

MISSION BRIEFING

Activity: Aerosol Sensor

Prep Time: 20 minutes 

Activity Length: 45-60 minutes 

Task: Participants will work in groups to make an aerosol sensor, a simple adhesive tool that allows them to collect data and estimate the extent of aerosols present in their surrounding outdoor and indoor environment.

By the end of this activity participants will

gain an understanding of data collection and interpretation as they explore and observe the amounts of aerosols present in the air around them.

Materials

- White paper plates or cardboard for each research team.
- Contact paper or alternative adhesive, petroleum jelly.
- Duct tape
- Wooden blocks/bricks
- Spoon or plastic knife to spread the petroleum jelly if using that method.
- Crayons or markers

Note: This activity is adapted from GLOBE's Up in the Air Activity. Contact paper with gridded backing is the recommended adhesive option for standardized data collection and clean set-up. Petroleum jelly is another adhesive option if more readily available.

Preparation

1. Read through the activity and related background information.
2. Gather and prepare all listed supplies.

Procedure

1. Divide participants into research teams of two to three.
 - a. Older participants should be able to conduct the activity individually or with a partner.
 - b. Younger members will need assistance in securing the aerosol sensors and ensuring proper, safe locations are selected.
2. Assign or have participants select four or more indoor and outdoor locations where they would like to place their aerosol sensors to test the atmosphere.
3. Individually label the back of each aerosol sensor (plate) from A-D and fill out the table below, leaving the last column blank for now.

Prior Knowledge:

Before beginning the lesson, ask participants the following questions and initiate a group discussion:

- What is an aerosol?
- What does it mean when we see haze outside?
- How do you and your family release aerosols into the atmosphere? Consider reading the elementary GLOBE resource [Exploring Colors in the Sky](#) with the participants to review topics like the atmosphere and aerosols.



NASA Science Connection

NASA observes Earth and other planetary bodies via satellite-, aircraft-, and spacecraft-borne sensors that detect and record reflected or emitted energy. One of the ways NASA uses satellites orbiting Earth is to keep an eye on air pollution. TEMPO (Tropospheric Emissions: Monitoring of Pollution) will measure air pollution hourly across the North American continent during daytime. Other satellites, like [Aqua](#), [CALIPSO](#), [Terra](#), and [IceSAT-2](#), specifically measure aerosols.

To learn more about TEMPO visit:

<https://weather.ndc.nasa.gov/tempo/>



MISSION GUIDANCE

GO

- Ensure participants have a background on [air pollution](#) and [aerosols](#).
- Select a time period during which there is no rain or snow.
- Allow participants to draw the aerosols or particulate matter they observe.

MAYBE

- Show participants the [Surprisingly STEM video](#) about how NASA uses specialized technology to provide clean air to astronauts aboard the International Space Station.
- Allow participants to photograph the samplers before exposure to the test areas. This will allow participants to compare sensors before and after collection.

NO GO

- Do not allow participants to wander the premises.



Air Pollution



Aerosols



STEM Video

| Aerosol Sensor | Location | Inside/Outside | Time Exposed | Rank (cleanest to dirtiest) |
|----------------|----------|----------------|--------------|-----------------------------|
| A | | | | |
| B | | | | |
| C | | | | |
| D | | | | |

- Create four sensors. Use the duct tape to securely attach a paper plate to a brick or other device to the test sensor.
 - Participants may have to anchor the sampler if the air is windy. Make sure the paper plate is firmly taped to the device anchoring or holding the sensor.
- After the paper plate or cardboard is secured, do one of the following:
 - Tape a piece of contact paper in the center of the plate or cardboard with the sticky side up, keeping the protective backing ON the contact paper.
 - Use a spoon or plastic knife to coat the top of the paper plate with petroleum jelly.
- Expose the sampler to the outside or indoor air for at least 2 hours, but for best results leave the sensors in the testing areas for up to 24 hours or multiple days.
- After at least 2-24 hours, have research teams collect the samplers.
- Have participants observe the aerosols or particulate matter that adhered to the plate and compare the aerosols collected from each group. Optional: Provide participants with magnifying glasses to see smaller particles.
- Task research teams to rank the locations from cleanest (1) to dirtiest (4) in the table and answer the following questions.

Challenge Questions

- Can you see any particles in the petroleum jelly or contact paper?
- Did the indoor aerosol sensors have more or less particles than the outdoor ones?
- What types of weather conditions could cause the results to change? Why? (Conditions like wind, rain, snow, or extreme heat could cause a change in results. These conditions affect the amount of aerosols present in the air.)
- What other methods might your team use to collect data on atmospheric particulates? (Observe deposits of aerosols on objects, i.e., cars, glass, furniture.)

Extensions

- Experimental Design: After participants experience a basic concept of how their sensors can detect aerosols, they may design a contraption that reduces aerosols to improve air quality in their community. Designs can be planned out on paper, graphically or built using household or craft supplies.
- Compare Samples Across Multiple Days: Have participants prepare additional aerosol samplers to take outside each day. Remind them to record weather conditions each day the sampler is exposed to the open air. The participants can then compare the average aerosols to the weather conditions.
- GLOBE "Up in the Air" – Students can complete this extended version that includes random sampling.



GLOBE Up in the Air

**ISS
FUN
FACT!**

With three to ten astronauts living in such a tight, enclosed space, air management on station is critical! Life support systems on the space station must not only supply oxygen and remove carbon dioxide from the cabin's atmosphere, but also prevent gases like ammonia and acetone, which people emit in small quantities, from accumulating. Living in space isn't easy!

