

Dirty Job

By *Beth Geiger*

Our reporter visits the world's biggest environmental cleanup.



AP Images

I stood on the brink of a vast landfill. Below me, workers piled soil onto sealed containers. Trucks labeled "Caution: radioactive material" rumbled by. In the distance, windowless buildings loomed above the bleak landscape.

It looked like the set for a movie about a nuclear wasteland. But it was real—the Hanford Site in eastern Washington state. It's the largest environmental cleanup operation on Earth. The U.S. Department of Energy (DOE) is now mopping it up.

Bomb Fuel

Hanford was once an enormous industrial complex covering almost 1,550 square kilometers (600 square miles). It included factories, nuclear reactors, and hundreds of other buildings. Its main product was *plutonium*, a silver-white metallic element that's used to fuel nuclear bombs. The nuclear bomb that the United States dropped on Nagasaki, Japan, on Aug. 9, 1945, contained plutonium made at Hanford.



Beth Geiger

This is one of Hanford's defunct nuclear reactors. In the reactors, controlled nuclear reactions turned uranium fuel into small amounts of plutonium for use in nuclear bombs.

Hanford stopped making plutonium in the 1980s. By then, the site was a huge mess. Billions of gallons of contaminated water had been spilled on the ground. Contaminated equipment lay buried all over the place. And underground tanks were leaking chemical and *radioactive* waste into the nearby Columbia River. Radioactive materials contain unstable atoms that emit high-energy rays. Exposure to those rays is extremely hazardous.

"It's hard to get your mind around how big Hanford is," Cameron Hardy of the DOE told me as we drove through the site. I saw what he meant. We had already driven past miles of sagebrush, metal fences, and faceless concrete buildings, and some of Hanford's nine nuclear reactors were just coming into view.

Finally, we made our first stop, at a groundwater treatment plant. During Hanford's heyday, water used to cool the nuclear reactors and process plutonium was simply dumped on the ground. Some of it seeped into the groundwater, which flows into the Columbia River. The DOE's goal is to reclaim the water before it reaches the river.

One contaminant in Hanford's groundwater is chromium 6, a toxic chemical. Chromium 6 is very *mobile*, or readily transported, in groundwater. Another contaminant is strontium-90, which is radioactive.

Cleaning up the groundwater involves pumping it to the surface. The chromium 6 is extracted and converted to chromium 3, which is safer and less mobile. The strontium-90 is absorbed by a mineral called apatite, which is injected underground. Within two years, the DOE will be pumping and treating 16,280 liters (4,300 gallons) of groundwater—the equivalent of 85 bathtubs' worth of water—every minute.

Hanford also has 200 million liters (53 million gallons) of toxic liquid on its grounds. To immobilize that stew, the DOE is building a *vitrification* plant the size of six shopping malls. Vitrification is the process of making glass. In the Hanford plant, explains DOE glass scientist Albert Kruger, the toxic waste will be heated to 1,150 degrees Celsius (2,100 degrees Fahrenheit). As the hot waste cools, it becomes glass, which will be sealed in steel canisters and buried underground.

When completed, Hanford's vitrification plant will be the world's largest chemical processing facility. The first glass won't roll out until 2018. Even then, it will still take 40 years to treat all the liquid waste.

Solid Mess

The cleanup doesn't stop there. Hanford is also a gargantuan grab bag of solid waste—hundreds of old buildings plus scores of underground burial sites. The burial sites contain tons of contaminated equipment, tools, partly decayed drums, soil, and train cars.

The nuclear reactors are now being cocooned. Everything but their radioactive cores is being destroyed. The cores will be sealed for perhaps 75 years, or “until enough radioactive *decay* has gone on,” explains DOE environmental scientist Nick Ceto. Decay is the slow breakdown of radioactive substances into more stable elements. Other buildings are being dismantled.

The burial grounds are a deeper problem. Hundreds are left to excavate and sort through. It's a slow process, says Hardy. At every step, workers must be protected from radiation, chemical contamination, and fire. “Some of the waste will spontaneously catch fire if it's exposed to air,” he says.

Where does most of the waste go? In a landfill the size of 35 football fields. The landfill is not just a big hole in the ground. At least 10 layers of material will keep it leak-proof for thousands of years. From the landfill's edge, I cautiously peered down seven stories to the bottom.



AP Images

Hanford Site workers wear suits to protect themselves against hazardous vapors.

Long Haul

As I left the Hanford Site, my head was reeling—and not from radiation. I was thinking about the vast operation, which will take at least 50 more years and consume billions of dollars.

Yet everybody I talked to agreed that cleaning up Hanford must be done. Otherwise, more contaminants will reach the Columbia River, says Ceto. People might stumble across dangerous radioactive waste. Wildlife could spread the contamination. “We’re trying to protect the whole food chain,” he says. Clearly, we’re in this mess for the long haul.



Joe LeMonnier

A map of Washington state

Name: _____ Date: _____

1. This passage explains why the cleanup of nuclear waste in Hanford, Washington, is
 - A famous around the world
 - B going to be finished in the next ten years
 - C so complicated and so important
 - D only of interest to people living near the plant

2. How does “Dirty Job” explain what makes the cleanup so difficult?
 - A It describes the dangers of nuclear waste.
 - B It presents information about the cost of the cleanup.
 - C It lists the different kinds of waste that exist at Hanford today.
 - D It tells the history of the site.

3. Which of the following conclusions is supported by the passage?
 - A If Hanford is not cleaned up soon, it will never be cleaned up.
 - B If Hanford is not cleaned up, it will be harmful to the environment.
 - C If Hanford is not cleaned up, it will eventually not be a problem.
 - D If Hanford is not cleaned up, millions of people will die.

4. Read the following sentence: “Hanford is also a gargantuan grab bag of solid waste—hundreds of old buildings plus scores of underground burial sites.”

In this sentence, the word **gargantuan** means:

 - A old
 - B smelly
 - C gigantic
 - D ordinary

5. The primary purpose of this passage is to
 - A compare and contrast Hanford with other polluted sites in the world
 - B present a list, in order, of events that happened at Hanford
 - C describe the dangerous situation that exists at Hanford today
 - D present both sides of the argument for cleaning up, or not cleaning up, Hanford

6. Name three kinds of dangerous, contaminated materials found at Hanford.

7. According to the passage, “the DOE’s goal is to reclaim the water before it reaches the river.” Why do you think the DOE picked that as its goal? Use evidence from the text to support your answer.

8. The question below is an incomplete sentence. Choose the word that best completes the sentence.

The scientists are working hard to pump Hanford’s water to the surface, bury some of its waste in a landfill, and, turn some of its poison liquids into glass, but _____ they want to ensure that none of these dangerous materials hurts any more human beings.

- A maybe
- B most importantly
- C sometimes
- D around

9. Answer the following questions based on the sentence below.

Over the next ten years, the U.S. Department of Energy is building a vitrification plant the size of six shopping malls to immobilize the toxic liquid.

What? U.S. Department of Energy

(is doing) What? _____

When? _____

Why? _____

10. **Vocabulary Word:** cocooned: wrapped up, sealed, like a caterpillar in a cocoon.

Use the vocabulary word in a sentence: _____

Teacher Guide and Answers

Passage Reading Level: Lexile 920

Featured Text Structure: Descriptive: the writer explains, defines or illustrates a concept or topic

Passage Summary: “Dirty Job” reports on the “largest environmental cleanup operation on earth.” Hanford, Washington, was once a massive industrial complex where materials used to make nuclear weapons were produced. Although the Hanford site was shut down in 1980s, contaminants have been leaking into the environment. Now, the cleanup of that nuclear waste is underway – in a process that will take 50 years and billions of dollars.

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6. Name three kinds of dangerous, contaminated materials found at Hanford.

Suggested answer: Hanford has polluted groundwater, toxic liquids, dangerous chemicals, and contaminated solid waste including buildings, equipment, soil, and train cars. [paragraph 4]

7. According to the passage, "the DOE's goal is to reclaim the water before it reaches the river." Why do you think the DOE picked that as its goal? Use evidence from the text to support your answer.

Suggested answer: The water at Hanford is contaminated with dangerous radioactive nuclear waste. If the polluted water at the Hanford site gets into the nearby Columbia River, it could travel downriver and be harmful to many more people and animals who live very far from the Hanford site. [paragraph 6]

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What? U.S. Department of Energy

(is doing) What? **building a vitrification plant the size of six shopping malls**

When? **over the next ten years**

Why? **to immobilize the toxic liquid**

10. **Vocabulary Word:** cocooned: wrapped up, sealed, like a caterpillar in a cocoon.

Use the vocabulary word in a sentence: answers may vary.