The discovery of the fission chain reaction first led to the creation of nuclear weapons. More recently, the energy produced in nuclear fission reactions has been used in a more peaceful way: the generation of electrical power. While the technology used in nuclear weaponry and nuclear power plants have many similarities, there are many differences. In this internet activity, you will explore the workings of nuclear power. You will learn the basic components and operations of nuclear power plants, focusing mainly on boiling water reactors and pressurized water reactors. Lastly, you will explore the benefits and hazards of nuclear power.

**Limerick Power Plant**

**Nuclear power plants in the U.S.**

*Click on State Nuclear Facts.*
1. How many operational nuclear power plants are in the U.S. and in how many states?

*Click on PA and open the PDF file.*
2. How many nuclear power plant **locations** are in Pennsylvania? How many total **reactors**?

3. What source of energy provides the most electrical power in the state? The second most?
How Nuclear Power Plants Generate Electricity

*Click on Nuclear Energy and the Electrical Power Plant*

4. Whether nuclear or fossil fuel (except hydroelectric), how do all power plants generate electricity?

5. What is different?

6. What are the 2 types of Uranium fuel used in power plants?
   a. 
   b. 

   Watch the NEI’s video on “The Design and Safe Operation of Nuclear Reactors”

7. What are the two types of Nuclear Power Plants?
   a. 
   b. 

8. Regardless of the type of nuclear power plant, what has to happen to the steam that’s used?

9. What are the 2 ways (the answer from above) this is done?

10. Where is the nuclear material kept in a power plant?

11. What reaction takes place in order to create the heat needed to warm the water?

12. What do control rods do?

13. True or False: Nuclear Power Plants are designed to prevent the release of radiation.

14. True or False: Nuclear Power Plants will NOT withstand natural disasters.
15. What are the four processing steps Uranium must undergo?

a. What is another name for uranium oxide?

b. What does uranium oxide get converted to?

c. What is the process where the concentration of the $^{235}$U isotope is increased called?

d. Can the Uranium used in a power plant explode? Yes or No

Interactive Nuclear Plant Tour

16. The reactor coolant removes excess heat. What is used as the reactor coolant?

17. Where does the primary reactor coolant go next?

18. As the primary reactor coolant flows through many tubes (red), it heats up the feed water or _______ _______ (blue). What is produced next?

19. What is the purpose of the control rods and where are they located?

20. What happens when the control rods are removed?

21. A one-inch pellet of uranium is comparable to how many pounds of coal?

22. After steam is produced from the heat of the reaction core, the steam is fed into pressurized turbines. The steam turns the turbines and what happens next?

23. How many turbines (total) spin?
24. How is electricity produced?

25. Where does the electricity go?

26. What happens to the steam that turned the turbines? (There are four steps-click bottom arrow)
   a. 
   b. 
   c. 
   d. 

Now that you know about the pressurized water reactor (PWR), complete the attached diagram and be sure to color-code and label it.
Pressurized Water Reactor (PWR)

A. Identify the powerplant parts by writing the number of the correct powerplant part on the blank.

1. reactor  
2. control rods  
3. cooling water loop  
4. containment building  
5. steam-generator  
6. turbine-generator  
7. transmission lines  
8. condenser  
9. first water loop  
10. second water loop  
11. nuclear fuel

B. Color the separate loops using a different color for each loop. Use the following symbols to show what is in the loop or part of the loop.

= steam  
= steam converted back to water  
= cooling water  
= water in first loop
**Nuclear Waste**
*Click on High-level Nuclear Waste*
27. What is high-level nuclear waste?

*Click on the link for Recycling*
28. Does the U.S. currently recycle high-level nuclear waste? Why or Why not?

*Click on the link for Storage*
29. Where is high-level nuclear waste currently being stored?

*Click on Low-level nuclear waste*
30. What is low-level nuclear waste?

31. List five things that can become low-level waste.
   a. 
   b. 
   c. 
   d. 
   e. 

32. How is low-level nuclear waste disposed of?

**Benefits and Hazards**
*Click on Pros and Cons*
33. What is a major advantage of a nuclear power plant over a coal burning power plant?

34. How does the radiation released into the atmosphere from a nuclear power plant compare to that released by a coal-based power plant?

35. What are the three major negatives associated with nuclear power?
   a. 
   b. 
   c. 

Test your nuclear smarts. Take this interactive quiz. What is your score?