Island at Risk: A Simulation

Background

Would you rather have fish—or chips? People on Prince Edward Island are discovering that their sources of both of these food items are increasingly at risk.

The fertile red soil of Prince Edward Island is famous for potato growing. Agricultural corporations have been increasing their potato plantings on this island province. In the process, they have been eliminating other crops, which has led to a monoculture. ("Monoculture" refers to the growing of a single crop in an area.) Potato pests are posing a huge threat to this profitable cash crop, however. Part of the problem results from the fact that the potato fields are very close together. To combat the pests—potato bugs, in particular—farmers are applying more and more pesticides, fertilizers, and herbicides to the potato fields.

What are the environmental effects of this heavy use of pesticides (insecticides and herbicides)? After heavy rains on the island, large numbers of dead fish have been found in the ocean, and washed up on the shore near the potato farms. The suspected cause is the leaching of sodium arsenite and other pesticides used in the potato fields. Sodium arsenate is a chemical used to kill both weeds and insects. If the poisoning of the ocean waters continues, Prince Edward Island's unique seafood industry will come to an end.

Suggestions for dealing with this problem have included:

- examples of household chemical products and their uses
- creating a mandatory untilled area spanning 20 m next to waterways;
- growing genetically engineered potatoes that are more blight-resistant. These genetically modified potatoes would contain genes from bacteria that have insecticidal properties;
- employing alternative fertilization and pesticide methods to reduce the amount of chemicals used on the potato crop; and
- rotating crops (that is, alternating types of crops from year to year) so that the spread of potato bugs and the overuse of soil would be less of a problem.

Plan and Present

1. Look up the properties of sodium arsenate in either the CRC Handbook or the Merck Manual. As well, search the Internet for an MSDS sheet about sodium arsenate.
2. Using your knowledge of solutions and dissolving, explain how the chemicals from the potato fields end up in the water with the fish. Make a diagram, a poster, or a PowerPoint™ presentation that clearly illustrates the processes involved in this type of aquatic pollution.
3. Provide a minimum of two advantages and two disadvantages of each of the four possible solutions to the problem.
4. The provincial government in Charlottetown has decided that action must be taken, in some form or another. The following people and organizations have been invited to participate on a board to develop an action plan:

- the P. E. I. Potato Board
- the scientists who helped develop the genetically engineered, blight-resistant potato variety
- the corporations who want to buy the potatoes and process them
- people who fish for their living
- potato farmers

(a) Your class will be divided into groups, and each group will research the point of view of one of these interest groups. Consider questions such as these:
- To what extent do landowners have the right to determine how they use their land?
- What recourse should the fishers on P.E.I. have available to them to respond to the threat posed to their livelihood?
- What possible consumers' rights need to be assessed in analyzing this issue?

(b) Before developing an action plan, each group should decide on and state clearly their motive and their mandate. In other words, what is the reason for their existence as a group and to whom is the group accountable? For example:
- Are the scientists working for biotechnology companies or are they doing pure research?
- What is each group's present policy regarding issues such as environmental protection and sustainability?
- What points might be included in each group's short-term and long-term action plan?

(c) Make a one-page summary of your points to hand out to other members at the meeting. A large diagram, poster, overhead transparency, or PowerPoint™ slide will help your group illustrate how your action plan:
- will affect the environment
- acknowledges the scientific realities of the leaching situation
- satisfies the needs of other interest groups

(d) Hold a meeting of the action plan board, to present all points of view, and to try to reach a consensus on an action plan.

Evaluate the Results

1 **(a)** Take notes on every point of view presented during the meeting.

(b) Decide what you think the best solution is, for everyone involved. Why do you consider it to be the best solution?

Assessment

After you analyze this issue,
- Assess the quality and practicality of your solution.
- Assess your solution based on how clearly the chemistry concepts are expressed and communicated.

2 From what you learned in Unit 3 about solutions and water treatment, do you think there could be other chemical-based solutions to this problem in the future? Give a chemical explanation of how the leachates might be contained, if such processing were possible.

3 Try to suggest some safe, alternative methods of reducing weeds, insects, and harmful microorganisms. For example, could boiling water be used as an effective herbicide? Would this method of reducing weeds cause more problems than it would solve? Why or why not?

Web LINK

www.school.mcgrawhill.ca/resources/
Go to McGraw-Hill Ryerson's Chemistry 11 web site at the above address, and then follow the links to access further information.