MAD ABOUT MERCURY

GRADES 6-8

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TIME ALLOTMENT:

Three 50-minute classes.

OVERVIEW:

What do the "Mad Hatter," fluorescent bulbs, and some fish have in common? These items contain the silver-colored, heavy metal element, mercury. This naturally occurring substance can cause health and environmental problems when released in the air and water by human actions. Students are familiar with the use of mercury in thermometers, but it is also used in light switches, flashing lights in shoes, batteries, antibacterial products containing thimerosal, blue tinted headlights and hundreds of other products. Large amounts of mercury are released in the air when coal, oil, and natural gas are burned in the generation of electricity. Long-term exposure to mercury can cause damage to the kidneys, liver, and nervous system and is especially risky for children and women of child bearing age.

In the following activities students will locate information on the presence and affects of mercury in the environment. Mercury presence in household and school items will be identified as well as its presence in local aquatic environments. The bioaccumulation of mercury in various organisms from the bottom to the top of a food chain will be demonstrated.

SUBJECT MATTER:

Science

LEARNING OBJECTIVES:

Students will be able to:

- Identify sources of mercury -containing products in the home and school
- Explain the effects of mercury bioaccumulation in the food chain.

STANDARDS:

National Science Education Standards
http://www.nap.edu/books/0309053269/html/index.html
Standard C: Life Science

- Develop understanding of structure and function living systems and populations and ecosystems

Standard F: Science in Personal and Social Perspectives

- Develop understanding of personal health, populations, resources, and environments, risks and benefits, science and technology in society.

Benchmarks for Science Literacy:
http://www.project2061.org/tools/benchol/bolintro.htm

5. THE LIVING ENVIRONMENT

A. Diversity of Life: All organisms, including the human species, are part of and depend on two main interconnected global food webs. One includes microscopic ocean plants, the animals that feed on them, and finally the animals that feed on those animals. The other web includes land plants, the animals that feed on them, and so forth. The cycles continue indefinitely because organisms decompose after death to return food material to the environment.

Louisiana Science Frameworks:
State Standards for Curriculum Development
http:www.doe.state.la.us/doe/assessment/standards/SCIENCE.pdf
SE-M-A4: understanding that human actions can create risks and consequences in the environment.

LPB State Farm Companies Foundation
NTTI National Teacher Training Institute thirteen Cisco Systems GE Foundation

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MEDIA COMPONENT:

Video:
Enviro-Tacklebox™, *Aggravation of Accumulation* (Louisiana Public Broadcasting)

Web site:

Enviro-Tacklebox™ http://www.envirotacklebox.org This is Louisiana Public Broadcasting's Web site providing teaching information, films, articles and student activities involving environmental science.

US Environmental Protection Agency http://www.epa.gov/espp/usa-map.htm Teachers can check this site for specific information about pesticide use in their area

Environment Canada-Ontario Region - These sites provide information about mercury sources in the home.

Background: The Story of Mercury
http://www.on.ec.gc.ca/community/classroom/millennium/m3-story-e.html Be a Mercury Sleuth -

Find Where Mercury is Hiding in Your Home
http://www.on.ec.gc.ca/community/classroom/millennium/m3-sleuth-house-e.html

Mercury in Schools http://www.mercuryinschools.uwex.edu/regions_map.htm This site has a map of the US. Click on each state for more information about mercury reduction agencies and contacts, mercury health advisories, funding opportunities, collection programs, case studies, and other useful information.
These pages have information about mercury in the home and in the schools
http://www.mercuryinschools.uwex.edu/community/index.htm
http://www.mercuryinschools.uwex.edu/schools/where.htm
The following page is an online Mercury IQ quiz
http://www.mercuryinschools.uwex.edu/lib/flash/iq_testMX.swf (needs Macromedia Flash Player:
http://www.macromedia.com/shockwave/download/download.cgi?P1_Prod_Version=ShockwaveFlash)

MATERIALS:

Per Class:

- Computers with Internet connection and multimedia presentation software such as **Microsoft® PowerPoint®**
- **Microsoft® Publisher ®** or similar software (optional)
- TV-VCR
- Make signs on 4"x 6" index cards with the following labels for a class of 30 students:

Label	*Number of signs*
diatoms	16
copepods	8
herring	4
salmon	2
killer whale	1

- 40 green marbles
- 8 brown marbles

Per Group of 3 or 4:

- Poster paper
- Markers

Per Student:

- WORKSHEET 1: ***Mercury in Our Favorite Fishing Spots!***
- Plastic quart size or gallon size bag
- 2 gallon plastic bag for teacher

PREP FOR TEACHERS:

Bookmark the following sites on the classroom computers:

http://www.on.ec.gc.ca/community/classroom/millennium/m3-story-e.html
http://www.on.ec.gc.ca/community/classroom/millennium/m3-sleuth-house-e.html

When using media, provide students with a **FOCUS FOR MEDIA INTERACTION**, a specific task to complete and/or information to identify during or after viewing of video segments, Web sites, or other multimedia elements.

INTRODUCTORY ACTIVITY:

"Quick Quicksilver Facts"

(Setting the stage)
Provide some background information concerning the characteristics, use and history of mercury. Students should read the information at this site and answer some questions.
http://www.on.ec.gc.ca/community/classroom/millennium/m3-story-e.html

Tell the students that Mercury can be found hiding in various items that could be found around their home. To practice looking for these items, have students go this site: http://www.on.ec.gc.ca/community/classroom/millennium/m3-sleuth-house-e.html. At this site students will go through several rooms in a home to find the items that could contain mercury. When a mercury item is located, the students will click on "The Finding Mercury in Your Home" (Chart). This online chart will give the students more information on the item, how to possibly dispose of the item safely, and an alternative non-mercury item. In groups the students will then construct a chart using this information, but also including local disposal information and additional alternatives

1. Divide the students into groups of 3 or 4. Tell each group to go to the following site: http://www.on.ec.gc.ca/community/classroom/millennium/m3-story-e.html. **FOCUS FOR MEDIA INTERACTION**: Tell the student groups to read the information at this site. After reading the information tell the student groups to compose ten short-answer questions about the information. Tell the students to write the answers to these questions on another sheet of paper. (*Consider giving the students a list of key words to include in the questions or answers. This is a sample list of words: vapour, liquid, toxic, damages organs, evaporation, "Mad Hatter", household products, coal, lights, thermometers, bacteria, methylmercury.)*

2. Allow the student groups to exchange questions and write the answers on a sheet of paper. The questions with the answers are then to be returned to the group that composed the questions. The answers are "graded" and the results can be discussed among groups.

3. Tell the students they are going to become "Mercury Detectives". Tell the student groups to go to this site: http://www.on.ec.gc.ca/community/classrom/millennium/m3-sleuth-house-e.html **FOCUS FOR MEDIA INTERACTION**: Tell the students to click on each room in this home to locate the items that contain Mercury. Tell the students to note the information given on the chart "The Finding Mercury in Your Home" (Chart). The student groups must make a chart of each room's mercury containing products, a description, how to dispose of the item, and name a mercury-free alternative item. The information from this chart can then be used to create a presentation such as a poster, brochure, or or use a multimedia software program such as **Microsoft® PowerPoint®** showing the possible sources of mercury products in the various rooms in a home.

LEARNING ACTIVITIES:

Activity 1
"Mercury on the Menu?"

(Teacher Prep)
Bookmark the following site: http://www.mercuryinschools.uwex.edu/regions_map.htm
When using media, provide students with a FOCUS FOR MEDIA INTERACTION, a specific task to complete and/or information to identify during or after viewing of video segments, Web sites, or other multimedia elements.

1. Divide the students into groups of 3 or 4. Give each student a copy of Worksheet 1: ***Mercury In Our Favorite Fishing Spots!*** Tell the students to go to this site: http://www.mercuryinschools.uwex.edu/regions_map.htm
   FOCUS FOR MEDIA INTERACTION: Tell the students to click on their state. (Some states can be accessed only by going to the list under the map.) Students must read the information provided under these types of titles: Lead Mercury Reduction Agencies and Contacts, Mercury Collection Programs, State Mercury Health Advisories
2. Using the information from the above site, tell the student groups to create a sign that could be posted at the site of the mercury advisory. Students can use poster paper or computer paint or publishing programs.

Activity 2
"Mercury Chow"

1. **FOCUS FOR MEDIA INTERACTION**: Ask the students to listen to the facts about the food chain and bioaccumulation of mercury in the video they will see. The students should be able to present in words or simple drawings the organisms in this food chain and the possible pathway of mercury accumulation. **PLAY** the video "Aggravation of Accumulation" from the start of the video to segment that starts with a map of the US. This is approximately 3minutes 55 seconds. The beginning of the video presents information on mercury in the environment. **STOP** the video when the words "Mercury is not the only bioacculmulating headliner…" and the screen is showing a green map.
2. Draw the following food chain on the board: ***diatoms → copepods→ herring →salmon → killer whale***. Discuss the general terms that these organisms represent: ***primary producers→primary consumers→secondary consumers→tertiary consumers***. The arrows point from the food source to the organism eating that source.
3. Hand out one of the 30 labels (diatoms, copepods, herring, salmon) to each student to wear. The teacher wears the killer whale label. Give each student a plastic quart size bag. Place all the marbles (which will represent energy/food sources) in a sturdy paper bag. Each "diatom" draws 3 marbles out of the paper bag and places the 3 marbles in their plastic bag.
4. The "copepods" will be allowed to tag the "diatoms" to obtain energy/food sources. Each *tag* will result in a "diatom" taking a marble out of his/her bag and giving it to a "copepod." Allow this to proceed for 2 minutes. Record the results on a chart on the board, carefully noting the number of green marbles and the number of brown marbles per organism.
5. Next, allow the "herrings" to tag the "copepods" and receive 2 marbles per tag. After a minute or two, stop the action and record the results on the board. Next, allow the "salmon" to tag the "herrings" to receive 4 marbles per tag. Record these results. Finally, the "killer whale" will tag the salmon and receive 8 marbles per tag. Record these results on the chart.
6. Discuss the results. Explain to the students that the green marbles are healthy energy sources, but the brown marbles contain inorganic mercury that has been metabolized to form toxic organic materials, such as methylmercury. These organic toxins can be stored in the tissue of the organisms and passed on to the next organism in the food chain. Ask the students to theorize where the inorganic mercury could have originated. (Consider the previous activities and the sources mentioned in them.) Tell the students to draw the food chain they have just demonstrated in this activity, being sure to represent the presence of the mercury toxin at each level. The students should then write a summary comparing this food chain to the one they drew in Step 1.

CULMINATING ACTIVITIES:

"Me and Mercury"

1. Student groups will design an information pamphlet on the effects of mercury in the environment and suggestions for reducing mercury in the environment. Ask the students to brainstorm at least 3 headings for the sections of the pamphlet. (For example, list the items in each room that may contain mercury and non-mercury alternatives, a consumer check list for these items, local safe disposal regulations for these items, effects of mercury in the food chain, local advisories that concern mercury in the water, government websites or phones numbers with mercury information, etc.) The pamphlet should have appropriate graphics. The can be hand drawn or created on the computer using software like **Microsoft® *Publisher®***.
2. Student groups will create a rough draft of the pamphlet. Groups will exchange pamphlets and write suggestions to other groups to improve the pamphlets.
3. Student groups will present their pamphlets to the class. These can then be displayed in the school library, or at local businesses and public facilities.

Additional Short Culminating Activity

- Students can take this short online quiz. Ask students to write a short essay on the question they considered the most important.
- Online mercury quiz at http://www.mercuryinschools.uwex.edu/lib/flash/iq_testMX.swf

CROSS-CURRICULAR EXTENSIONS:

LITERATURE:

- Students can research the origin of the term "Mad Hatter" in Alice in Wonderland

SOCIAL STUDIES:

- Students can research the historical uses of mercury from ancient times to the industrial age. Students can also research the cultural uses of mercury.

COMMUNITY CONNECTIONS:

- Students can display the posters or other presentation materials from the **Introductory Activity** at local hardware stores, food stores, malls, daycare facilities, etc. These presentations show the possible sources of mercury in products around the home and possible alternatives. The student made pamphlets in the culminating activity can also be displayed.
- Invite a member of a local or state or federal environmental quality department to talk to the students concerning local regulations and advisories related to mercury and other chemicals that could cause local bioaccumulation. If no one is available, the students could email questions to these employees.
- Ask students or their family members to take pictures of any advisory signs posed at their favorite fishing spots. The students should find out the government agency in charge of posting the sign.

STUDENT MATERIALS:

- Worksheet 1: ***Mercury in Our Favorite FIshing Spots!***

Worksheet 1: Mercury in Our Favorite Fishing Spots!

Name: _____

Partner: _____

DUE _____

40 points

1. Go to this site http://www.mercuryinschools.uwex.edu/regions_map.htm .
2. Click on your state and find information about mercury in our aquatic environments.
3. Pick one area that you have been to or you know about or would like to visit.
4. Make a sign that could be placed at the area to give visitors useful information about the water advisory. The sign should be between 8"x11" and 9"x12".
5. The sign must give the species of fish affected, the name of the lake, river, etc., that the sign applies to, and the age group of people impacted.
6. Use at least one significant graphic.
7. You may use the computer to do this or you may draw this.
8. You will be graded as follows:

Correct information	20 points	
Attractive appearance	10 points	
Appropriate graphic	10 points	
Total	40 points	