



# EXAMINING EFFLUENT

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- I. Objectives
  - a. Students will learn the definition of influent and effluent.
  - b. The process by which sewage is cleaned, as well as the usage of the cleaned effluent, will be discussed in detail.
  - c. Students will understand that water is constantly recycled, both naturally and by necessity.
  
- II. Materials
  - a. 1 bag crushed Oreos, mixed with...
  - b. 1 bag crushed shortbread sandies
  - c. 1/4 cup Nestlé's Quik per presentation
  - d. 1/8 cup sprinkles
  - e. 1/2 gallon milk per presentation
  - f. 1 canister whipped cream
  - g. white/dark chocolate chips (mixed)
  - h. 1 spoon per student
  - i. 1 diagram per student
  - j. Cups (one per student)
  
- III. Introduction
  - a. Think of how much water you use in one day.
    - Now add the water used by your brothers... sisters... the rest of your family...
    - The average person uses 50 gallons of water every day!
      1. What do we use it for? (Let students answer. Point out showering, bathing, brushing teeth, washing dishes, washing clothes, cooking, and toilet usage if they aren't mentioned.)
    - The City of Lubbock uses anywhere from 30-60 million gallons of water every day (depending on the time of year)!
  
- IV. What Is Wastewater, and How Do We Treat It?
  - a. A moment ago you told me many things we use water for. Now I don't mean to be gross, but I have to ask a question...
    - What is in that water that you used once it goes into the sewer pipes? (Let students answer.)
    - Why can't we just take that water and dump it out somewhere? (It would SERIOUSLY mess up the environment, and laws have been passed that make it illegal for us to do that – up to \$25,000/day in fines!)
  - b. Just like we have to clean your water before you drink it, we also have to clean out that water from the sewers before letting it go out into nature!
  - c. A few definitions (Pass out diagram while going over definitions):
    - Wastewater Treatment Plant is the place where the Lubbock sewer lines take all of the sewer water so it can be cleaned.
    - Influent is the water that comes into the Wastewater Treatment Plant. This is sewer water that has NOT been cleaned yet!
    - Effluent is the water that has been cleaned and leaves the Wastewater Treatment Plant.

d. Wastewater Treatment (Have students follow worksheet, bold words can be found on the worksheet.)

-When all the sewer water comes in, it first goes to the screw pumps through 6 26"-36" pipes

1. Each screw pump can handle 18.5 million gallons of water every day!
2. The wastewater treatment plant cleans 24 million gallons of sewer water every day, average.
3. Screw pumps are 6' wide and 50' long (and look like a huge screw)! As they turn, they bring water through bar screens that filter out trash, bottles, wood, and even tires!

-The water is then taken through grit pumps, which filter out the grit.

1. The grit is then washed and taken to the landfill.

-All right, we got all the big stuff out! But is everything out of the water yet? (Oh no, not even close!)

1. There is a lot of solid matter that has been dissolved in the water, or is simply floating around suspended in the water. To get this out, we put the water in a clarifier.
2. This clarifier gets out almost all (95%) of the suspended solids and most (60%) of the dissolved solids (give example of suspended solids vs. dissolved solids, if necessary – i.e. tea leaves in tea (suspended) vs. artificial sweetener in tea (dissolved)). This takes 2 hours.

- That takes care of solid matter, but it doesn't take care of microorganisms. To do that, we send the water to aeration chambers where we put bacteria that EAT organic material into the water.

This process lasts 9-14 hours.

e. During all of these processes, chlorination takes place. We add chlorine to help destroy live creatures in the water.

f. All of the material removed from the water during these processes is called sludge. Sludge, simply said, is all the disgusting stuff in the water. We load it up and take it to the landfill once it has been removed from the water.

g. Before the water can be released, it must be disinfected (Would you want those bacteria released into the lakes around here?!)

h. The water is run through a filter made of sand one more time... then it is ready to be released. It is now effluent.

i. This entire process takes 24 hours.

j. Employees at the wastewater plant work 365 days every year! Even on Christmas – someone is always working at the plant.

V. What Do We Do With the Effluent?

a. We have several options in regard to the effluent:

-We can release it back into nature (called stream discharge). We do release some of the water into the Canyon Lakes, and the water we release from the wastewater plant is actually cleaner than the Canyon Lakes water!

1. We discharge 1.5 million gallons every day!

-We could send it back to the Water Treatment Plant, clean it all over again and use it for drinking water again!

1. Due to shortages in water, many cities do this (including Denver and El Paso).

- We send some of this water to power plants! They use the water in the cooling towers (the huge towers that vent large amounts of steam)!

1. Anywhere from 0-8 million gallons per day is used this way!

-Some effluent is pumped to local farmers to use on their crops!

-Lubbock, however, releases most of this water onto the Lubbock City Farm.

b. The Lubbock City Farm

-Lubbock started the City Farm in 1932, and began releasing effluent onto the farm the same year. The farm has grown much bigger since then!

1. 6,000 acres at the Lubbock site

2. 4,000 acres at the Wilson site – 10,000 acres total!

3. This is the largest City Farm site (called a Land Application site) in the United States!

-The effluent from the wastewater plant gets pumped to a storage reservoir that can hold 412 million gallons of effluent!

1. The Wilson reservoir holds 750 million gallons of effluent!

- The Farm uses an average of 3-4 million gallons every day!

-Many crops have been grown at the farm, including cotton, alfalfa, corn, wheat, and sorghum.

1. We needed crops that used a LOT of water!

- We have also had cattle grazing programs at the Farm sites.

- Currently the Lubbock site runs a haying program (growing hay) at the Farm.

1. The City sells the hay bales produced. They are round and stand about 6'-8' tall.

VI. Activity

a. Let's watch that cleaning process one more time... only this time, in reverse!

b. Choose 3 students to represent the following areas:

- Aeration chambers (give student bag of sprinkles)

- Clarifiers (give student bag of Nestlé's Quik)

- Grit Pumps (give student bag of crushed cookies)

- Bar screens & Chlorination (do NOT let the students do this!)

c. Here is our water after we clean it at the Wastewater Plant. (Hold up gallon of milk for students to see. Measure out 2 cups and put in the blender.) It is clean and ready for release into nature or at the City Farm. But before it was clean...

- It was put in the aeration chambers (What were those?). Have students with sprinkles empty bag into the blender.

- It was run through the clarifiers (What were those?). Have students with Quik empty bag into the blender.

- It was run through the grit pumps (What were those?). Have students with crushed cookies empty bag into the blender.

- Only it wasn't separated like this... it was all mixed together! Add milk to 8-cup line in blender, PUT LID ON and blend for 15-20 seconds on high.

- Pour "sewer-sludge" into cups for everybody.

- But wait a minute... chlorination took place all throughout the process! Give one small squirt of whipped cream in each glass.

- And before the grit pumps, the sewer water (influent) was run through the bar screens to get out the big chunks/debris! Add a few chocolate chips to each glass.

- Before... (Hold up glass containing sludge) and after (hold up milk jug).

- Distribute glasses and a spoon to each student so they may sample their sludge!

VII. Conclusion

- a. Remember that many places in America (including Lubbock) are often short on water. That often makes what we do with the water AFTER we drink it just as important as what we do BEFORE we drink it!
- b. That's a lot of information – are there any questions?



