Candy Model of a Nuclear Reactor

(outline script)

Required Materials (per child):

- 1 paper plate
- 1 Dixie cup (small, 3 or 5 oz)
- 6-7 3" sections of plastic drinking straws (cut into thirds, about 3" long pieces)
- Nerds candy (one fun size box or similar amount)
- 6-9 pieces of Twizzlers candy about 3" long (each piece is 1/3 a Twizzler)
- Several marshmallows to plug straws
- 7-up (~ 3 oz)

Procedure:

1. Cut drinking straws (if not already cut) and break Twizzlers into approximately 3" pieces. *Explain how the Dixie cup will represent the reactor vessel. The reactor vessel supports the fuel, guides control rods, and directs reactor coolant flow through the reactor vessel and fuel assembly.*

2. Plug bottom of straw with marshmallow. Fill the straw with Nerds candies. Place the filled straws into the Dixie cup (marshmallow down).
   Explain how the straws are analogous to the hollow metal rods (called fuel cladding) and the Nerds are analogous to uranium fuel pellets. Mention that as long as the fuel rods remain intact, all fission products from the fuel are trapped inside the rod. Also mention that fuel rods are loaded prior to being placed in the reactor vessel.

   Mention that fuel pellets are precisely machined (not like Nerds). If you have a candy that won't fit in the straw – that would never happen with fuel pellets. The amount of fuel in a pellet is really important, it is like the amount of gunpowder in a bullet. Too much could cause the pellet to swell and break. Too little would cause the reactor to not make enough power.

   Cover some fuel rod facts: Typical commercial fuel rods are ~12' long. A typical fuel pellet is a ½" long cylinder with a diameter of 1/3" (show pretend fuel pellet).

3. Insert the Twizzlers into the remaining spaces in the cup between the drinking straws.
   Explain how the Twizzlers represent the control rods. Mention that the control rods absorb neutrons (the emitted part during radioactive decay). The control rod material is like a sponge for neutrons. If the neutrons are not absorbed, they run into the reactor coolant and transfer their energy by heating the water. The control rods can be raised and lowered into the fuel assembly to control reactivity. Inserting the control rods is like closing a valve for the flow of neutrons. When the reactor "scrams" all the rods go to the bottom and the flow of neutrons is stopped. A typical commercial PWR fuel assembly contains 264 fuel rods assembled into a square with 24 control rods.

4. Fuel rods with a control rod make a fuel assembly (see Evelyn's poster). A typical commercial PWR core utilizes 193 fuel assemblies in one reactor vessel.

5. The last part of the reactor is the reactor coolant. What is the reactor coolant that we have been talking about? Water! But we will use 7-up because it bubbles and looks like a reaction is happening. It the Pressurized Water Reactor that we have discussed, there would be no bubbles, because even though the water (the reactor coolant) gets very hot, it won't boil, because it's also at very high pressure so bubbles can't form.

6. Now you can eat your model reactor! (*Review and quiz on highlights – hand out some of the extra Nerds or Twizzlers to promote participation)*