

# Particle Pollution Activity – Paper Wad Game



**Grades: 6-12**

**Subject: Science**

**Time: 15 minutes**

## Student Objectives

- Understand the meaning of particle pollution.
- Identify sources of particle pollution.
- Understand the health problems associated with particle pollution and how our bodies work to protect us.
- Identify ways to reduce particle pollution.

## Materials

- Swim noodle
- Golf ball
- Grain of sand
- Baseball-size paper wads (25 +/- paper wads depending on the number of participants) – these represent coarse particles in particle pollution.
- Marble-size paper wads (50 +/- paper wads depending on the number of participants) – these represent fine particles in particle pollution.

## Background Information

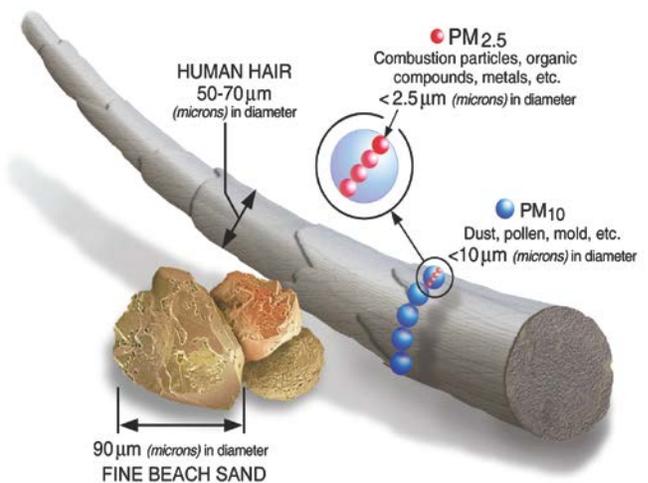
In this activity, students pretend to be cilia, tiny hairs that protect and filter out particles in the lungs. As cilia, participants wave their arms and smack away particulate matter in the form of paper wads.

Particulate pollution, also called particulate matter (PM) is a combination of tiny solid and liquid materials found in the air. Examples include dust, pollen, mold, and even metals. Potential sources include industries, power plants, automobiles, fires, construction sites, and unpaved roads.

Air monitoring stations throughout the US measure particulate pollution of various ranges, but most monitor for PM<sub>2.5</sub> and PM<sub>10</sub>.

- PM<sub>2.5</sub> - “fine particles” that are smaller than 2.5 micrometers in diameter.
- PM<sub>10</sub> - both “fine particles” (PM<sub>2.5</sub>) and “coarse particles” (PM<sub>10-2.5</sub>)
  - PM<sub>10-2.5</sub> – “course particles” that are larger than 2.5 micrometers in diameter and smaller than 10 micrometers in diameter.

The largest fine particle (measuring 2.5 micrometers in diameter) is almost 30 times smaller than the average human hair (averaging 70 micrometers in diameter).



*Image courtesy of the U.S. EPA*

## Setting the Stage

- Ask the students how we know air pollution exists. Are air pollutants visible?
- Have the students give examples of visible air pollutants (e.g., smoke, dust, smog, etc).
- Define PM for the students by sharing the “Background Information.”
- Use the materials when discussing PM. Show students the image of human hair, fine beach sand, and particulate matter (PM). Tell students that the swim noodle represents a human hair, the golf ball represents PM<sub>10</sub> and the grain of sand represents PM<sub>2.5</sub> “fine particles” in the image.
- Discuss the health problems associated with particulate matter. Visit EPA’s website to learn more:  
<https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm>

## Activity

6. Tell students that they are going to do an activity where each of them will pretend to be cilia. Tell participants that cilia are tiny hairs that protect and filter out dust and other particles in the lungs. Tell them that you will be throwing paper wads at them. The paper wads represent coarse

particles in particle pollution (in the image the coarse particles are referred to as PM<sub>10</sub>). *NOTE: you will only be using the baseball-sized paper wads during this section of the activity.*

1. As cilia, students are responsible for protecting the lungs from particle pollution (paper wads). Tell cilia (participants) to wave their arms and if a paper wad comes near them to smack it away. Depending on the size of the group you may need another volunteer to help you throw particle pollution (paper wads) at the cilia (students).
2. After throwing particle pollution (paper wads) at the cilia (students), ask them if it was easy or difficult protecting the lungs from the coarse particle pollution (paper wads).
3. Tell the cilia (students) that they now will be protecting the lungs from fine particles (PM<sub>2.5</sub> in the image). *NOTE: you will only be using the marble-sized paper wads during this section of the activity.*
4. Tell the cilia (students) to again wave their arms and if a paper wad comes near them to smack it away. Again, depending on the size of the group, you may need another volunteer to help you throw particle pollution (paper wads) at the cilia (students).
5. After throwing particle pollution (paper wads) at the cilia (students) ask them if it was easy or difficult protecting the lungs from the fine particle pollution (paper wads). Ask students if it was easier or more difficult protecting the lungs from the coarse particles or fine particles.

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## Activity (Cont.)

9. Collect all the paper wads. Tell the cilia (students) that they now will be protecting the lungs from fine and coarse particles in particle pollution. *NOTE: you will be throwing both the baseball-sized paper wads and marble-sized paper wads in this section of the activity.*
10. Tell the cilia (students) to again wave their arms and if a paper wad comes near them to smack it away.
11. Discuss ways to reduce particle pollution. Examples include:
  - prohibiting smoking indoors,
  - reducing use of candles, woodstoves, and fireplaces,
  - only burning dry, seasoned wood,
  - ensuring woodstoves are EPA-certified (and replacing woodstoves that are not EPA-certified),
  - never burning garbage, and
  - using public transportation, carpooling, biking, or walking to reduce automobile emissions.

## Additional Resources

The Cilia (Not Silly!) Game - San Luis Obispo County Air Pollution Control District

<http://www.slocleanair.org/images/cms/upload/files/programs/kids/pdfs/Cilia%20Game.pdf>

### Reference

U.S. EPA. *Particulate Matter: Basic Information.*

<https://www.epa.gov/pm-pollution>