

## How to Use This Module

The AMBIENT curriculum water module is comprised of a number of segments. Some of these segments can be taught independently and others are meant to be used together in a certain order. The segments are presented roughly in order of planned presentation although it is noted when a segment can be skipped or used out of order. Each segment begins with a cover sheet for teachers describing its;

- Purpose
- Time required
- Required skills
- Key concepts
- Materials needed
- Assessment techniques

The following is a description of the segments and instructions on how teachers can use them to best suit their interests and the time they have allotted to the module.

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### **“Ethics Enigma”**

**The AMBIENT curriculum features shaded areas accompanied by the “Ethics Enigma” [put character here] in some of its exercises, which highlight ethical issues for teachers. These topics come in two forms:**

- 1) A “Classroom Concern” – These are practical issues teachers may face when doing a given lesson. The ethics box points out pitfalls to avoid when carrying out an exercise.**
- 2) A “Big Idea” – These highlight the larger ethical questions that face society as a whole, or particular segments of society as part of dealing with given environmental health issues. These include concepts of responsibility, harm, fairness and compensation. These boxes can serve as discussion starters during the work of the exercise.**

## Student Segments

### Video Clip

- Various TV News reports of the actual sewer pipe break incident.

### A Teacher's Guide to Water Quality

- This document contains the basic factual information about water quality necessary to knowledgeably lead class discussions and guide students' research efforts. It also outlines, by topic, relevant module segments, websites and articles provided with the curriculum. This should be read through before the teacher begins the module with the students. The water primer also contains a glossary which contains definitions for scientific and conceptual terms used in the module. Teachers may want to define these terms with the students as they come up in the module or use them as a starting point for discussion.

### Scenario

- The scenario focuses on an actual sewage spill and the potential impact to beach water quality after the spill. The scenario is the core of the unit around which the activities are developed. Students will generate questions, develop a research plan, read critically, and learn to organize research material as part of the scenario exercise. Students will also share information with others and work in a group.

### Laboratory Exercises

- The laboratory exercises developed through this module are designed to illustrate the characteristics of microbes and the different factors that must be considered when deciding whether or not to close a beach after a sewage spill. The first laboratory exercise focuses on illustrating what microbes look like. The second set of laboratory exercises are designed to illustrate the ability of microbes to grow or die-off under different environmental conditions. The second set of experiments focus on evaluating the mixing and dilution of microbes as they are transported from the sewage spill to other areas.

#### 1) Viewing Bacteria

During this exercise students will use micro-slide viewers to observe the shapes of various bacteria and the structures within the bacterial cell.

#### 2) Bacterial Growth

This set of laboratory exercises is designed to illustrate concepts of microbial growth. The use of exponents are introduced. Students will be asked to make observations, measure solutions, tabulate data, test hypotheses, and communicate observations in writing and graphically. This set of laboratory experiment consists of three parts.

- i. Teacher Led Demonstration -- Teachers will grow yeast (a surrogate for bacteria) in the laboratory. Students will be shown how to grow the yeast and will participate in an in-class discussion as the laboratory experiment is underway.
- ii. Salinity Tolerance Lab -- Students will design an experiment to evaluate the ability of yeast to grow in water containing different salt contents or salinity.
- iii. Temperature Tolerance Lab -- Students will conduct research to determine the range of temperatures that can be tolerated by microbes and the range of temperatures typically found in beach waters. Students will then design an experiment to evaluate the ability of yeast to grow at different temperatures.

### 3) Movement Through Water

This set of experiments is designed to illustrate concepts associated with the transport of contaminants in the marine environment. Students will learn about dilution and diffusion processes and their impact on the concentration of contaminants (microbes) in water.

- i. Diffusion – In this activity, learners will observe and compare the molecular movement within water at various temperatures and of varying salinity.
- ii. Dilution – In this lab experience learners will make dilutions using dilution trays. They will keep track of their dilutions and the concentrations of solute, to parts per million (ppm) and parts per billion (ppb), in order to have an understanding of the terms.

### Mapping Exercise

- This is a classroom exercise in which spatial data of the movement of a sewage spill through the coastal environment and various influential factors are presented. The kids are expected to analyze the visual data and to make predictions about where the sewage spill will distribute, given various environmental factors. A map of showing actual sewage beach monitoring data can then be superimposed on the tidal maps to "test" their hypotheses.

### Beach Clean-up Field Trip

- The highlight of this activity is a field trip to a local beach. The purpose of the field trip is to determine the amount of solid waste (e.g. cigarette butts) found on the beach. Students will learn how to gather and organize data during this activity. They will also utilize math skills to estimate accumulation of waste on the beach. Students as a result of this exercise will be able to identify sources of pollution, apply their math skills, and develop recommendations for a solution to the problem.

### Critical Reading

- This exercise consists of a set of three articles. One focuses on the high costs and other practical limitations associated with improving the sanitary system of the Florida Keys. The second is a somewhat humorous article that focuses on the need to ultimately dispose of sewage. The third article focuses on the negative impacts of increased development of the Florida Keys which results in the need to dispose more sewage. As part of this scenario, students are asked to critically review each article and write an essay that focuses on the student's interpretation of the sewage disposal problem.

### **Creative Writing**

- This exercise focuses on a passionate story about a man's lifetime experiences within the Florida Keys. It focuses on how the Keys have changed with increased urbanization and pollution. After reading this story, the students will be asked to write about a place that they enjoy.

### **Role-Play Debate**

- The role-play debate serves as a challenging conclusion to the module. Students will use their accumulated factual knowledge and knowledge of current events to engage in the current debate about the extent of the sewage spill problem and the merits of possible solutions. A variety of roles are suggested representing the many sides of this complex issue. Students will prepare presentations to support their position on the issue.