Laboratory work №7

RADIOACTIVE CONTAMINATION SIMULATION

Purpose

Objectives

Students will be able to:

1. Describe procedures required to prevent the spread of radioactive contamination.

2. Discuss problems and limitations of various approaches to decontamination.

Required Equipment and Supplies

1. Fluorescent chalk.

2. Ultraviolet (UV) lamp and UV protective goggles.

3. Mortar and pestle.

4. Test tubes.

5. Soap, water, and paper towels.

6. Large beakers or plastic buckets for waste.

7. Latex or other waterproof gloves.

8. A dirt-filled ant farm apparatus or a thin wall plastic cup full of dirt (container walls should permit UV light penetration; UV will not pass through plastic).

9. Cellophane or masking tape and Zip-lock bags.

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To demonstrate the practical procedures and problems involved in containing radioactive material.

Name: Class: Date:

Discussion

This activity is designed to simulate the practical aspects of managing low-level radioactive waste associated with the production, cleanup, storage, and disposal of nuclear material. Students are encouraged to suggest procedures for containment and to utilize any means available to minimize the spread of "invisible" contamination.

Before beginning, the instructor should briefly demonstrate the "black light" effect of the UV lamp with a piece of fluorescent chalk. This should take place in a 'clean" area, with no residual chalk residue from any previous classes.

Note: It is important that students understand that fluorescence (an electron excitation phenomenon) and radioactivity (nuclear disintegration) are entirely different and should not be confused. No radioactive material is being used in this simulation.

Set Up

1. Place a small piece of fluorescent chalk at each station with a mortar and pestle. Have towels, soap, and water available.

2. Provide labeled containers for “radioactive” waste.

Procedure

1. Direct each laboratory team to devise a procedure to crush the small piece of chalk using the mortar and pestle. Remind them that an important objective is to avoid any “contamination” from the spread of the “radioactive” chalk.

2. Evenly divide the resulting powder. Place one-half (1/2) of the power onto a paper towel. Place the remaining powder into a test tube filled half way with water.

3. Pour the test tube of water and chalk onto the dirt in the jar or ant farm.

4. Now ask the teams to carefully fold the towel holding the chalk powder and to “package” it for safe shipping — using tape or other means they consider effective.

5. When the packaging is complete, direct the teams to thoroughly clean up all traces of chalk “contamination” at their station. Remind them that all materials, solid or liquid, used in this clean-up must be properly disposed into appropriate waste containers.

6. When the clean-up is complete, “survey” the work areas and waste containers using the UV lamp “radiation monitor.” (Ensure anyone using the UV lamp is wearing the UV protective goggles.) Include the “workers” hands and clothes and the surrounding bench and floor in the survey. The results should be very enlightening.

7. Examine the dirt-filled jar or ant farm with the UV lamp. Add a little water to demonstrate the movement of materials and potential effect on the water table.

Questions

1. How would you recommend disposing of the “contaminated” waste generated in this experiment to avoid spreading it any further?

2. What was the most effective means of cleanup? What problems or limitations might be associated with that approach?

3. Could you recommend any other ways to “decontaminate?”

4. What will eventually happen to most stored radioactive material? How is this different from chemical contamination in the environment?