

Lesson 3: What are the hazards of shipping on the Great Lakes?

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Time: 2 days. One day for limitations and one day for hazards.

Target: Grades 8-10

Lesson overview:

This lesson will focus on limitations with the intention of studying the lock system between Lake Superior and Lake Michigan. The goal of this lesson is to get students thinking about how products get from where they are produced to where they are used. In this lesson the student will identify limitations and hazards of shipping on the Great Lakes.

Minnesota Science Standards Addressed

1. History and Nature of Science. B. Science inquiry, 3. The student will use appropriate technology and mathematics skills to access, gather, store, retrieve and organize data.
2. History and Nature of Science. D. Historic Perspectives, 2. The student will cite examples of how science and technology contribute to changes in agriculture, manufacturing, sanitation, medicine, warfare, transportation, information processing or communication.
3. Earth and Space Science. A. Earth Structure and Processes, The student will investigate the impact humans have on the environment.

Objective

Students will know what a lock is, and how a lock works. The students will also be able to understand the necessity of locks to shipping on the Great Lakes.

Pre-Assessment

Students through discussion or a brief written essay will discuss what are some limitations to shipping on the Great Lakes. Through this discussion, the class will focus on how to solve the problem of different water surface levels of the different Great Lakes. Lakes Superior and Michigan are best to use for this lesson.

Background

A lock system works by having a ship approach the lock from either a higher or lower water elevation. The ship enters one end of the lock system, once the doors close the water will either increase or decrease as the water is either being drained out or more water is being allowed in. Once the water has reached the level of elevation of either lake the doors at the other end will open up and the ship moves out of the lock and on down the channal. A lock system has four main features for operation; the two doors at either end of the lock, a filling valve and an emptying valve. Locks between Lake Superior and Lake Michigan are open for about ten months out of the year closing in January and Febuary as the shipping lanes partially freeze.

Procedure

How Navigation Locks Operate at Sault St. Marie, Michigan

The ship enters from the lower level, the Lake Michigan side. The ship is said to be inbound as it comes through the Soo locks. Both upper gates and lower gates are then closed. The emptying valve is closed and the filling valve is open, the lock chamber is filled to the upper level. The upper gates are then opened, allowing the ship to exit the lock chamber into Lake Superior and onward toward Duluth.

The reverse is when the ship enters the locks from the Lake Superior side. This is said to be outbound. The lock chamber is filled. The Superior side gate is opened and the ship enters the lock. Both gates are closed and the lock chamber is emptied. This allows the ship to exit into Lake Michigan. Now the lock is ready for an up-bound ship to come in and be lifted, or may be filled to lower another down bound ship.

1. Have students view the animation of the Soo locks at <http://huron.lre.usace.army.mil/SOO/alogk.html>. Once the students have viewed the video have them create a model on their own if time permits or by using the follow direction: Demonstrate how a lock works. Students will become the gates to the locks, the ships passing through the locks, and a lock master who directs the flow of traffic. You will need minimum of 7 volunteers. If there is an excess of volunteers, there may be extra ships waiting to get through the locks if more students want to become involved.
 - a. Four students will comprise the lock gate. two at each end. The lock gates will stand opposite each other with hands together, arms extended, and finger tips touching when the gate is closed.
 - b. The lock master will direct an outbound (from L. Superior to L. Michigan) or inbound (from L. Michigan to L. Superior) ship into the lock. The lock master will tell the gates to open and close at the correct time. He/she will tell the ship to enter and leave the lock on his/her command. The lock master should be able to explain whether the lock needs to be filled or drained depending on the ships direction of travel. If he/she cannot hire do this, a new lock master.
 - c. Ships must follow the direction of the lock master if they do not fire the Captain of the ship, hire a new Captain, or promote the First Mate to Captain.
 - d. You may run this demo as long as you have ships to go through the locks.
2. Students are now ready to build a model on their own.
3. Have students bring in a shoebox or another box of similar shape that will fit the ship they built in lesson 2.
4. Construction of the model:
 - a) The box could have the ends cut to represent the door system of a lock.
 - b) Foam packing peanuts can be used to represent the water in the lock. Adding more peanuts would be equivalent to filling up the lock. Different lake levels could also be represent by using larger boxes with foam peanuts in them.
 - c) Have the students label the parts of their locks.
5. The students may take the models to other classrooms to explain how the lock system works by using their models to assist them. Students could also display their lock system models out in the hallway.

Assessment:

Students will be able to explain how the Soo lock system works by successfully completing a short essay.

Extensions:

- Take the students on a field trip to a lock system in your area. There is a lock system on the Mississippi river in Minneapolis and St. Paul.

- The students may demonstrate their models to the other classrooms by using the models to explain how the lock system works. In my case, they will go to the 6th grade classrooms when they are studying shipping on the Great Lakes.
- Students may research the pros and cons of a lock system whether on rivers or on the Great Lakes.

Website:

http://collections.ic.gc.ca/stlauren/econ/ec_consslseaway.thm

<http://www.boatnerd.com/pictures/fleet>

<http://huron.lre.usace.army.mil/SOO/alock.html> <http://www.ogdensburg.neric.org/~jputman/Seaway.htm>

<http://www.exploringthenorth.com/soo/locks.html>

<http://www.great-lakes.net>

http://www.lre.usace.army.mil/_kd/go.cfm?destination=page&pge_id=1324 Locks homepage

References:

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Penrod, John. (2001) Soo Locks : Sault Ste. Marie - Michigan Penrod/Hiawatha Company. Berrien Center, MI

Richardson (1990) Richardsons' chartbook and cruising guide. Lake Superior edition. Richardson's Marine Publications Co. New Bedford, MA