technologies. In response to this requirement, in 1984, EPA promulgated alternative standards that apply to those facilities using what the statute called “equivalent to secondary treatment” technologies.

POTWs using a trickling filter or waste stabilization pond system for biological treatment that meet criteria specified in the regulations at 40 CFR 133.10(g) qualify for application of the equivalent to secondary treatment standards, which are found in 40 CFR 133.105.

## 1.13 Equivalent to Secondary Standards – § 133.105



The slide features a title 'Equivalent to Secondary Standards – § 133.105' and a table with three columns: 'Parameter', '30-Day Average', and '7-Day Average'. The table lists standards for BOD<sub>5</sub>, TSS, Removal, and pH. A blue arrow points to the BOD<sub>5</sub> row. Below the table is a note about inorganic chemicals and pH. The slide also includes logos for NPDES and EPA, and a landscape illustration at the bottom.

Parameter	30-Day Average	7-Day Average
BOD <sub>5</sub>	Not to exceed 45 mg/L (40 mg/L CBOD <sub>5</sub> )	Not to exceed 65 mg/L (60 mg/L CBOD <sub>5</sub> )
TSS	Not to exceed 45 mg/L	Not to exceed 65 mg/L
Removal	As low as 65% BOD <sub>5</sub> (or CBOD <sub>5</sub> ) and TSS	—
pH	Maintained within the limits of 6.0 – 9.0 standard units	

\* Unless the POTW demonstrates that inorganic chemicals are not added to waste stream as part of treatment process and that contributions from industrial sources do not cause pH to be out of the specified range

### Notes:

As you can see on this slide, the equivalent to secondary treatment standards adjust the requirements for BOD and TSS to upper-bound values that are greater than the secondary treatment standards. The equivalent to secondary standards require:

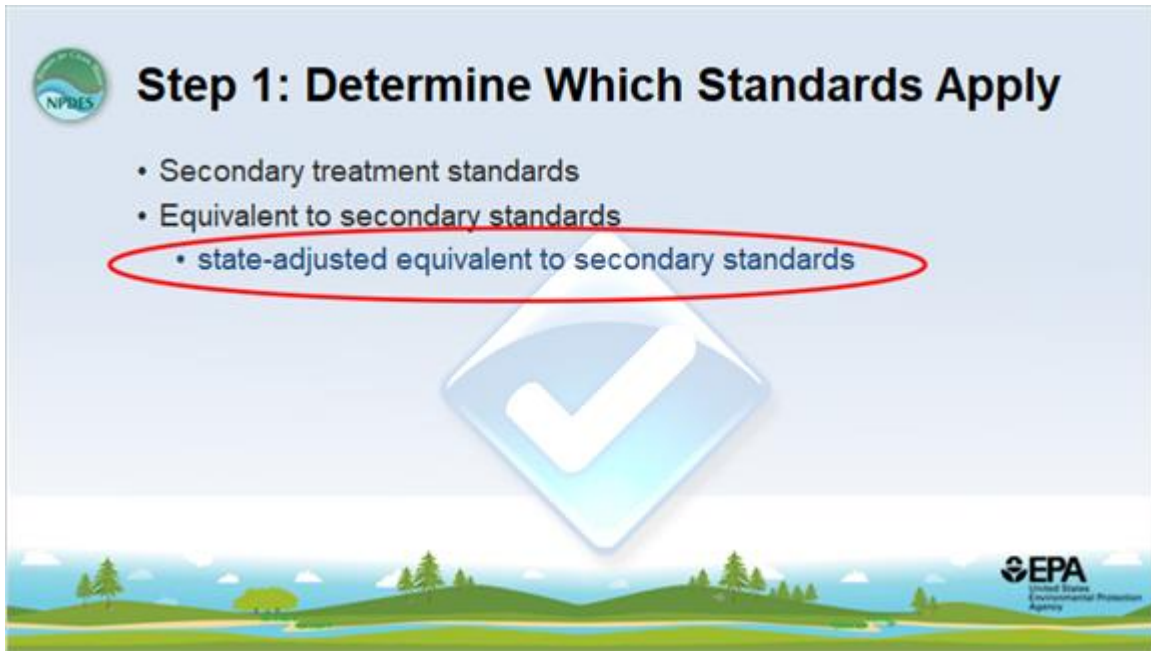
- 30-day average BOD<sub>5</sub> and TSS concentrations not to exceed 45 mg/L;
- 7-day average BOD<sub>5</sub> and TSS concentrations not to exceed 65 mg/L; and
- Not less than 65% removal of BOD<sub>5</sub> and TSS as a 30-day average.
- pH must be maintained within a range of 6.0 to 9.0 standard units, which is the same as the secondary treatment standards.
- Note also that, as with the secondary treatment standards, CBOD<sub>5</sub> concentrations can be substituted for BOD<sub>5</sub> concentrations.

Finally, notice that the slide says that BOD<sub>5</sub> and TSS are “not to exceed” a certain concentration. These values represent the maximum acceptable discharge concentrations, not fixed values applied to all facilities qualifying for application of the equivalent to secondary standards.

40 CFR 133.105(f) requires permitting authorities to calculate the appropriate limitations for each facility based on the performance capability of the facility. If the facility is able to perform better than the maximum effluent concentration allowed by the equivalent to secondary standards, its limits should be based on that performance capability.

Any more exceptions or adjustments, Dave?

## 1.14 Step 1: Determine Which Standards Apply



The slide features a light blue background with a white checkmark icon in the center. At the top left is the NPDES logo. The title 'Step 1: Determine Which Standards Apply' is in bold black text. Below it is a bulleted list with three items: 'Secondary treatment standards', 'Equivalent to secondary standards', and 'state-adjusted equivalent to secondary standards'. The third item is circled in red. At the bottom right is the EPA logo. The bottom of the slide shows a landscape with green hills, trees, and a blue sky.

**Step 1: Determine Which Standards Apply**

- Secondary treatment standards
- Equivalent to secondary standards
- state-adjusted equivalent to secondary standards

**EPA**  
United States  
Environmental Protection  
Agency

### Notes:

Well, Greg, just when you thought it couldn't get any more complicated, we're going to throw in another wrinkle.

It turns out that the secondary treatment regulations also allow each state to further adjust the equivalent to secondary standards based on unique factors within the state.

Let's take a look at how this works.

## 1.15 State Adjustments to BOD<sub>5</sub> and TSS Requirements



**State Adjustments to BOD<sub>5</sub> and TSS Requirements**

States, territories, and tribes may further adjust the maximum concentration standards for equivalent to secondary facilities:

- special adjustment to **TSS** requirements for **ponds** (from 1977 regulations) [§ 133.103(c)]
- Alternative State Requirements (ASRs) to address climatic or geographic conditions and their effects on performance [§ 133.105(d)]
  - trickling filters – BOD<sub>5</sub> and TSS
  - waste stabilization ponds – BOD<sub>5</sub>

The slide features a light blue background with a green landscape illustration at the bottom. The NPBES logo is in the top left, and the EPA logo is in the bottom right.

### Notes:

There are two specific provisions in 40 CFR Part 133 that allow states to make adjustments to the standards under certain circumstances.

First, 40 CFR 133.103(c) allows a state to set TSS effluent quality requirements that are less stringent than the national secondary treatment standards or equivalent to secondary treatment standards where it determines that the levels prescribed by EPA can't be achieved by properly operated waste stabilization ponds within the state. This exception was put in place back in 1977.

An adjusted TSS requirement can be applied to any waste stabilization pond system in the state.

Later, EPA determined that state-specific adjustments should also be available for BOD<sub>5</sub> standards for waste stabilization ponds and for both BOD<sub>5</sub> and TSS standards for trickling filters. So, in a separate part of the regulations, EPA created something called "alternative state requirements." The regulations at 40 CFR 133.105(d) allow states to set alternative state requirements for facilities that otherwise qualify for application of the equivalent to secondary treatment standards.

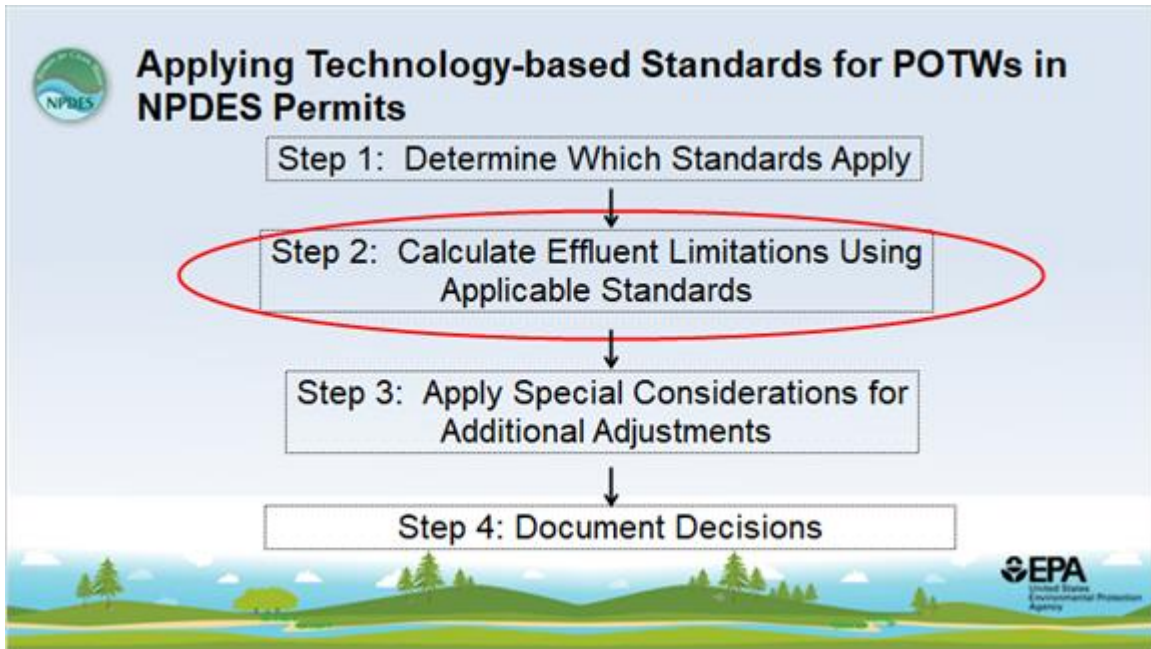
Alternative state requirements allow states the flexibility to set the upper end of the concentration range above the maximum established by the equivalent to secondary treatment standards--again based on unique performance characteristics of these types of treatment systems within a particular state.

Similar to the nationally applicable equivalent to secondary standards, the alternative state requirements give the maximum (or "ceiling") concentrations for BOD<sub>5</sub> and TSS for trickling filters and for BOD<sub>5</sub> for waste stabilization ponds.

When applying the alternative state requirements, the actual limits developed for the NPDES permit for each facility are intended to be determined case-by-case based on actual treatment plant performance.

OK, I think that covers the first step in our process, what's next Greg?

### ***1.16 Applying Technology-based Standards for POTWs in NPDES Permits***




#### **Notes:**

After we have determined which standards apply to the facility we're permitting, in Step 2, we use those standards to calculate effluent limitations.





## 1.17 Step 2: Calculate Effluent Limitations Using Applicable Standards



### Step 2: Calculate Effluent Limitations Using Applicable Standards

- Limits expressed as **average monthly and average weekly** limits for POTWs unless impracticable [§ 122.45(d)(2)]
- BOD<sub>5</sub> and TSS limits should be **concentration-based** (at a minimum) because secondary treatment standards are expressed in concentration units [§ 122.45(f)(1)(ii)]
- Often supplemented by **mass loading limitations**



### Notes:

Establishing effluent limitations based on the applicable standards is pretty straightforward, but two EPA regulations can sometimes create a little bit of confusion about how to do this.

First, the secondary treatment standards are stated as 30-day and 7-day averages, whereas 40 CFR 122.45(d)(2) requires that effluent limitations for POTWs be expressed, unless impracticable, as average monthly and average weekly limitations. The regulations define average monthly and average weekly limits on a calendar basis, which is not quite the same as a 30-day or 7-day average. However, EPA recommends interpreting the 30-day and 7-day average secondary treatment standards as average monthly (calendar month) and average weekly (calendar week) limits in an NPDES permit.

The second regulation we need to mention here is found at 40 CFR 122.45(f)(1). This regulation requires that all permit limits, standards or prohibitions be expressed in terms of mass except under certain conditions. Two of those conditions, relevant here, are:

- 1) When limitations are for pH, temperature, radiation or other pollutants that cannot be appropriately expressed by mass limitations; and
- 2) When applicable standards or limitations are expressed in terms of other units of measure.

Clearly, the first exception applies to pH requirements established by secondary treatment standards. We express pH limits in terms of standard units, not mass.

Also, because the 30-day and 7-day average regulatory standards for BOD<sub>5</sub> and TSS are expressed as concentrations, the second exception applies to these standards. Thus, we express BOD<sub>5</sub> and TSS limits as concentration limits, at a minimum. Mass limits are not specifically required to implement the secondary treatment

standards, but frequently are used to supplement concentration limits.

## 1.18 Step 2: Calculate Effluent Limitations Using Applicable Standards (cont.)

**Step 2: Calculate Effluent Limitations Using Applicable Standards (cont.)**

Percent removal permit requirement for BOD<sub>5</sub> and TSS must be included (with some exceptions for dilute influent)

- Compliance determined based on monthly average removal efficiency calculated using influent and effluent concentrations [§ 133.101]

$$\text{Percent Removal} = \frac{\text{Monthly average influent conc.} - \text{Monthly average effluent conc.}}{\text{Monthly average influent conc.}} \times 100$$

EPA  
United States  
Environmental Protection  
Agency


### Notes:

Remember, the secondary treatment standards and equivalent to secondary standards also include a percent removal requirement for BOD<sub>5</sub> and TSS. This requirement must be included in the effluent limitations section of the permit as a concentration-based requirement. There are a few exceptions that allow substitution of mass limits for the percent removal requirements, but we'll address those exceptions in a later slide.

How would a permitting authority know if a discharger is complying with the percent removal requirement?



- First, the permit writer must make sure there is a requirement in the monitoring section of the permit to monitor both the influent to and effluent from the POTW.
- Then, the permitting authority would calculate the percent removal by taking the measured monthly average influent concentration and subtracting the monthly average effluent concentration and then dividing that difference by the monthly average influent concentration. To turn this result into a percent, just multiply it by 100.

## 1.19 Effluent Limitations Calculated from Secondary Treatment Standards



### Effluent Limitations Calculated from Secondary Treatment Standards

Parameter	Average Monthly Limitation	Average Weekly Limitation
BOD <sub>5</sub>	30 mg/L (25 mg/L CBOD <sub>5</sub> )	45 mg/L (40 mg/L CBOD <sub>5</sub> )
TSS	30 mg/L	45 mg/L
BOD <sub>5</sub> and TSS Percent Removal (concentration)	≥ 85%	—
pH	Must be maintained within the limits of 6.0 – 9.0 standard units at all times.	



### Notes:


So, to summarize, here are the final results of applying the secondary treatment standards in a permit.

Where “baseline” secondary treatment standards apply, an NPDES permit should include the 30-day average BOD<sub>5</sub> and TSS concentration standards and percent removal requirement directly as average monthly effluent limitations.

Likewise, the permit should include the 7-day average BOD<sub>5</sub> and TSS concentration standards directly as average weekly effluent limitations.



And, we can't forget, the permit should include the required pH range of 6.0 to 9.0 standard units.

## 1.20 Applying Equivalent to Secondary and State-Adjusted Standards



### Applying Equivalent to Secondary and State-Adjusted Standards

- Except for TSS adjustment for ponds, equivalent to secondary and state-adjusted standards for BOD<sub>5</sub> and TSS are **maximum** ("up to") values
- Actual limitations should be based on **performance capability** [§ 133.105(f)] considering at least two years of data for existing facilities [§ 133.101(f)] and design capability and site-specific conditions for new facilities
- **Examples:** If an *equivalent to secondary* facility can meet an average monthly BOD<sub>5</sub> limitation of:
  - 40 mg/L – set average monthly limit at 40 mg/L
  - 50 mg/L – set average monthly limit at 45 mg/L



### Notes:

Another important point to remember from our earlier discussion is that, when applying the equivalent to secondary standards or the state-adjusted standards, the permit writer should calculate the appropriate effluent limit concentrations and percent removal requirements for BOD<sub>5</sub> and TSS for each facility.


The actual limitations for a given facility are based on that facility's performance capability and, for existing facilities, should be supported by at least two years worth of performance data. These data should show what BOD<sub>5</sub> and TSS concentrations are consistently achievable as defined in the regulations at 40 CFR 133.101(f). For new facilities, the performance capability is based on the design capability and any geographical and climatic conditions.

The equivalent to secondary standards give an upper boundary for these limits. In other words, the effluent limits cannot exceed the equivalent to secondary standards.

For example, if performance data show that a facility employing equivalent to secondary treatment can achieve an average monthly BOD<sub>5</sub> limit of 40 mg/L, the limit should be set at 40 mg/L, even though the equivalent to secondary standards would allow that limit to go as high as 45 mg/L.




If performance data from another equivalent to secondary facility show that it's only capable of achieving an average monthly BOD<sub>5</sub> limit of 50 mg/L, the average monthly limit in the permit is set at 45 mg/L--the maximum allowed by the equivalent to secondary treatment standards.

## 1.21 Mass Loading Limitations



### Mass Loading Limitations

- Use **design flow** of POTW to calculate mass loading limitations if used to supplement concentration limitations [§ 122.45(b)]
- Example mass loading limitation calculation:
  - POTW Design Flow = **5.00 mgd**
  - BOD<sub>5</sub> Average Monthly Limitation = **30 mg/L**
  - BOD<sub>5</sub> Average Monthly Mass Loading Limitation = **(5.00 MGD)(30 mg/L)(8.34\*) = 1,250 lbs/day**  
\* 8.34 is the conversion factor for converting to lbs/day



### Notes:

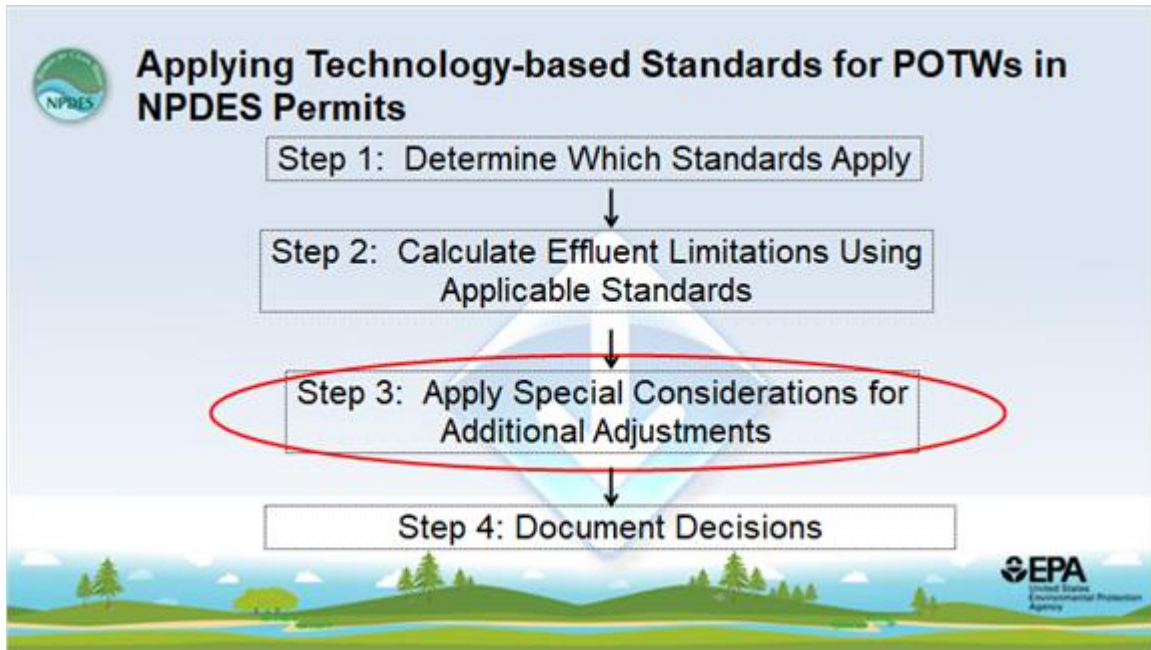
We noted previously that an NPDES permit must include at least concentration limits to implement the secondary treatment standards; however, permitting authorities also frequently choose to include mass limits to supplement concentration limits.

In general, regulations at 40 CFR 122.45(b)(1) require using the facility design flow as the flow rate when calculating mass limits from concentration limits for a POTW.

For example, if the design flow of the POTW that we are permitting is 5.00 million gallons per day and the BOD<sub>5</sub> average monthly concentration limit is 30 mg/L, then to calculate a mass loading limit, we simply take the design flow times the concentration limit times the conversion factor, which is 8.34, to get 1,250 pounds per day.

So, at this point, we've calculated effluent limits from the standards, which completes Step 2.

## 1.22 Applying Technology-based Standards for POTWs in NPDES Permits

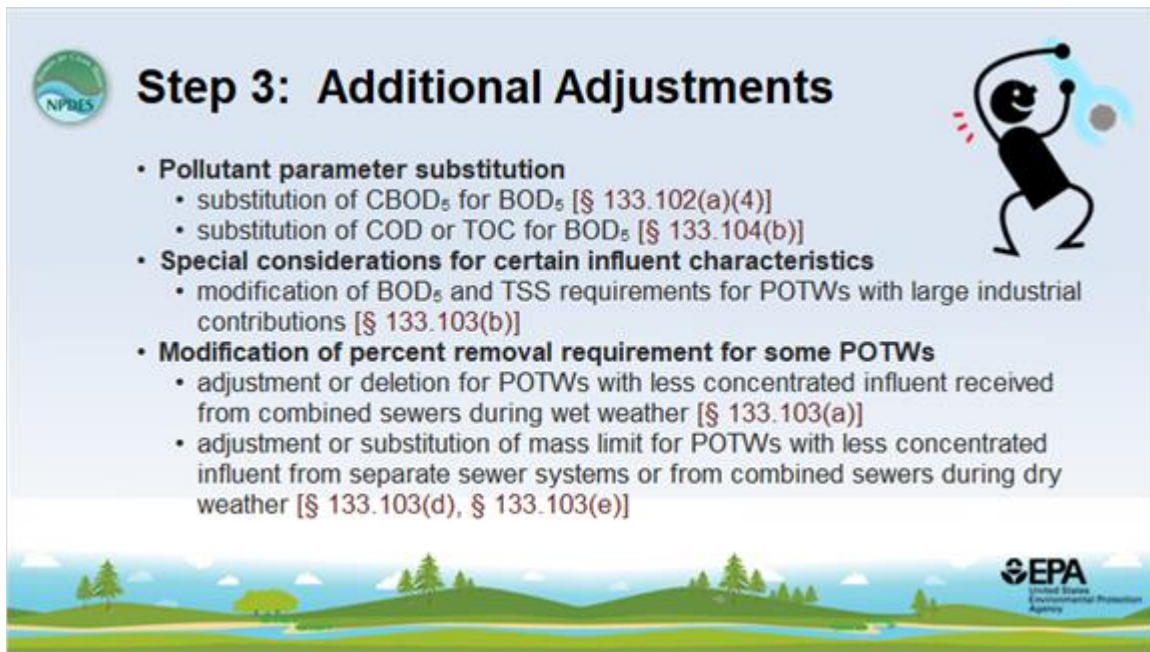


### Notes:

But wait, there's more!!


Let's move on to Step 3 and look at some further adjustments that may be made to limits based on secondary or equivalent to secondary standards.

## 1.23 Step 3: Additional Adjustments



**Step 3: Additional Adjustments**

- **Pollutant parameter substitution**
  - substitution of CBOD<sub>5</sub> for BOD<sub>5</sub> [§ 133.102(a)(4)]
  - substitution of COD or TOC for BOD<sub>5</sub> [§ 133.104(b)]
- **Special considerations for certain influent characteristics**
  - modification of BOD<sub>5</sub> and TSS requirements for POTWs with large industrial contributions [§ 133.103(b)]
- **Modification of percent removal requirement for some POTWs**
  - adjustment or deletion for POTWs with less concentrated influent received from combined sewers during wet weather [§ 133.103(a)]
  - adjustment or substitution of mass limit for POTWs with less concentrated influent from separate sewer systems or from combined sewers during dry weather [§ 133.103(d), § 133.103(e)]



### Notes:

In addition to the alternatives that we've already covered, the secondary treatment regulations provide several other adjustments to the standards that can be made under certain circumstances.

In most cases, these adjustments are pretty technical and cover circumstances that a permit writer is unlikely to encounter when developing most POTW permits. For this presentation, we'll just briefly review each situation, and refer listeners to the regulations and guidance if you need more detail.

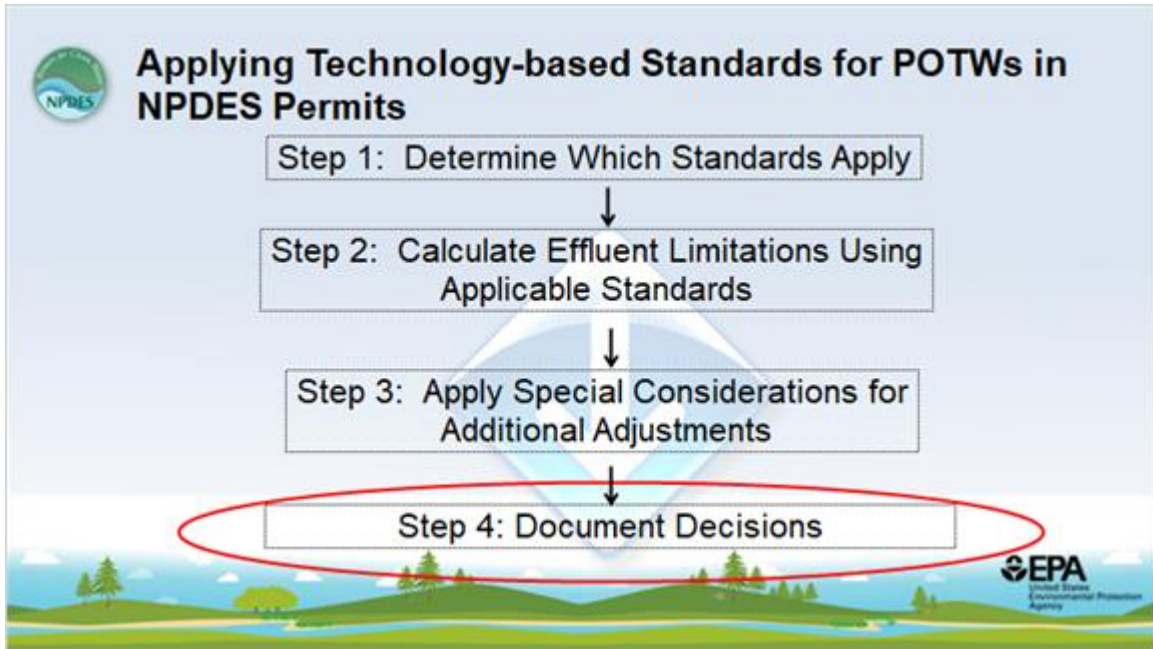
The first two adjustments allow permit writers to substitute alternative parameters in lieu of 5-day biochemical oxygen demand.

- 40 CFR 133.102(a)(4) allows the use of 5-day Carbonaceous Biochemical Oxygen Demand, or CBOD<sub>5</sub>, as a substitute for BOD<sub>5</sub>. This is a fairly common practice in many states and addresses a BOD test interference issue that occurs when nitrifying bacteria are present in a finished wastewater sample. If this substitution is made, the secondary and equivalent to secondary standards provide alternative CBOD<sub>5</sub> performance standards upon which the effluent limits would be based.
- An additional substitution is allowed under 40 CFR 133.104(b) where Chemical Oxygen Demand (COD) or Total Organic Carbon (TOC) can be used in lieu of BOD<sub>5</sub>. This substitution requires the development of a site-specific "translator" and is very rarely used.

There are adjustments that a permit writer could make to BOD and TSS concentration requirements or percent removal requirements based on the presence of either large industrial contributors to the POTW, or where the influent to the POTW is unusually dilute due to the nature and configuration of the collection system. We won't cover these unique situations in this presentation, but permit writers should be aware that these alternatives do exist in the regulations.

Now let's move on to Step 4.

### ***1.24 Applying Technology-based Standards for POTWs in NPDES Permits***




**Notes:**


The last step in our process covers the proper documentation of all of the decisions and calculations that we made in Steps 1, 2 and 3.





## 1.25 Step 4: Document Decisions



### Step 4: Document Decisions



- Document in the fact sheet or statement of basis:
  - Statutory and regulatory citations
  - How you determined which standards apply
  - How you characterized the POTW's past performance (if equivalent to secondary or adjusted standards apply)
  - How you calculated effluent limitations (concentration and, if applicable, mass)



### Notes:

In most cases the documentation of our decisions will be recorded in the “fact sheet” or “statement of basis” that is developed to accompany the draft NPDES permit.

The fact sheet should record the appropriate statutory and regulatory citations, which standards were applied, any special considerations, such as treatment plant performance, and all calculations that were used to derive the permit limits.

Hopefully, your Region or state will have a fact sheet template that covers these elements, and perhaps contains standardized language to help document your decisions.

Well, that wraps up this presentation. What's next Greg?