Irradiated Salt Demo

Materials:
Hot plate
Irradiated salt
Shallow metal or aluminum-foil pan for heating the irradiated salt
Sheet of white paper or small paper cup for displaying the salt

Precautions:
The salt is safe to handle and is non-toxic, but you should NOT eat it.

The salt is regular table salt purchased from a local grocery store. It was irradiated in its original container and is not harmful. You could eat the salt directly from the original container.

However, because the plastic bottle is not food-grade certified and food-grade sanitary precautions were not taken when the salt was transferred into the plastic bottles, you should not eat the salt.

Procedure:
Pre-heat a small metal or aluminum foil pan by placing it on the hot plate and setting the temperature to medium-high. Non-coated metal pans are recommended, due to the temperatures involved.

While the pan is pre-heating, pour a little of the irradiated salt into the paper cup or onto the sheet of white paper. Point out the fact that the salt is orange in color instead of the expected white color.

When the pan is hot, dim the lights in the room and sprinkle several grains of the orange salt onto the hot surface. You will see obvious flashes of light from each crystal you drop onto the hot surface. You may want to do this for small groups of students so that they can get close enough to the hot plate to observe the small flashes of light.

When all students have had a chance to observe the demonstration, turn on the lights, turn off the hot plate and remove the pan from the hot plate. Tip the pan so that the salt collects in a corner. Point out the fact that the salt is no longer orange in color.

Return any left-over orange salt to the container and close the cap tightly. Light and humidity will cause the stored energy to be released. Once the salt returns to its white form it will no longer luminesce when heated. The de-activated (white) salt can be safely disposed of in the regular trash.

Explanation:
Normal table salt (NaCl), purchased at a local store, was exposed to 4 *kilogray* of gamma radiation. This is a very large amount of radiation energy. (Note: visit http://hps.org/sciencesupport/ for the definition of the unit gray and other information on radiation.)

The gamma radiation energy caused some of the electrons in the NaCl molecule to move to a higher energy state. The crystalline structure of the molecules allowed some of these electrons to be trapped in energy levels above the ground state. These trapped electrons cause the crystals to change color.

When the crystals are heated, the heat energy raises the trapped electrons to an even higher energy level where they are free to drop down to the ground state. As the trapped electrons are freed, their excess energy is released in the form of visible light. This phenomenon is called thermoluminescence. The amount of light released is proportional to the amount of radiation energy absorbed by the crystal.