Napa Sanitation “Tiny Bubbles” - Video Script

Cast:  
Steve – Operator III Lead  
Stephanie – Pollution Prevention & Outreach Coordinator  
Jeff - Director of Administrative Services and Chief Financial Officer (Microbe)  
Elsa- Administrative Assistant (Microbe)  
Rodrigo – (Goldilocks)

Introduction Scene:

Steve: Hi. My name is Steve Chavis, I’m an Operator III at the Napa Sanitation District. Our work is very important for our community and the environment. Here we operate several treatment processes to remove pollutants from the water.

Stephanie: My name is Stephanie Turnipseed and I’m the Pollution prevention and Outreach Coordinator. I have been with Napa San for about 1.5 years. In my position I give tours, conduct classroom presentations, plan events for the community, work with businesses on pollution prevention issues, issue press releases, and take care of our website and Facebook pages.

Elsa: My name is Elsa Seal. I’m an administrative assistant at Napa San and I work in the front office. I’ve been here for 12 years and main responsibilities are greeting visitors, answering phones, processing permits, paying invoices and offering clerical support to all departments at the District.

Jeff: My name is Jeff Tucker. I’m the Director of Administrative Services and Chief Financial Officer here at NapaSan. At NapaSan I oversee budgets, accounting, IT, safety and fleet management.

Rodrigo: Hello my name is Rodrigo Montanez. I’ve been working for Napa Sanitation District as a Laboratory Analyst for the past 12 years. Some of my responsibilities here in the District are to perform a wide variety of chemical, physical and bacteriological analyses. I also do data interpretation of surface, ground, wastewater and recycled water to assist in making changes to plant operations. In addition, my responsibilities include conducting field sampling and field investigations.

Stephanie: We are definitely not professional actors, and that will likely be clear after you watch this video. But, what we want you to take away from this video is not our Oscar-worthy performances, but the amount of math that goes into every process at a wastewater treatment plant. Math is needed for every operation here at Napa San. So, you could say that math helps us to protect public health, the environment, and the Napa River, which is what we all enjoy most about working here. We hope you enjoy this video as much as we enjoyed making it.

Scene 1 (This can be used as a lead-in video for a few scenarios)

Open with video of flow pouring into the aeration basin (volume turned up to capture sound. 5-10 seconds). Picture 1 - Aeration Tanks
Switch to shot of protozoa under the microscope actively swimming and working around a floc. (Volume quiet 5 – 10 seconds) **Picture 2** – Laboratory, activity under microscope can be shown on monitor. If possible identify a stalked ciliate feeding.

Switch to close-up shot of aeration tank bubbles (volume turned up catching sound of the simmer, 5-10 seconds) **Picture 3**- Aeration Tanks

Switch to a different shot of protozoa under microscope active, darting (volume quiet, 5-10 seconds) **Picture 4**- Laboratory, activity under microscope can be shown on monitor.

Switch to shot of secondary clarifier weir and treated water flowing (volume turned up capturing the sound of water cascading) **Picture 5**- Secondary clarifier weir

Words “Tiny Bubbles” fades in.

**Scene 2 Aeration Basin Deck (Air Requirement) Picture 6** – Aeration Tank/digester backdrop : **Steve talking to Stephanie**

**Steve**: So this is called secondary treatment. The wastewater has already gone through primary treatment where we removed debris from the wastewater such as rags, paper, diapers, wipes, sand and also heavier stuff like sludge. This water now has dissolved material in it we have to get out. We get the dissolved material out in this process called Activated Sludge.

**Stephanie**: Activated Sludge is the point in the treatment process where we get the microorganisms or microbes active. We get them activated to help clean the water.

**Steve**: Yes we use the Activated Sludge process where we grow microorganisms to eat the pollutants as a food source. Just like people, the microbes stay alive because we keep them happy. They need to be wet and fed and they need oxygen to breathe.

**Scene 3 Switch to shot of the aeration tank surface (same as scene 1).**

**Stephanie**: Look at all those tiny bubbles! Hmm, they must be heavy eaters.

**Scene 4** : Three microbe actors standing in front of a bubble backdrop. Microbes slowly wake up....

**Elsa**: What is this place?

**Stephanie**: It’s so warm....and bubbly!

**Jeff**: *(Looking into BOD box)* And look at all this food!

*Everyone eats like crazy, stops for breath, repeat.*

**Scene 5**: Same as scene 2

**Steve**: Aeration is one of the largest energy consumers in a treatment plant. Too much air is wasteful. Too little air causes process upsets.
**Stephanie:** So the microbes like just enough air. Sounds like the story of Goldilocks.

**Scene 6:** Scene Screenshot of Goldilocks character;

**Rodrigo:** Ohh that’s too much, hmmph that’s too little, mmm that’s juuust right.

**Scene 7:** In Classroom (Operations Meeting Room) Backdrop: Whiteboard

**Stephanie and Steve:** I guess so.

Stephanie: So how do you know how much air you need for the microbiology when you’re feeding them?

**Steve:** This is actually a very important calculation we use both for process control and energy efficiency. Here let me illustrate this. (Steve begins to point out on the white board) we know how may pounds microorganisms we have in the system and we know how much food or BOD they can eat based on the Food to Microorganism ratio. We have little control over the quantity of food that comes in but we can control the number of organisms and the amount of air we add.

Stephanie: Okay, I’m following this, so if we know how much food is being added and we know how much oxygen is used by the microorganisms we should be able to use math to figure out how much air is needed.

**Steve:** Yes. Let’s go do math.

Scene 7: Whiteboard Backdrop
Math problem discussion:

This builds upon the calculation of pounds of BOD previously calculated in “The Great Shake”.

1. Calculate BOD Percent Removal – Given BOD in (mg/L)

   BOD out (mg/L)

   Percent BOD Removal (BOD in (mg/L) – BOD out (mg/L))/ BOD in (mg/L)

2. Calculate the BOD pounds to be removed- Given Flow ( MGD)

   Find BOD in (lbs) = MGD x mg/L x 8.34 lbs/gal

   Find BOD to remove (lbs) = BOD in (lbs) x ( answer to 1. Above)

3. Calculate the oxygen requirement – Given 1.5 lbs Oxygen /lb BOD

   Find Oxygen lbs/day = BOD removed x 1.5 lbs Oxygen/lb BOD

   This could end here or go further as outlined below

4. Calculate lbs of air – given oxygen is 20% of air. This relates to the work in “The Air and Why We Should Care”

   Find air requirement lbs/day= Oxygen lbs / 0.2

5. Calculate the adjusted air requirement for the OTE (Oxygen Transfer Efficiency) of the diffuser system- Given OTE = 22%

   Find : adjusted air requirement (lbs/day) = \[
   \frac{\text{Air Requirement (lbs/day)}}{\text{OTE (100)}}
   \]

6. Calculate the volume of air required – The conversion can be given to the student or the student can look up the conversion given the air temperature and the relative humidity. Say 80 degrees and 50%.

   Find air volume = Air (lbs/day) / 0.0731 lbs/ft³

   Convert cubic feet per day to cubic feet per minute

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   \text{Air CFM} = \frac{\text{Air CFD}}{1440 \text{ min/day}}
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**TABLE 1. DENSITY AND MOISTURE WEIGHT PER CUBIC FOOT OF AIR AND RELATIVE HUMIDITY**