

Lesson 10 – I Want to Be an Engineer

Grade 5–8 (science and social studies)

Grade 9–12 (science and social studies)

Topic: How engineers design water treatment plants.

Time: 60 minutes

Methodology: Class discussion, cooperative learning

Space Requirement: Regular classroom, computer lab

Materials: Computers with internet

Objectives: Students will develop a list of necessary steps to take prior to building a water treatment facility. Students will also explore the perspectives of an engineer and a water keeper, including what steps are taken in preparing to build a water treatment facility, who should be consulted and what they are responsible for.

For the Teacher: The goal for this lesson is for students to critically think about the work that has to be done before a water treatment plant is built. The students can then see the similarities and differences between their ideas and those of the engineer and water keeper. The students should also notice a difference in the way water is treated in the business of the engineer and the life of the water keeper.

All efforts should be made to get a civil engineer and a water keeper to come to the class. If you cannot find the engineer who designed your water treatment plant, you could invite another civil engineer or the water treatment plant operator. Whether you invite an engineer or the plant operator, make sure that the brainstormed questions for the presenters are appropriate to their profession. Water keepers are the individuals responsible for water in Aboriginal communities. If it is not feasible to have a guest speaker come to the class, try to contact someone in these fields and arrange a phone meeting or have them respond to the questions on paper or through email. In that manner, students may still get the benefits of their knowledge and expertise, and overall experience.

Directions/Procedure:

1. Prior to the lesson, contact your local water treatment facility and speak to the water treatment operator. In a large urban area, there may be a specific engineer that works there, but in most towns and cities, there may not be an engineer. If this is the case, ask them which engineering company designed the water treatment facility and attempt to contact a representative from the engineering firm.
2. If you can locate an engineer, ask him or her to visit the class and make a 15 to 20 minute presentation about the local treatment plant and answer some questions about the water and the treatment process. If you cannot find an engineer, invite the water treatment operator.
3. Contact the closest Aboriginal community and ask the water keeper to come to the class and make a presentation about water treatment in the community and answer some questions about the water and the treatment process. These presentations will occur during lesson 11.
4. With the students, review some of the types and causes of water pollution (see Lesson 2, 3, & 4), reminding students of some of the difficulties that they faced when they tried to clean polluted water. (5 min)
5. Present the scenario (see below) to the class by reading it out loud. (3 min)
6. After the scenario has been read once, instruct the students write down the first things that come to mind when they hear this scenario. (4 min)
7. Read the scenario at least once more, and have the students write down the steps that they would take if they were the engineer designing the water treatment plant. (4 min)
8. On the board write "What steps would you take?"
9. Have students volunteer answers for what they would do and record their answers on the board. Have the students write down the question and the responses from the class. (10 min)
 - a. Some points that should be listed are:
 - i. Test the source water before beginning the plan so that you know what treatment is needed.
 - ii. Inspect the area around the water source for sources of possible contamination and include in the plan the removal of the pollution sources.
 - iii. Based on the population, determine the consequences of water withdrawal on the lake, stream, river or groundwater source.

- iv. Talk to the people in the community about what they understand or expect in terms of appropriate water use.
 - v. Consider implementing a grey water recycling facility in the plan to reduce water waste.
 - vi. Examine the surrounding area, especially downstream, to determine the impact that the wastewater effluent may have on the environment and community.
10. As a class, discuss the importance of each consideration and write down new points as they come up. (5 min)
11. Have the students use the computers to research water keepers (depending on your time frame, this may be assigned for homework if they have access to computers). They should look for information about the roles and responsibilities of a water keeper, noting some differences between the roles of engineers and water keepers. (15 min)
12. If having an engineer and/or water keeper as a guest speaker is an option, inform the students that an engineer (or water treatment operator) and/or water keeper will be coming to the class to make a presentation about the local water and water in Aboriginal communities.
13. As a class, brainstorm some questions to ask of the experts. Make sure that all students are somewhat aware of what the general responsibilities of the engineer and the water keeper are. Possible questions could include: (14 min)
- a. What kinds of contaminants are typically found in our raw water source before treatment?
 - b. How did you decide which type of water treatment processes were the best for our water?
 - c. What population is our water treatment plant designed for? What happens if our population grows beyond this amount?
 - d. What considerations did you take as to where waste would be disposed of, and how this would affect the quality of our drinking water?
 - e. How did you determine the amount of water that could be withdrawn from the water source, without depleting it?
 - f. What do you consider your role to be in providing our community with safe drinking water?
 - g. Who did you consult (or believe should be consulted) when designing and constructing a water treatment facility?



Evaluation: The assessment can be based on the student's participation in the class discussion. Following the presentation in lesson 11 will be an optional formal evaluation.

Resources: The following resources and handouts are found below:
– Designing a Water Treatment Facility Scenario

Extension Activity: The Safe Drinking Water Foundation has other educational programs that can be taught with this set of lessons. Operation Water Drop examines the chemical contaminants that can be found in water; this program is designed for a science class. Operation Water Flow explores the use of water and where it comes from; this program is designed for a Social studies and Math collaboration. Operation Water Spirit presents a First Nations perspective of water and water issues and is designed for a Native Studies or Social Studies class. Operation Water Health explores common health issues surrounding drinking water in Canada and around the world and is designed for a Health, Science and Social Studies collaboration. To access more information on these and other educational activities visit the Safe Drinking Water Foundation website at www.safewater.org.

Sources and Related Links:

[Inuktitut](#) – a SDWF fact sheet

[Ojibway](#) – a SDWF fact sheet

[Operation Water Pollution Lesson 2: Types of Water Pollution](#)

[Operation Water Pollution Lesson 3: Cause and Effect of Water Pollution](#)

[Operation Water Pollution Lesson 4: Demonstration of Water Pollution](#)

[The Cree Language](#) – a SDWF fact sheet

Designing a Water Treatment Facility Scenario:

For many years, the First Nations community has had unhealthy water. The community has been under a Boil Water Advisory for five years. After a lot of negotiating and campaigning, the government has finally agreed to build a new water treatment facility. You, as the lowest bidder, have won the tender for the water treatment facility.

The community is located in the northern part of the province and is surrounded by the boreal forest. It is 30 km from a pulp and paper mill where most of the men from the community work. The community has been complaining that the water tastes funny (even after passing through the treatment plant) and it often smells bad. Health Canada has detected high levels of coliforms (hence the Boil Water Advisory). In all water tests, the community's water source has consistently resulted with high or almost the maximum level of TDS, pH, coliforms, turbidity, arsenic, and other contaminants.

After reading the Health Canada and Indian and Northern Affairs Canada reports, you are looking forward to the challenge of making the water healthy and safe for the people in the First Nations community.

When you arrive at the community, you notice a very strong odour in the air and are told that it is the pulp and paper mill upstream from the community. The Chief and members of the band council as well as the elders and local water keepers are skeptical that you can do anything to help, because all other engineers have failed to give them what every human being has a right to: healthy, safe drinking water.

What do you do? What is your first step? How do you win over the Chief, elders, band members and water keepers? Can you give them healthy, safe drinking water?