DEQ in the Classroom:
Making a Mini Landfill

IDAHO DEPARTMENT OF ENVIRONMENTAL QUALITY

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Grade Level:
Grades 4 - 7

Time Required:
Day 1: 1 hour to 1 hour 15 minutes
Day 2 (one month after day 1): 30 minutes
Day 3 (two months after day 1): 45 minutes
Some landfills will also require weekly watering.
Note: All times are approximate, depending on level of discussion.

Objective:
Students will understand the concept of how a landfill works, become acquainted with environmental issues surrounding landfills, and learn actions they can take to help keep solid waste out of landfills.

Meets State Standards:
Grade 4: 4.S.1.2.1, 4.S.1.2.3, 4.S.1.6.5, 4.H.1.1.10
Grade 5: 5.S.1.2.1, 5.S.1.2.3, 5.S.1.6.2, 5.S.1.6.4, 5.S.5.1.1, 5.H.1.1.8
Grade 6: 6-9.GWH.2.5.2, 6-9.GEH.2.5.2, 6-9.WHC.2.5.4, 6.S.1.2.2, 6.S.1.2.3, 6.S.1.6.2, 6.S.1.6.4, 6.S.5.1.1, 6.H.1.1.10
Grade 7: 6-9.GWH.2.5.2, 6-9.GEH.2.5.2, 6-9.WHC.2.5.4, 7.S.1.2.2, 7.S.1.2.3, 7.S.1.6.1, 7.S.5.3.1, 7-8.H.1.1.9

Meets standards in social studies (grades 6 and 7), science, and health.

Focus:
Waste, pollution prevention, landfills.

Materials:
12, one-gallon plastic milk jugs
Trash: 2 plastic grocery bags (1 for the first day; 1 for the last day)
2 pieces of aluminum foil (each about 12” x 12” square) (1 for the first day; 1 for the last day)
2 pages of a newspaper (1 for the first day; 1 for the last day)
3 banana peels (2 for the first day; 1 for the last day)
3 orange peels (2 for the first day; 1 for the last day)
3 facial tissues (2 for the first day; 1 for the last day)
5 latex balloons (4 for the first day; 1 for the last day)
Watering can
Water
6 large rubber bands
Plastic wrap

Materials continued on page 2.

Materials, Cont.

Potting soil (approx. 25 dry quarts; divide into smaller containers for ease of use)
12 large spoons or small hand trowels
Scissors (1 per student)
Tape
Plastic tablecloths (or large plastic garbage bags) to protect tables (if doing the activity indoors)
Labels for milk jugs (Print from page 11 or have students make their own)
Record sheets (Print from page 12). Page 12 has two record sheets per page. Each group or individual will need three record sheets (one each for Day 1, Day 2, and Day 3 for their landfill); the class as a whole will need an additional three record sheets for the control.
Labels for recycle, reuse, etc. (Print from pages 14 – 17) (optional)

Background:

According to the U.S. Environmental Protection Agency, an average of 4.5 pounds of solid waste (trash) is produced per person per day in the United States. There are many things individuals (even kids!) can do to reduce this: not create waste in the first place (eliminate), reduce the amount of waste created, reuse products, and recycle those products that can't be reused.

Once waste is generated, it is often sent to a landfill. A landfill is an area of land in which wastes (such as household trash) are placed for permanent disposal. Landfills are designed to prevent the wastes placed there from impacting the surrounding environment.

One of the most common environmental impacts of landfills is water (called "leachate") seeping through a landfill, then into the ground water below, taking pollutants from the landfill with it. This can contaminate ground water, which in Idaho is our main source of drinking water.

To prevent this, some landfills (mainly larger landfills) have liners along the sides and bottom to keep water (leachate) that accumulates in the landfill from seeping out. These landfills also have leachate collection systems that remove the leachate. Most landfills are designed so that the amount of moisture in them is very limited (often called a "dry tomb" type of landfill). This helps prevent leachate from accumulating in the first place. Without moisture, the microorganisms that break down the waste can't function, which keeps wastes from breaking down or decomposing. Under ideal "dry tomb" landfill conditions, most waste doesn't decompose.

There is also a relatively new landfill type called bioreactor landfill that is operated just the opposite of the dry tomb method. In these landfills, liquid is added at a calculated rate to encourage microbial breakdown of the waste. This serves two purposes. The first is to decompose waste as fast as possible. This allows the landfill to accept the maximum amount of waste. This also creates methane, which can be used to generate energy. Currently, there are no bioreactor landfills in Idaho.

At the end of each day, new waste in a landfill is covered, usually with a layer of soil, resulting in a series of layers within the landfill. Some bioreactor landfills use cover materials other than soil to allow water or other added liquids to seep through the daily cover.

Eventually, landfills fill up and must be closed. When that happens, new landfills must be built. This is an expensive, time-consuming, and often unpopular, undertaking. In general, Idaho has ample landfill space, although some counties are approaching capacity. However, eventually each landfill will reach capacity, so it is always preferable to recycle, compost, reduce, and reuse to keep as much trash out of our landfills as possible.

Vocabulary:

Bioreactor landfill	A landfill where liquid is added at a calculated rate to encourage microbial breakdown of the waste. Currently, there are no bioreactor landfills in Idaho.
Contaminate	To make something impure or unclean. In this context, "contaminate" refers to placing something that cannot be recycled (or is not accepted for recycling by a particular recycler, or can be recycled but must be separated) in a load of recyclable materials. This can prevent the entire load of recyclables from being recycled and the materials often have to be thrown away. (e.g., throwing garbage into a recycling bin for aluminum cans contaminates the bin of recyclable cans.)
Compost	A mixture of decaying organic substances, such as dead leaves or kitchen scraps, used for fertilizing soil. *Or (verb),* To make this type of substance (e.g., we compost our grass clippings).
Divert	To turn aside. In this context, "divert" refers to keeping things out of a landfill by finding alternatives to throwing items away. (e.g., "We diverted the aluminum cans from the landfill by recycling them instead.")
Dry tomb landfill	A landfill designed to limit the amount of moisture in it.
Dump (noun)	A place where garbage/trash/waste is deposited. "Dump" is an older term, and is sometimes used casually to refer to a landfill (e.g., "We took our trash to the county dump." [meaning the county landfill]). However, while people sometimes use the terms "dump" and "landfill" interchangeably, a "dump" more accurately refers to a site where waste is left illegally. These "dumps" are not regulated and not protective of the environment.
Eliminate(ing)	To take out. In this context, "eliminate" refers to not creating or using something in the first place (e.g., not creating any waste at all).
Microb(e)(ial)	A very small (micro) organism, such as bacteria. *Or,* Involving or caused by microbes.
Leach	To dissolve out soluble portions of a substance as water percolates through it.
Leachate	A product or solution formed by leaching, especially a solution containing contaminants picked up through the leaching of soil. In this context, "leachate" refers to water that has percolated through a landfill and picked up contaminants from the waste in the process.
Landfill	An area of land in which wastes are placed for permanent disposal. A landfill is regulated by the government and is designed to protect the environment from the impacts of the wastes that are placed there.
Pollution Prevention (P2)	Practices that reduce or eliminate the creation of pollutants or waste through increased efficiency in the use of resources. P2 goes beyond recycling and reusing and involves using resources efficiently to not create waste in the first place.
Recycle(ing)	Transforming waste materials into new products or resources (e.g., sending used aluminum cans to a recycler to be melted down and made into new aluminum cans).
Reduce(ing)	Using less so that less waste or pollution is generated (e.g., packaging a gift to use as little wrapping paper as possible).

Vocabulary, Continued:

Reuse(ing)	Using something again to avoid generating the waste that is created by throwing something away and replacing it with something new (e.g., using grocery bags over and over).
Waste	Trash. Any material (solid, liquid, or contained gas) that is discarded, recycled, reused, or considered inherently waste-like.

Procedure:

Day 1.

Ahead of time: Call your local landfill to gather information about it. (If you can't find a phone number for the landfill itself in the phone book, try calling your county office.) Is it at or nearing capacity? How many more years is it anticipated it will be in use? Are there any issues in the news concerning the landfill?

Gather materials. Set aside one plastic grocery bag, one piece of aluminum foil, one page of newspaper, one facial tissue, and one balloon to use on the last day. You'll also need an orange peel and a banana peel for the last day, but you'll want to wait until immediately before that day to collect those.

If you will be doing the activity indoors, spread plastic table cloths or bags on tables or desks. Set scissors on tables. The activity can be messy, so you may wish to do it outdoors.

Step 1. Discuss the concept of a landfill with your students. (See "Background," page 2.) Who has been to one? What was it like? What happens to trash once it gets to a landfill (e.g., Does it get buried? Does it decompose? Does it just lie there?)? Discuss potential environmental impacts of landfills (mainly leachate contaminating ground water) and that landfills are regulated by the government to ensure they protect the environment. Discuss the difference between a dry tomb landfill (used in Idaho) and a bioreactor landfill.

Step 2. Divide the seven types of "trash" (1 plastic bag, 1 piece of aluminum, 2 orange peels, 2 banana peels, 1 page of newspaper, 4 balloons, and 2 tissues) among the students. (The differences in quantities of items is because of differences in size of the items.) Have the students cut the trash into 13 pieces that are approximately 1-inch to 2-inches square. That is, 13, 1-inch square pieces of orange peel; 13, 1-inch square pieces of plastic bag; 13, 1-inch square pieces of aluminum, etc.

Step 3. Have students place the pieces into seven piles (one pile for each type of trash [one pile of pieces of tissue, one pile of pieces of balloon, etc.]) on a desk or table in a central location.

Step 4. Divide the students into 12 groups. Assign each group a number (1 – 12).

Step 5. Give each group a large spoon or trowel and a plastic milk jug. Have each group cut the top off of their milk jug so that it has a wide opening at the top (cut off about the top ¼ of the jug). (Younger students may need some assistance with this, or teacher may want to do this ahead of time.)

Step 6. Using their spoon or trowel, have each group fill their milk jug approximately half full (or a little less) with potting soil.

Step 7. Have students gather one piece of each type of trash per group and observe and record the condition of each piece of trash (use record sheet on page 12; see example on page 13). Also have students record date, etc. on record sheet. Each student can do this on their own or do one as a group.

Step 8. Using their spoons or trowels, have the students bury their trash in the soil in their milk jugs.

Step 9. Provide each group with their appropriate label (print from page 11 or have them create their own). Have them tape the label to their milk jug.

Step 10. Once all groups are finished up to this point, bring the class back together for discussion. Have each group tell the rest of the class what their instructions are (see below and labels), then have them do what their instructions say (e.g., put plastic wrap over the top [use a rubber band to secure], water, place in the assigned location, etc.). For groups that are watering, use about ½ cup of water.

Group Number	Location	Other instructions
1	Window	No water.
2	Window	Water on day one, then water weekly thereafter.
3	Window	Cover with plastic wrap. Do not water.
4	Window	Water on day one. Cover with plastic wrap. Water weekly thereafter.
5	Dark	No water.
6	Dark	Water on day one, then water weekly thereafter.
7	Dark	Cover with plastic wrap. Do not water.
8	Dark	Water on day one. Cover with plastic wrap. Water weekly thereafter.
9	Classroom*	No water.
10	Classroom*	Water on day one, then water weekly thereafter.
11	Classroom*	Cover with plastic wrap. Do not water.
12	Classroom*	Water on day one. Cover with plastic wrap. Water weekly thereafter.

*e.g., on a counter or shelf or on the floor; out of direct sunlight.

Step 11. Take the remaining 7 pieces of trash (one of each type) and record the condition of each piece on a record sheet (page 12). Set them aside (on the teacher's desk, on a shelf, or somewhere similar) as a control. Do not place the control trash in a milk jug.

Step 12. Once everyone is done, have the class predict what they think will happen after one month and after two months to the trash in each milk jug and what will happen to the control. This can be done as the entire class together (this can be time consuming), in the small groups (have them predict only for their jug and the control), or as individuals (only for their jug and the control). Have them record their predictions on blank paper or on a record sheet printed from page 12.

End Day 1.

Step 13. Have even-numbered groups water their landfills once per week. (They don't need much – about 1/2 cup per week). Do <u>not</u> water the fourth week (the week of Day 2) until after step 14 is completed (do as part of step 15). Odd-numbered groups do nothing.

Day 2. After one month (four weeks). Do not water this week until after step 14 is completed (water as part of step 15).

<u>Ahead of time:</u> Cover tables with tablecloths or plastic bags if doing the activity indoors. Set out one spoon or trowel for each group.

Step 14. Have students break into their groups and retrieve their "landfills." Using their spoons or trowels, have students carefully dig through their landfills and record what they see on the record sheet on page 12 (sample on page 13). Students should look for each of the seven pieces of trash they placed in their landfills. Have students try to keep as much of the soil in the milk jugs as possible (do not dump out). Have students remove the pieces of trash to observe them, then return the trash to the landfills.

Step 15. Re-bury trash in landfills. Even numbered groups water landfills. Return landfills to their assigned locations.

Step 16. As a class, observe the trash from the control group. Teacher record on a record sheet.

Step 17. Discuss. Which landfill's trash was the most intact after one month? The least? Which type(s) of trash were the most intact after one month? The least? What similarities and differences did they observe? Was the soil in the wet landfills wet, or did it dry out? How did the trash in the landfills compare to the "control" trash? How did their observations compare to their predictions?

Step 18. Have students re-visit their predictions. Provide them the opportunity to alter their predictions for the second month based on results from the first month, if they wish.

End Day 2.

Weekly for month two.

Step 19. Have even-numbered groups water their landfills once per week. (They don't need much – about 1/2 cup per week). Do not water the last week (the week of Day 3). Odd-numbered groups do nothing.

Day 3. After second month. Do not water this week.

Ahead of time: Cover tables with tablecloths or plastic bags if doing the activity indoors. Set out one spoon or trowel for each group.

Step 20. Have students break into their groups and retrieve their "landfills." Using their spoons or trowels, have students carefully dig through their landfills and record what they see on the record sheet on page 12. Students should look for each of the seven pieces of trash they placed in their landfills. If necessary, students can carefully dump the landfill contents onto the tablecloth or ground (if outdoors).

Step 21. As a class, observe the trash from the control group. Teacher record on a record sheet.

Step 22. Lead a class discussion on what students observed in their landfills. Did different groups observe different things? Which landfill's trash was the most intact after two months? The least? Which type(s) of trash were the most intact? The least? What else did they observe? What items decomposed? What didn't? Do they think what did and did not decompose would be realistic in a "real" landfill? Why? What did they think was the most realistic about their landfills (compared to a "real" landfill)? What was least realistic? Why? Was the soil in the wet landfills wet, or did it dry out? How did the trash in their landfills compare to the "control" trash? How did their observations compare to their predictions? Use the table on page 7 to assist you with the discussion.

Similarities and differences between "real" landfills and our landfills

Real Life	Our Mini Landfills
Landfills covered with soil every night	Ours is similar. Our trash buried.
Most landfills designed to keep moisture out (dry tomb landfills). This prevents the trash from decomposing.	Similar to our dry (odd-numbered) landfills. No water. *Did the trash decompose in our dry landfills?*
Some landfills (bioreactor landfills) are designed to let water in to promote decomposition. There are no bioreactor landfills in Idaho.	Similar to our wet (even-numbered) landfills. We added water. *Did the trash decompose in our wet landfills?*
Some landfills (mainly larger ones) have liners to keep water (leachate) from seeping out of the landfill. They also have leachate collection systems to collect and transport the leachate away from the landfill.	Similar in that the bottom and sides of our milk jugs acted as liners to keep water (leachate) from seeping out. However, our landfills did not have any means to transport the leachate out, so it just stayed there. *Did the soil in our "wet" landfills get wetter as the weeks went on, or did it dry out on its own between waterings?*

Step 23. Discuss the issue of landfills reaching capacity. While most of Idaho has ample landfill space now, some counties do not. In addition, eventually all places will someday face issues of landfills reaching capacity. What is the status of your county landfill? (Call the landfill ahead of time to find out.) How can we help solve the problem? The term often used for this is to "divert" waste from the landfill. *Look for answers such as recycle, compost, create less waste (eliminate), reuse. Examples of each of these are below.*

Action	Examples
Create less waste (Also called "Eliminate" [you eliminate the waste] or "Rethink" [you rethink your actions]	Don't use a bag at the store when you only buy one or two items. Don't print items from your computer that you can store electronically.
Reduce	Print on both sides of paper. Purchase products with less packaging. Buy products in bulk.
Reuse	Use grocery bags again and again to avoid getting new ones at each visit. Use the back of used paper as scratch paper. Donate old clothes, toys, etc. to charity or provide as "hand-me-downs" to a friend or family member.
Recycle	Recycle things such as aluminum cans, newspaper, office paper, plastic bottles, glass, etc. They are made into new things. Buy products made with recycled content.
Compost	Put lawn clippings, leaves, and organic food scraps into a compost bin to create your own fertilizer.

Step 24. Retrieve the plastic bag, aluminum foil, facial tissue, balloon, and newspaper that you set aside on the first day (see "Ahead of Time" under Day 1 on page 4). Get a fresh banana peel and orange peel. Of this trash, discuss which pieces (if any) will need to go to a landfill and what can be done with the others. If you wish to make the discussion more visible, use the labels on pages 14 – 17 and have students physically place the items in their proper "location."

Trash	What we can do with it
Orange Peel	Compost
Balloon	Send to a landfill (throw away). Technically, latex balloons are organic and will eventually decompose, but not at a rate that they will be able to be made into compost. Mylar balloons will not decompose.
Plastic Bag	Reuse – as a grocery bag again, as packing in a box, to line your trash can, etc.
Aluminum foil	Send to landfill (throw away). While aluminum cans can be recycled, aluminum foil is usually not accepted at recycling facilities. When we put something in a recycling bin that cannot be recycled or is not accepted at the recycling facility, it is referred to as "contaminating" the recycled products. Often the entire load of potentially recyclable products has to be thrown away.
Banana Peel	Compost
Facial Tissue	If clean – compost ; if dirty, send to a landfill (throw away)
Newspaper	Recycle, compost, or reuse (e.g., for art projects, pet messes, etc.)

Assessment/Follow-Up Suggestions:

- Complete "DEQ Kids: Let's Talk Trash: What to do With the Garbage in Your Home." Available for download at http://www.deq.idaho.gov/waste/educ_tools.cfm, Student Resources, or from your DEQ regional office.
- Discuss recycling. If your school has a recycling program, visit its recycling bins or get a bin for your class. Identify the recycling symbol and discuss what it means. Discuss what recycling is and how it works. Discuss purchasing recycled products and how to tell if they are recycled.
- Have students bring in products from home. Look for the recycling symbol. Discuss which products can be recycled. Look at labels to see which products were made with recycled content.
- Research recycling opportunities in your community. Does your community have a recycling program? What products will it accept? (Not all things that can be recycled are accepted in all communities.) Does your community provide curbside recycling? Check out DEQ's online recycling directory to learn more about recycling options at http://www.deq.idaho.gov/waste/recycling/recycle_home.cfm.
- Start a recycling program at your school. If one already exists, find ways to enhance the program (increase the number of commodities that are recycled, help publicize the program/remind students/staff to recycle, etc.).
- Take a field trip to your local sanitary landfill or to a recycling center. Or, invite a guest speaker from your local sanitary landfill or recycling center.
- Play "P2 Bingo" (download from http://www.deq.idaho.gov/waste/educ_tools/bingo_lp.pdf).
- Visit a nearby composting area (possibly at a community garden, private residence, or landfill).
- Start a composting program at your school or at home.
- Initiate a campaign to encourage students and staff at your school to reduce the amount of waste they generate (e.g., copy and print double-sided, use the back of used paper for homework, use a lunch box or reusable bag to bring lunch to school instead of a daily "throw-away" lunch sack, etc.).
- Check into local charities that accept used goods for resale. Collect used goods from students to donate.

Additional Resources:

DEQ Kids: Let's Talk Trash: What to do With the Garbage in Your Home (DEQ activity booklet)
http://www.deq.idaho.gov/waste/educ_tools.cfm, Student Resources

EPA Environmental Kids Club: Garbage and Recycling (U.S. EPA Web site)
http://www.epa.gov/kids/garbage.htm

Online Recycling Directory (DEQ Web site)
http://www.deq.idaho.gov/waste/recycling/recycle_home.cfm

Pollution Prevention (DEQ Web site)
http://www.deq.idaho.gov/multimedia_assistance/p2/overview.cfm

Recycling in Idaho (DEQ Web site)
http://www.deq.idaho.gov/waste/recycling/recycling.cfm

Waste Management Educational Tools (DEQ Web site)
http://www.deq.idaho.gov/waste/educ_tools.cfm

Waste Management and Remediation: Programs and Issues (DEQ Web site)
http://www.deq.idaho.gov/waste/prog_issues.cfm

Group 1 **Window** **No water**	**Group 2** **Window** **Water weekly**
Group 3 **Window** **Plastic wrap** **No water**	**Group 4** **Window** **Plastic wrap** **Water weekly**
Group 5 **Dark** **No water**	**Group 6** **Dark** **Water weekly**
Group 7 **Dark** **Plastic wrap** **No water**	**Group 8** **Dark** **Plastic wrap** **Water weekly**
Group 9 **Classroom** **No water**	**Group 10** **Classroom** **Water weekly**
Group 11 **Classroom** **Plastic wrap** **No water**	**Group 12** **Classroom** **Plastic wrap** **Water weekly**

Record Sheet

Group Number _____ Date _____ Days Into Experiment _____

Type of Landfill (e.g., "window, no water")**: _____**

Is the soil in the landfill wet? _____

Type of Trash	Present? (Yes or No)*	Observations (e.g., physical condition of trash):

*Is the piece of trash physically present (and identifiable) in the landfill? On Day 1, all trash will be present (write "yes"), but on Days 2 and 3, some trash may not still be there or not be identifiable.

Record Sheet

Group Number _____ Date _____ Days Into Experiment _____

Type of Landfill (e.g., "window, no water")**: _____**

Is the soil in the landfill wet? _____

Type of Trash	Present? (Yes or No)*	Observations (e.g., physical condition of trash):

*Is the piece of trash physically present (and identifiable) in the landfill? On Day 1, all trash will be present (write "yes"), but on Days 2 and 3, some trash may not still be there or not be identifiable.

Record Sheet - Sample

Group Number ___2_____ Date ____May 1_____Days Into Experiment 0 – first day

Type of Landfill (e.g., "window, no water")**: ____**window, water weekly**_____**

Is the soil in the landfill wet? _____No_____

Type of Trash	**Present? (Yes or No)***	**Observations (e.g., physical condition of trash):**
Plastic grocery bag	Yes	White with red writing on it
Aluminum foil	Yes	Just a square of foil
Newspaper	Yes	Part of a movie advertisement
Orange peel	Yes	Just part of an orange peel – square
Banana peel	Yes	Part of a banana peel – long and skinny
Tissue	Yes	Unused (!)
Balloon	Yes	Green

*Is the piece of trash physically present (and identifiable) in the landfill? On Day 1, all trash will be present (write "yes"), but on Days 2 and 3, some trash may not still be there or not be identifiable.

Record Sheet - Sample

Group Number ___2_____ Date ____June 1_____ Days Into Experiment 30 – first check

Type of Landfill (e.g., "window, no water")**: ____**window, water weekly**_____**

Is the soil in the landfill wet? _____A little_____

Type of Trash	**Present? (Yes or No)***	**Observations (e.g., physical condition of trash):**
Plastic grocery bag	Yes	Looks the same
Aluminum foil	Yes	The same, except torn (probably tore when I was digging for it)
Newspaper	Yes	Wet – can't read it anymore
Orange peel	Yes??	Think it's there, but not positive what we see is it
Banana peel	Yes	Kind of gross. Black and slimy.
Tissue	No??	Can't find it. Gone?
Balloon	Yes	Looks the same

*Is the piece of trash physically present (and identifiable) in the landfill? On Day 1, all trash will be present (write "yes"), but on Days 2 and 3, some trash may not still be there or not be identifiable.

Recycle

Compost

Reuse

Landfill