

Particle Pollution Activity – Paper Wad Game



December 2020

Grades: 6-8

Subject: Science

NGSS Connections: ESS3.C, MS-LS1-3

Time: 15 minutes

Student Objectives

- Define particle pollution
- Discuss potential sources of particle pollution
- Identify health problems associated with particle pollution and how our bodies work to protect us

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 particle pollution in the form of paper wads.

Particle 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 particle pollution of various ranges, but most monitor for PM_{2.5} and PM₁₀.

- PM_{2.5} - “fine particles” that are smaller than 2.5 micrometers in diameter.
- PM₁₀ - both “fine particles” (PM_{2.5}) and “coarse particles” (PM_{10-2.5})
 - PM_{10-2.5} – “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).

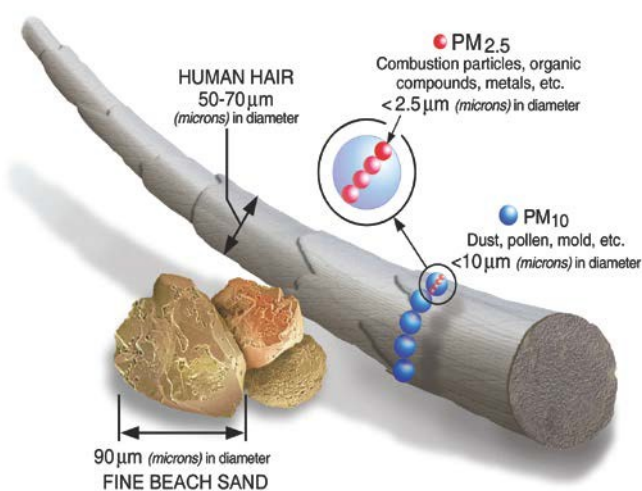


Image courtesy of the U.S. EPA

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Setting the Stage

- Tell students that they are going to play a game where each of them will pretend to be cilia - tiny hairs in the lungs that filter out dust and other particles we breathe in. They will have to block particles (paper balls) from going past them!
- Lead a discussion with students about how we know air pollution exists. Are air pollutants visible, can we use any of our senses to detect some or all of them?
- Have students give examples of visible air pollutants (e.g., smoke, dust, smog, etc).
- Define PM for the students by sharing the “Background Information” above. This information can also be found on the EPA website; the link is listed in the additional resources section at the end of this document.
- Use the materials you collected as props to model the relative size of particulate matter for students. Tell them the swim noodle represents a strand of human hair, the golf ball represents PM₁₀ and the grain of sand represents PM_{2.5} “fine particles” in the image.

Activity

1. Have students stand in an open area (outside, gym, etc.) at least an arms-length distance from one another. Tell them they are the cilia in lungs.
2. 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).
3. 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).
4. Tell the cilia (students) that they now will be protecting the lungs from fine particles (PM_{2.5} in the image). *NOTE: you will only be using the marble-sized paper wads during this section of the activity.*
5. 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)

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Activity (Cont.)

6. 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.
7. 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.*
8. Tell the cilia (students) to again wave their arms and if a paper wad comes near them to smack it away.
9. 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

Reference

U.S. EPA. *Particulate Matter: Basic Information.*
<https://www.epa.gov/pm-pollution>

Teens Health. *Lungs and Respiratory System.*
<https://kidshealth.org/en/teens/lungs.html>