



‘ŌPALA OUTING

How has technology changed the way we consume and dispose of products and what can we do to reduce waste to *ho`ōla* (heal) our *ahupua`a*?

HAWAII DOE STANDARD BENCHMARKS

Science 2: The Scientific Process: NATURE OF SCIENCE

- **SC.6.2.2** Explain how the needs of society have influenced the development and use of technologies.

Science 6: Physical, Earth, and Space Sciences: NATURE OF MATTER AND ENERGY

- **SC.6.6.2** Describe the different types of energy transformations.

Language Arts 5: Writing: RHETORIC

- **LA.6.5.2** Use an organizational structure (e.g., chronological, comparison and contrast, spatial order, climactic order, order of importance) to support meaning.

Language Arts 6: Oral Communication: CONVENTIONS AND SKILLS

- **LA.6.6.1** Explain how appropriate participation affects the productivity of group activities.
- **LA.6.6.3** Give short prepared oral presentations to inform and persuade.
- **LA.6.6.4** Use appropriate listening strategies (e.g. listening attentively, taking notes, asking questions) to learn from an oral presentation.

GENERAL LEARNER OUTCOME

GLO 5: Effective Communicator

- Communicate effectively and clearly through speaking, using appropriate forms, conventions, and styles to convey ideas and information for a variety of audiences and purposes.

NĀ HONUA MAULI OLA

- **NHMO 14-2** Maintain a clean and healthy environment (i.e. waste management).
- **NHMO 15-2** Plan and participate in community service projects.
- **NHMO 15-3** Teach others about the concept of *mālama* through example.

KEY CONCEPTS

- Technology has changed the way we consume by allowing us to purchase many new products that are shipped over long distances and often manufactured from new human-made materials.
- Technology impacts the way we dispose of and recycle products.
- HPOWER burns wastes to convert heat energy into mechanical energy, which drives turbines and produces electrical energy.
- We can make consumer choices that will reduce waste, and we can take action to recycle and compost more of the materials we use.



ACTIVITY AT A GLANCE

Students tour several recycling facilities and write a letter to one of the facilities to explain how technology has changed the way they consume and dispose of products and how their school community can help reduce waste and *ho'ōla* their *ahupua'a*.

Students groups take action to reduce waste in their school community and then present their projects to 'ohana and the school community.

ASSESSMENT

Students:

- Write a one-page letter to a recycling center to summarize learning and address the unit essential question.
- Complete a diagram that shows how HPOWER converts heat energy into mechanical energy and mechanical energy into electrical energy.
- Work with a *hui* (group) to complete a project that reduces waste and reflects caring for and healing our *ahupua'a*.
- Present projects (e.g., computer presentation, video, model, story, or song) to peers and 'ohana and explain ways in which technology has changed our society.
- Complete a self-assessment of contributions to group work and personal commitment to care for the 'āina.

TIME

4 class periods



SKILLS

collaborating, constructing, diagramming, critical listening, communicating orally, writing, creativity

MATERIALS

Provided:

- ✓ Learning Log sheets 8-11
- ✓ Teacher Answer Sheets and diagrams
- ✓ Project Ideas (optional – one per group)
- ✓ Student Assessment Overview and rubrics (Provided in Unit Introduction)

Needed:

- ✓ an assortment of materials for students to use in developing their projects (video equipment, computer, cardboard, modeling clay, butcher paper, markers, paints, scissors, cloth scraps)

ADVANCE PREPARATION

- Make copies of the rubrics provided in the Unit Introduction (or plan to project them for students to review).
- Make arrangements for students to visit recycling facilities. Contact the Schnitzer Steel Hawaii Corporation's Community Relations Department (see box on following page) to make the arrangements.
- Review the Field Sites Appendix for materials needed for the field trip and management suggestions.
- **Pre-tour Visit:** You can also make arrangements to have recyclers from each of the businesses visit your school and make a presentation about what your students can expect to see on the tour. See box on following page for contact information.
- Make a copy of Learning Logs 8-11 for each student.



To Schedule a Tour Contact:

Rene M. Mansho
 Community Relations Director
 Schnitzer Steel Hawaii Corporation
 Campbell Industrial Park
 91-056 Hanua Street
 Kapolei, Hawaii 96707

E-mail: rmansho@schn.com

(E-mail is the preferred method of communication)

Ph: (808) 682-5810 Fax: (808) 682-0604

Mobile: (808) 306-1876

Website: www.hawaiimetal.com www.schnitzersteel.com



When booking, advise coordinator that the recycling tour is part of the Pacific American Foundation – Aloha 'Āina curriculum. The current minimum age requirement to tour HPOWER facility is 12 years old. However, arrangements have been made by Pacific American Foundation to lower the age requirement for visiting students to age 10 if school groups are using the Aloha 'Āina curriculum. There is no fee for the tour.

TEACHER BACKGROUND INFORMATION

How has technology changed the way we consume and dispose of products?

Technology has enabled us to purchase materials that have traveled a long distance to reach us. We consume more products, many of which are made from new human-made materials that take a long time to decompose. The average consumption of goods and services by American households has doubled since 1957 when televisions became common in private homes (Kingsolver, 2004). We also have the advantage of using disposable products that are often convenient, but there is a trade-off when the impact of disposing these materials is considered.

What can we do to reduce waste to *ho'ōla* (heal) our *ahupua'a*?

There are many ways that we can reduce waste, from the choices we make as consumers to the actions we take to reduce what we throw away. As we consider purchasing products, it's useful to consider how the product impacts the environment, for example, does it have an excessive amount of packaging? Is it recyclable? Will it last a long time? Does it contain toxic material that might be released into the environment? When these things are taken into consideration, we might decide to pass up some products, to consume less, and to select more "green" items that have less of an impact and contribute less to the stream of waste.



When we have finished with a product, we can reduce waste by composting natural materials, recycling or re-using containers, or donating outgrown items to others.

‘Ōpala Outing

Schnitzer Steel Hawaii Corporation helps organize school tours of recycling facilities in the Campbell Industrial Park area. Groups can sign up to get an up-close look at recycling

and waste processing technology in operation on the island of O‘ahu.

The list of different businesses that participate in recycling efforts are listed in the Field Sites Appendix and in Teaching Suggestion #6. Schnitzer Steel Hawaii Corporation is a one-stop-shop to help groups schedule tours. Contact the Community Relations Director to make arrangements to visit each facility. (See Advance Preparation section for contact information.)

TEACHING SUGGESTIONS

1. Review the Student Assessment Overview and discuss students’ culminating projects that address the unit essential question:

How has technology changed the way we consume and dispose of products, and what can we do to reduce waste to *ho‘ōla* (heal) our *ahupua‘a*?

- Ask students to generate some initial responses to the essential question.
- Review the tasks on the Student Assessment Overview. Explain that students will be visiting recycling centers and then writing individual letters to a recycling facility and conducting a group project to take action and reduce waste in their school community.
- Ask students to generate some initial ideas about what those projects could be.

2. Review the concepts from the previous lessons and have a class discussion.

Discussion Questions

- Why was it easier for people in early Hawai‘i to dispose of their waste? (*Their waste was made from natural materials, which decompose quickly.*)
- What are some ways we currently eliminate, reuse, or dispose of waste? (*Recycling centers, composting green waste, waste-to-energy combustion facilities, and landfills.*)
- Why do items such as glass bottles, fishing line, plastic bottles, and diapers have such a great impact on our ‘āina (land)? (*It takes longer for these items to decompose – some up to 1 million years*) Refer to the chart in Student Reading 1 for decomposition rates.
- How do we become more responsible citizens to help reduce waste in our *ahupua‘a*? (*By developing a plan to reduce waste in our school community, implementing it, and educating others about it.*)

3. Discuss the class field trip to recycling facilities.

- Describe each place students will be visiting. (Every effort will be made by Schnitzer Steel to secure a tour at each of the sites listed below. However, scheduling conflicts may result in certain sites being unavailable for school visits.)



4. **Discuss the process of energy transfer that students think occurs at HPOWER.**
 - Ask students to give examples of heat energy, mechanical energy, and electrical energy.
 - Have students share initial ideas about types of energy transfer they think they will learn about on the HPOWER tour.

5. **Distribute and review Learning Log 8 to prepare students for the field trip.**
 - Encourage students to ask questions while visiting the different businesses.
 - Discuss ways to focus attention and listen carefully to presentations and how to take notes effectively.
 - Review what students need to bring on the field trip and your expectations for good behavior while visiting sites.

6. **Conduct the 'Ōpala Outing field trip with students.**
'Ōpala Outing (tour of recycling facilities)
 - 9:00 a.m. - Schnitzer Steel Hawaii Corporation – scrap metal processing and recycling facility
 - 9:45 a.m. HPOWER - waste to energy recycling facility
 - 10:30 a.m. - Hawaiian Earth Products – green waste, compost recycling
 - 11:10 a.m. - Waimanalo Gulch Landfill
 - 11:45 a.m. LUNCH (Kapolei Regional Park)

After the Field Trip

7. **De-brief with students and discuss what they learned at the recycling facilities.**
 - Ask students to share responses from their Learning Log 8.

8. **Discuss students' individual unit projects. Distribute and review Learning Log 9.**
 - Review the rubrics for students' culminating projects to write a letter to a recycling facility that they visited.
 - Review ways to structure a thank-you letter, including correct punctuation, and how to structure the letter to support meaning.
 - Discuss expectations, due date, and criteria for grading.

9. **Distribute and review Learning Log 10.**
 - Have students form *hui* (groups) to work on projects that will reduce waste in the school community.
 - Review the rubric and criteria for grading.
 - Brainstorm various project ideas such as putting on an educational puppet show about recycling, conducting a used clothing drive, or starting a recycling center at school. If desired, hand out or discuss the Project Ideas sheet provided at the end of the lesson.

10. **Discuss ways to work cooperatively and be an effective group member.**
 - Distribute Learning Log 11 and review it with students.



- Explain that students will be responsible for assessing their contribution to the group at the end of this project.

11. Plan the presentations and set a date for students to present their projects.

- Invite other grade levels, administrators and/or families to attend.
- Students can have a *pūpū* party celebration with invited guests after sharing their projects.
- If desired, ask each student to bring a healthy snack that uses little or no disposable packaging to share.
- Ask all guests to dispose of their waste in appropriate recycling bins.

12. Have students complete all assessments.

REFERENCE

Kingsolver, Barbara. 2004. *Small Wonder*. Harper Collins Publishers. New York, NY.

RESOURCES

Advanced Disposal. Landfill Diagram.

http://www.advanceddisposal.com/ads_gar/101_education_zone/101_kids_corner/101_landfill_diagram.aspx (Simplified diagram, designed for students to understand how a landfill works)

EM Technology Network. © 2002-05 EM Technology Network, Inc., Tucson, Arizona. *Waste to Wonderful* Teacher's Manual. Retrieved on March 10, 2007, from

<http://www.emtechnologynetwork.org/~en/web/library/teachersmanual/teachersmanual.html> Free download; a great resource for teachers wanting to introduce this system to schools.

Michigan Environmental Education Curriculum. Where Does Our Garbage Go?

<http://techalive.mtu.edu/meec/module15/Landfills.htm> (Interactive diagram of a landfill – move cursor over parts of the landfill to see how it works)

North Western Hawaiian Islands Multi-Agency Education Project. *A Teacher's Guide to Navigating Change™*. 2006. NOAA (National Oceanic and Atmospheric Administration). Retrieved July 31, 2006, from <http://lilt.ics.hawaii.edu:16080/teachers/NavChange.php>

State of Hawai'i, City & County of Honolulu. Refuse Division. <http://www.opala.org>



'ŌPALA OUTING

LEARNING LOG 8
TEACHER ANSWER SHEET


1. What kind of products does Schnitzer Steel Hawaii recycle?

automobile bodies, pipes, beams, posts, cables, wires, cast irons, motor blocks, bicycles

2. Where does Schnitzer Steel get the metal it recycles?

homeowners, businesses, and government agencies

3. Draw a diagram that shows how HPOWER converts waste into energy. Include at least three steps that show transformation of heat energy, mechanical energy and electrical energy.

See diagram on following pages.

4. Name three by-products of HPOWER.

electrical energy

ash

exhaust gas

5. How does HPOWER have a positive impact on Hawai'i's environment?

It reduces the amount of waste that would have ended up in our landfills and produces energy that provides electricity to our homes.

6. What process does the green waste at Hawaiian Earth Products have to go through before it becomes mulch and can be used in a garden? List the steps.

- a) weighed
- b) delivered by truck and "tipped" into composting pile
- c) green waste loaded into tub grinder
- d) piles are offloaded and turned regularly
- e) compost is screened and ready for sale



‘ŌPALA OUTING

LEARNING LOG 8
TEACHER ANSWER SHEET

7. What are some of the items produced by Hawaiian Earth Products?

soil conditioners, compost, soil blends

8. What are some items, which should not be sent to Hawaiian Earth Products?

plastics, steel, aluminum, glass,

9. Identify four (4) or more items you observed in the Waimanalo Gulch Landfill that could have been reused or recycled. *(Items will vary depending on when you visit.)*

- a. _____
- b. _____
- c. _____
- d. _____
- e. _____
- f. _____

10. Explain and/or diagram how the landfill is constructed.

See diagram on following page and refer to Resources section for interactive online diagrams.

11. What are some dangers that the landfill may cause to the environment?

- **emits foul odors**
- **releases harmful methane gas into the atmosphere**
- **potential for leaching will release toxic liquid into groundwater**

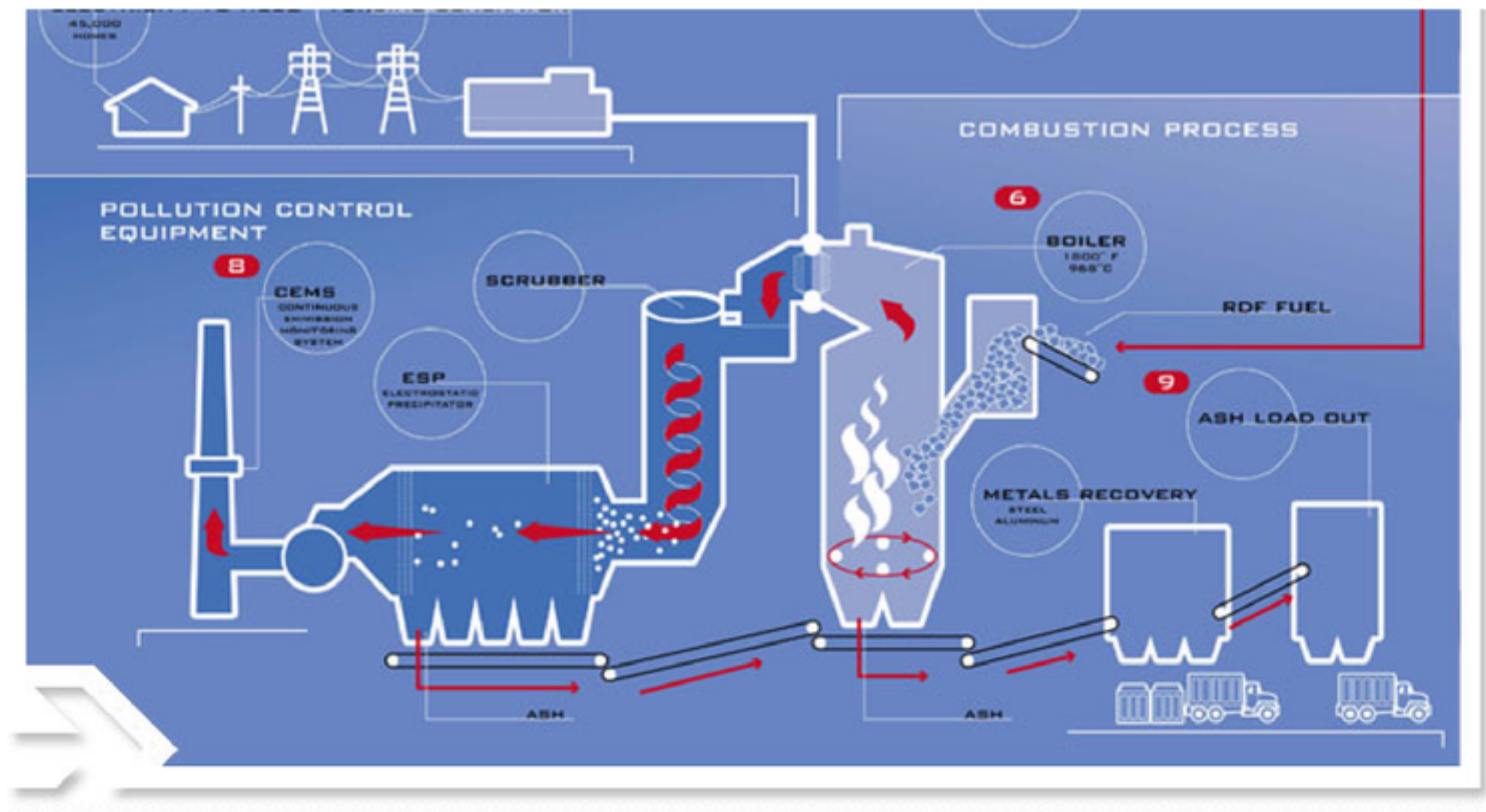


'ŌPALA OUTING

LEARNING LOG 8

TEACHER ANSWER SHEET

HOW DOES HPOWER WORK?



- Trucks deliver Municipal Solid Waste (MSW)
- Primary shredders open and spread waste
- Electromagnets remove metals for recycling
- Screens remove dirt, sand, and glass
- Secondary shredder processes remaining waste
- Waste is combusted in boiler producing steam – [heat energy]
- Steam drives turbine [mechanical energy] to generate electricity [electrical energy]
- Air pollution control equipment cleans exhaust gas
- Ash is hauled to landfill for disposal
- Renewable electricity powers 45,000 Hawai'i

(Graphic and text reprinted from Covanta Energy. © 2003. HPOWER. Covanta Honolulu Resource Recovery Venture).



HOW DOES THE LANDFILL WORK?

Graphic and text reprinted from www.wm.com. WM Waste Management. © 2003. Waste Management Inc.)

Typical Anatomy of a Landfill

Protective Cover

- 1 Cover Vegetation**
As portions of the landfill are completed, native grasses and shrubs are planted and the areas are maintained as open spaces. The vegetation is visually pleasing and prevents erosion of the underlying soils.
- 2 Top Soil**
Helps to support and maintain the growth of vegetation by retaining moisture and providing nutrients.
- 3 Protective Cover Soil**
Protects the landfill cap system and provides additional moisture retention to help support the cover vegetation.

Composite Cap System

- 4 Drainage Layer**
A layer of sand or gravel or a thick plastic mesh called a geonet drains excess precipitation from the protective cover soil to enhance stability and help prevent infiltration of water through the landfill cap system. A geotextile fabric, similar in appearance to felt, may be located on top of the drainage layer to provide separation of solid particles from liquid. This prevents clogging of the drainage layer.
- 5 Geomembrane**
A thick plastic layer forms a cap that prevents excess precipitation from entering the landfill and forming leachate. This layer also helps to prevent the escape of landfill gas, thereby reducing odors.
- 6 Compacted Clay**
Is placed over the waste to form a cap when the landfill reaches the permitted height. This layer prevents excess precipitation from entering the landfill and forming leachate and helps to prevent the escape of landfill gas, thereby reducing odors.

Working Landfill

- 7 Daily Cover**
At the end of each working period, waste is covered with six to twelve inches of soil or other approved material. Daily cover reduces odors, keeps litter from scattering and helps deter scavengers.
- 8 Waste**
As waste arrives, it is compacted in layers within a small area to reduce the volume consumed within the landfill. This practice also helps to reduce odors, keeps litter from scattering and deters scavengers.

Please Note: This illustration depicts a cross section of the standard environmental protection technologies of modern landfills. While the technologies used in most landfills are similar, the exact sequence and type of materials may differ from site to site depending on design, location, climate and underlying geology.

(Not to scale)

Leachate Collection System

Leachate is a liquid that has filtered through the landfill. It consists primarily of precipitation with a small amount coming from the natural decomposition of the waste. The leachate collection system collects the leachate so that it can be removed from the landfill and properly treated or disposed of. The leachate collection system has the following components:

- 9 Leachate Collection Layer**
A layer of sand or gravel or a thick plastic mesh called a geonet collects leachate and allows it to drain by gravity to the leachate collection pipe system.
- 10 Filter Geotextile**
A geotextile fabric, similar in appearance to felt, may be located on top of the leachate collection pipe system to provide separation of solid particles from liquid. This prevents clogging of the pipe system.
- 11 Leachate Collection Pipe System**
Perforated pipes, surrounded by a bed of gravel, transport collected leachate to specially designed low points called sumps. Pumps, located within the sumps, automatically remove the leachate from the landfill and transport it to the leachate management facilities for treatment or another proper method of disposal.

Composite Liner System

- 12 Geomembrane**
A thick plastic layer forms a liner that prevents leachate from leaving the landfill and entering the environment. This geomembrane is typically constructed of a special type of plastic called high-density polyethylene or HDPE. HDPE is tough, impermeable and extremely resistant to attack by the compounds that might be in the leachate. This layer also helps to prevent the escape of landfill gas.
- 13 Compacted Clay**
Is located directly below the geomembrane and forms an additional barrier to prevent leachate from leaving the landfill and entering the environment. This layer also helps to prevent the escape of landfill gas.
- 14 Prepared Subgrade**
The native soils beneath the landfill are prepared as needed prior to beginning landfill construction.

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