

# How Clean is My Air?

## Eco-Standards Check Activity

### Essential Question(s):

*What is in the air? Is our club site air clean?*

**At a Glance:** Learners will learn the importance of trees as air purifiers. Learners will conduct a research activity measuring dust in the air as well as ozone in order to test air quality on their school site and then compare it over time with samples taken in the future.

### Background Information:

Tiny particles of matter swirl about constantly in the air that we breathe. Airborne particles can clog ventilation and cooling equipment, interfere with the performance of motors, and intensify health problems for many people. The amount and composition of airborne “dust” varies throughout the year, due partly to environmental factors such as wind and rainfall, human activities such as plowing or harvesting agricultural fields, and the life cycles of plants and fungi.

Indoor dust consists of large amounts of finely-broken-up fibers from fabrics of all types, including draperies, carpets, upholstery material, and clothing. Household paper products also shed a substantial amount of fibers. Other sources of indoor airborne matter include pollen from flowering plants, small fragments of tiny insects, residues from tobacco smoke, dander (skin flakes) and fur from house pets, tiny flakes of dead skin from humans, and spores from molds and yeasts that flourish in moist, poorly-ventilated areas, such as bathroom shower areas.

Outdoors, dead leaves and other vegetative matter sometimes decompose to a dry, crumbly state, particularly during dry weather. Agricultural activity breaks dry soil into fine particles that become windborne, and traffic traveling over unpaved roads has the same effect. Industrial smokestacks, household heating systems (including woodstoves and fireplaces), and automotive exhausts emit variable amounts of fine soot into the air. This particulate matter is called a *primary pollutant* because it is released directly into the air.

Another air pollutant is ground-level ozone (O<sub>3</sub>). This is the major component of smog and is a product of emissions from manmade substances and machines. This ozone can be harmful to the health of humans and other life on Earth. Naturally occurring ozone can be found about six miles up in the stratosphere. This ozone is very beneficial because it absorbs UV radiation, preventing it from reaching us. Ozone, regardless of where it is found, is a highly reactive gas that is a form of oxygen (O<sub>2</sub>).

Ground-level ozone reacts chemically with internal body tissues, such as those in the lungs. It is produced when volatile organic compounds (VOCs) and nitrous oxide (NO<sub>x</sub>) are combined in the presence of heat and sunlight. VOCs include compounds such as benzene and hexane and are known to be toxic to humans at high levels. Many VOCs surround us every day, including emissions from paints, paint thinners and dry cleaning chemicals. Some, like benzene, make their way inside buildings through pollution from traffic outside. The NO<sub>x</sub> are a byproduct of burning fuel in sources such as motor vehicles, power plants, and factories.

**Location:** Checkpoints outdoors

**Objectives:** *Learners will*

- 1) collect data on the number of trees, amount of particulate matter and wind patterns on the club site.
- 2) formulate questions about the interactions between the air cleaning department and the social systems and features of the club site.

**Skills:** data collection, observation, analysis, communication, inference

**Supplies:**

- Tree Finder Guide
- chalk
- petroleum jelly (Vaseline)
- string
- hole punch
- laminating sheets or clear contact paper
- index cards
- Air Purification Color Scale
- Plastic wrap to save cards for later comparison

**Subject:** science

**Time:** 10 minutes

Trees and other plants are excellent air purifiers of all air pollutants, but in many urban areas, trees are losing ground to lawns and asphalt. Plants act as air purifiers by removing dust and other pollutants from the air. The wind carrying the dust particles is slowed by the trees and by the large surface area of the leaves that collect the dust. They have also been scientifically proven to reduce VOCs. Separate research studies by NASA and an Australian science team demonstrated that plants could reduce from 80 – 100% of the harmful VOCs in a closed environment. Lower levels of VOCs in the air help prevent the formation of ground-level ozone.

A goal of the Garden Earth project is to improve the health of the ecosystem on your club site. In the case of the Air Cleaning Department, this can be done through planting trees and green plants or through working to reduce air pollution. In this activity, learners will investigate the health of the Air Purification Department on the school site by measuring the amount of dust in the air.

### **NO<sub>x</sub>**

- is one of the main ingredients involved in the formation of ground-level ozone, which can trigger serious respiratory problems.
- reacts to form nitrate particles, acid aerosols, as well as NO<sub>2</sub>, which also cause respiratory problems.
- contributes to formation of acid rain.
- contributes to nutrient overload that deteriorates water quality.
- contributes to atmospheric particles that cause visibility impairment.
- reacts to form toxic chemicals.
- contributes to global warming.

*See Also: Air Pollution Fact Sheet – Ozone Air Pollution  
Background Information for Garden Earth: Air Cleaning Department.*

### **Getting Ready:**

Gather all supplies needed for the activity. Before starting the activity, make sure you have some suitable test locations in mind, preferably as different as possible. Are you doing this as a large group activity or are you splitting the learners into smaller groups?

### **Procedure:**

#### **Introduction**

Ask the learners if they enjoy clean air. Explain to learners that our bodies need oxygen found in air to carry out cellular respiration, which is necessary for our bodies to survive and function properly. Tell learners that the pollution we create, as humans, directly affects our own health as well as the health of all life around us. How does air remain clean even though humans create pollution? Discuss the importance of trees and other green plants in cleaning the air of dust particles and gases. (Learners may have already watched the puppet show “A Visit with Old Man Spruce”). Explain to learners that they will monitor the school site each year to see how the Air Cleaning Department functions on the school site and how it changes over time. In order to compare the air quality from year to year, learners must collect the same data each year. In the first year, the learners will be collecting “baseline data”. Scientists routinely collect baseline data when they begin a



scientific investigation. Making a map of your school site will aid the collection of data in subsequent years.

### **Dust in the Air**

1. Explain the following to the learners: Plants act as air purifiers by removing dust from the air. In this Standards Check, learners will measure the amount of dust in the air at several locations on the club site. Save your samples for comparison in later years.
2. Tests will be conducted at Checkpoints. At least one Checkpoint should be an area that receives dust from a football field, dirt path, or near a road or parking lot. Another area might be near trees. Be sure to record the exact location of your test on a map of your school site because you will repeat it in subsequent years.
3. Cut a transparency sheet into three long strips or four equal sections, and use a hole punch to make one hole at the top of each strip. Give one strip to each learner.
4. Ask each learner to tie a piece of string to the strip and coat the strip lightly on one side with petroleum jelly.
5. Ask learners to suspend the transparency strips in the air by tying them to an object (tree) with the string. Ideally, the strips should be free to move in all directions without rubbing against any surface. Leave the strips in place for two days.
6. After two days, learners will collect the strips, place them on top of a white index card, and cover each strip with clear contact paper.
7. Learners will then compare the strips from each site and select the one from each site that has the most dust on it. They can match the amount of dust on each strip to the gray shade that it most closely resembles on the Air Purification Color Scale, and record those numbers on the master data sheet in the school log. If microscopes are available, learners can also examine the dust closely to determine its source.
8. Retain the dust samples for comparison in later years by wrapping in plastic wrap.

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### **Formulating Questions**

Ask learners to think about questions they came up with during the activity. Ask learners to choose the question their most well-thought-out question, write it on a slip of paper, and hand it in to the leader. These questions can be used for additional Garden Earth Naturalist investigations or they can be used as the basis for science fair experiments.

### **Discussion/Assessment:**

- What did we find out from our results?
- How did the results compare to what we imagined might have happened?
- What else could we do to investigate air quality?
- What factors influenced our results?
- What could we do to improve air quality?

### **Connections**

[http://www.ozoneny.org/about\\_ozone/how\\_plants\\_reduce\\_it.asp](http://www.ozoneny.org/about_ozone/how_plants_reduce_it.asp)

**Air Cleaning Department**  
***ECO-STANDARDS CHECK***

**HOW CLEAN IS MY AIR?**

Team Members \_\_\_\_\_ Date \_\_\_\_\_ Time \_\_\_\_\_

Checkpoint # or Name \_\_\_\_\_

Weather Conditions \_\_\_\_\_

Temperature \_\_\_\_\_ Humidity \_\_\_\_\_

Time: 10 minutes

**INSTRUCTIONS:** Use the Air Purification Color Scale (APCS) for rating the sample cards: 1 – very good; 2 – fair; 3 – poor; 4 – bad.

Exact Location for hanging card (checkpoint # & Paces N S E or W)	Air Purification Color Scale (APCS) Rating



1 - very good

2 - fair

3 - poor

4 - bad