Science Unit: ***Marine Pollution***

Lesson 3: ***Iona Wastewater Treatment Plant Field Trip***

School year:	2006/2007
Developed for:	David Oppenheimer Elementary School, Vancouver School District
Developed by:	Sara Harris (scientist), Liza Archer and Scott Lundell (teachers)
Grade level:	Presented to grades 4-5; appropriate for grades 4-7 with age appropriate modifications.
Duration of lesson:	3 hours
Notes:	Call Iona Wastewater Treatment Plant (604-215-8900) to arrange for a guided tour. Grade 4s are the youngest group they will take on tours. They prefer grade 5s and older.

Objectives

1. Learn where our sewage goes after it disappears down the drain.
2. Learn about primary sewage treatment.
3. Observe and quantify plastic pollution on an ocean shoreline.
4. Practice sampling technique, observation, and sample collection using quadrats.

Background Information

Two common types of marine pollution are sewage and plastic. In the Greater Vancouver Regional District, we have 5 sewage treatment plants. Two of the plants complete primary treatment on the sewage before pumping it into the river or ocean, and three of the plants complete secondary treatment. Primary treatment involves removing large solids and grease. Secondary treatment breaks down organic matter in the sewage using bacteria. Tertiary treatment is the highest standard in sewage treatment and is not done anywhere in B.C. at the present time.

Plastic pollution is ubiquitous on shorelines all over the world. Plastics dumped, intentionally or unintentionally, are carried by currents to wash ashore. Most plastic pollution is composed of small, unidentifiable pieces originating from larger objects breaking down over time. International treaties in the 1980s made plastic dumping in the ocean illegal, which has reduced the amount of plastic pollution in the marine environment.

Vocabulary

Sewage:	Liquid and solid waste that is carried off in sewers, drains and pipes
Greywater:	Waste water from sink and shower drains
Blackwater:	Waste water from toilets
Stormwater runoff:	Waste water that enters street drains, from rainwater
Rag:	Toilet paper!
Plastic:	Synthetic (human-made) material that can be soft or hard and can be shaped and molded. Plastics are typically made from hydrocarbons plus chlorine, and are usually less dense than water, so they float in the ocean. Examples: plastic bag,

yogurt container, “rubber” duckies.

Quadrat: A square frame used to outline an area to be sampled or examined.

Materials

- Quadrats (one for every 2-3 students). (3/4 inch PVC pipe and PVC “elbows” work very well. One 10-foot length of PVC will make a quadrat that is a good size for handling (though not quite a square meter!)
- Sharpies for labeling sample bags
- Ziploc plastic bags to collect plastic samples, one per student group
- Tongs for picking up plastic (so students don’t need to touch anything)
- Gloves (optional)
-

In the Classroom

Introductory Discussion

1. When you flush the toilet, where does it go? If a car is leaking oil, where does it go? When you take a shower, where does it go? When you throw something in the garbage, where does it go?
2. What do you use in your life that’s made out of plastic? Where do those things come from? (Many products we use in Canada spent some time on a container ship.)
3. Review vocabulary.
4. Describe the field trip (2 parts – the sewage treatment plant, and the beach).
5. Safety guidelines: Stay away from machinery with moving parts. Use gloves and tongs to pick up samples at the beach. Do NOT touch any needles, condoms, or sharp glass, if you find them on the beach.

Science Activity/Experiment

Activity Title: Field trip to sewage treatment plant and sampling plastic pollution on a beach

Purpose of Activity: Learn about Vancouver’s sewage treatment and learn how to sample/quantify the distribution of plastic pollution

1. At the IONA sewage treatment plant, we’ll have a guided tour of the plant. Ask questions during the tour.
2. During the tour, keep track of what gets removed from the sewage before the final product gets pumped into the ocean. What’s still in it when it goes into the ocean?
3. Drive west from the sewage treatment plant to Iona Beach Regional Park. Note the sewage outfall pipe by the side of the road.
4. At the beach stop, first discuss observations of the sewage treatment process and any questions students still have.
5. Then, spend a few minutes orienting everyone. Where are we? Where’s the school? Where’s the end of the sewage outfall pipe? (It goes offshore to the end of the jetty)

6. Give everyone a few minutes to search for and bring back an example of pollution that they find on the beach. Discuss the variety of types of pollution found.
7. Students will work in groups of 2-3 to sample for plastic. Label a plastic Ziploc bag (one bag per 2-3 students) with student names, the date, and the location (use a Sharpie).
8. Place a quadrat somewhere on the beach (students can spread out. Some places will have little plastic, e.g. the region between the most recent high and low tide. Students might choose a few different places, depending on time. If they do, they need to keep track of how many quadrats they sampled). Within the boundaries of the quadrat, collect ALL the pieces of plastic you can find. Put the plastic pieces in the Ziploc bag. Count them as you put them in and write the number of plastic pieces on the outside of the bag AND in your lab notebook. We'll use these data in the next lesson.
9. Note anything else of interest within the area outlined by the quadrat. Other types of pollution?

Closure Discussion

1. What was the most interesting/surprising thing you learned at the sewage treatment plant?
2. What was the most interesting/surprising thing you found at the beach? When you first walked out on the beach, did it look like there was much pollution? What about after you looked closely?
3. What can you do to decrease marine pollution?

References

1. http://www.gvrd.bc.ca/sewerage/treatment.htm the GVRD's web page about sewage treatment in our area.
2. http://www.gvrd.bc.ca/education/resources-links.htm for many relevant links from the GVRD Education site.
3. http://en.wikipedia.org/wiki/Sewage_treatment Descriptions of primary, secondary, and tertiary sewage treatment, with useful further links.
4. http://www.georgiastrait.org/CAW/sewage1.php Information from the Georgia Strait Alliance about sewage treatment (lack of) in Victoria.
5. http://www.caw114.bc.ca/sewage/ Information from the Victoria Sewage Alliance.
6. http://www.mcsuk.org/coolseas/topic:+pollution Lesson plan ideas from the Marine Conservation Society.
7. http://video.google.com/videoplay?docid=3892310789953943147 link to "Alphabet Soup" video documenting plastic pollution in our oceans.