Teacher Sheet 1

CRITICAL THINKING ACTIVITY: ON THE TRAIL OF CO_2

OBJECTIVES: Students will:

- Identify and locate the NOAA/ESRL Baseline Observatories;
- Investigate and analyze the process used to measure CO_2 at the Mauna Loa Observatory;
- Create a visual and written representation of the CO_2 monitoring process at Mauna Loa;

MATERIALS:

- Map/globe of Earth
- Blank map of Earth with latitude and longitude
- Images of NOAA/ESRL baseline observatory sites
- List of steps in the monitoring process at Mauna Loa, Hawaii
- Large sheets of paper
- Pencil/colored pencils/markers
- **Student Activity Sheets**

PROCEDURE: PART 1- The NOAA/ESRL Monitoring Network

1. Read over and discusses the information on the **Student Sheets.**
2. Project the images of the baseline observatories and discuss their locations and the rationale behind their placement.
3. Review how to locate sites on a map using latitude and longitude coordinates.
4. Use 1-2 erroneous locations as examples and help students locate them on their maps.
5. Students should create a key using the following symbols:
   Baseline Observatory - Blue Square
6. Instruct students to go ahead and complete their map by placing a symbol for each observatory location.
7. Students should give the map a title.
8. Students should now complete the **ANALYSIS/COMPREHENSION** questions when they are done with the map part of the activity.

Teacher Sheet 2

PART 2: MONITORING CO_2 AT MAUNA LOA, Hawaii

- Do not project the image of the Mauna Loa set-up- use it as a reference for your review of student work.
- Have students read through the attached list of the steps of the Mauna Loa procedure. (There are 9 steps, which should be included.)
- Discuss each step in detail and encourage students to take notes as needed.
- Explain to the class that each group of 2-3 will be responsible for creating a large visual representation of the monitoring process as done at the observatories using the model from Mauna Loa.
- Divide the class into groups.

2. Students should work with a partner to create a simple simplified, step-by-step diagram of the procedure on the butcher paper.

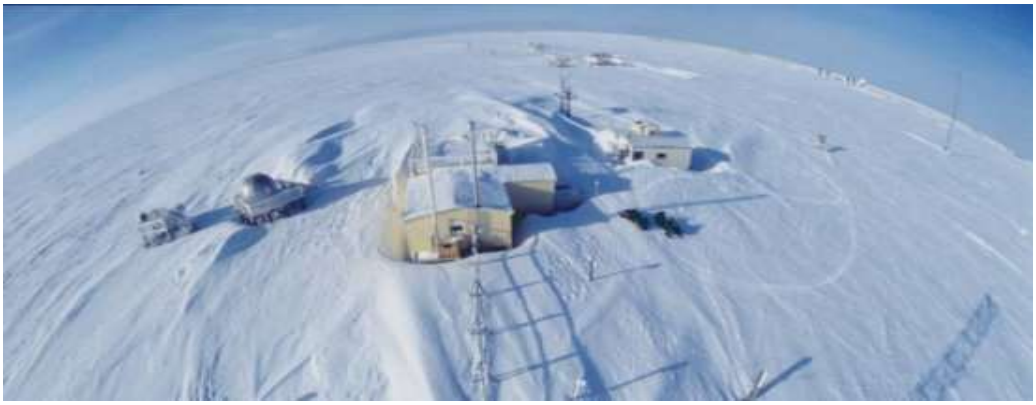
   - Use arrows to show the direction of flow of the gases.
   - Cut out and glue the images provided in the process in the correct order.
   - Label the steps in the diagram and explain what is happening at each step.

3. Have students display their work in the front of the room.

   - Groups should compare their diagrams and make any corrections they feel are needed.

4. Students should complete the **ANALYSIS/COMPREHENSION** questions for **PART 2.**

NOAA BASELINE OBSERVATORIES



Barrow, Alaska Observatory

Latitude: 71.32° North Longitude: 156.61° West

Summit, Greenland Observatory

Latitude: 72.58° North Longitude: 38.48° West

Trinidad Head, CA Observatory

Latitude: 41.05° North Longitude: 124.15° West

Mauna Loa,Hawaii Observatory

Latitude: 19.53° North Longitude: 155.57° West

American Samoa Observatory

Latitude: 14.24° South Longitude: 170.56° West

South Pole, Antarctica Observatory

Latitude: 90° South Longitude: 59° East

Teacher Sheet 4

HOW CO_2 IS MEASURED AT MAUNA LOA

1. Air comes into the lab from the top of a 300-foot tower. The tower is above the level where it would be polluted by people and machines in the lab.
2. A pump pulls the air in through thin stainless steel tubes and forces it into the different pieces of lab equipment. (Stainless steel will not react with the gases.)
3. The air enters a kind of "freezer" where the water vapor is taken out
4. The air goes into a dry test chamber in the analyzer.
5. The air is warmed by infrared energy in the analyzer by a heating coil. (Infrared energy is easily absorbed by greenhouse gases.)
6. A thermometer in the analysis chamber measures the temperature of the gas. The warmer the gas the more CO_2 it contains.
7. Two regulating tanks with exact concentrations of CO_2 are connected to the chamber to be measured.
8. Valves open and close the tanks and control the movement of the air into and out of the chamber.
9. A computer analyzes the measurements and provides a read-out for scientists with the recorded levels of CO_2 in the samples measured.
10. The data on the computer is then made available to scientists around the globe through the Internet.