

## **What is in the Air?**

**Author:** *Clay Beck*

**Topic:** Air quality and the impact on human health.

**Targeted Grade Level:** Grade 4

**Time Needed:** *240-300 minutes*

**Subject Integration:** Science, Technology, Math and Drama (Art) are integrated into this unit.

### **Justification:**

Science: Student discover about the environment they live in, the human and nature impacts on it and how that effects quality of life.

Mathematics: Using data collection and pattern recognition to make judgments about real life issues.

ELA and Drama: Using communication skills to demonstrate understanding in real world issues.

### **Enduring Understandings**

- Waste comes from many sources, and we can't always see it with our eyes.
- Air pollution results from the waste products of energy production, industrial processes, daily activities such as driving a car, and even from nature.
- Some pollutants found in the air are toxic to humans and the environment.
- Air quality can impact our health. We can measure and monitor pollutant levels to help keep ourselves safe.
- We can all take steps to help keep our air clean and prevent it from becoming polluted.

**Prior Knowledge** Students should be able to identify natural processes and human technology that produce waste. They should understand that materials are recycled through the environment over and over again. Students should identify clean air as a necessity of life for humans, plants, and animals.

**NGSS Performance Expectations**

**4-ESS3-2.** Reduce the impacts of natural disasters on humans.

**4-ESS3-1.** Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. (Grade 4)

**5-ESS3-1.** Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment. (Grade 5)

**MS-ESS3-3.** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

| Science and Engineering Practices  | Disciplinary Core Ideas  | Crosscutting Concepts:  |
|--|--|---|
| Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. | Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. | A system can be described in terms of its components and their interactions.<br><br>Science findings are limited to questions that can be answered with empirical evidence. |

**Common Core State Standards:**

**Grade 4 Science, Topic A: Waste and Our World**

2. Identify and classify wastes that result from human activity.

4-5 Recognize that human activity can lead to the production of wastes, and identify alternatives for the responsible use and disposal of materials.

7. Identify kinds of wastes that may be toxic to people and to the environment.

11. Identify actions that individuals and groups can take to minimize the production of wastes, to recycle or reuse wastes and to ensure the safe handling and disposal of wastes.

12. Develop and implement a plan to reduce waste, and monitor what happens over a period of time.

**Math:**

Use patterns to describe the world and to solve problems.

Collect, display and analyze data to solve problems.

**ELA:**

Students will listen, speak, read, write, view and represent to enhance the clarity and artistry of communication

Students will listen, speak, read, write, view and represent to respect, support and collaborate with others.

| ITEEA Standards   |
|---|
| <p style="text-align: center;"><b>Drama</b></p> <p style="text-align: center;">GROUP DRAMA</p> <ul style="list-style-type: none"><li>• develop the ability to make decisions in a group: – accept self as part of a group – listen to ideas of another – offer own ideas – become aware of and accept the group purpose</li></ul> |

**Measurable Student Learning Objectives:**

After this activity, students should be able to:

- Explain why air pollutants are harmful to human health and the environment.
- Identify some of the main causes and sources of air pollution.
- Explain the effects of air pollution on humans and their environment.
- Identify some ways to reduce air pollution.

**Nature of STEM:** During this unit students are encouraged to explore and problem solve real life problems through activities that are intended to be as authentic as possible. The students will experience nature-augmented education with real world applications while using technology to create data that they can use to establish ideas air and its role.

**Engaging Context/Phenomena:** [Nasa Image show air pollution drop in India after lockdown](#)

Images of Edmonton before and after a forest fire that effects air quality.

**Data Integration:** *Collecting air quality data for five days. With this information the students can discuss a variety of topics such as:*

- *Is there a difference from indoor and outdoor air?*
- *Are their differences between where you are inside for air quality?*
- *What conditions might affect air quality?*

**Differentiation of Instruction:**

To encourage reluctant participants, use cooperative learning strategies

Inside out circle where students pair up and make two circles, one on the inside one on the outside. Ask them to share their ideas about the problem with the partner across from them. Then have them each take a step right and again ask them to share their ideas about the problem with the partner across from them. Do this a couple of times and each student will have heard several ideas that they can now consider as they move forward in the class.

Post-it note activities where the student can write down their answers and place the on the board or poster can reduce some of the students anxiety.

Use a reading/write program for students that may have difficulty reading or writing down the material.

**Real-life Connection:** *Recently we have had air quality issues due to the greater number of forest fires and increase in their average size. Recommendations were made to stay indoors for health reasons.*

**Lesson Procedure:**

| 5E Model                        | 5E Objectives   |
|---------------------------------|---|
| <p><b>Engage</b><br/>20 min</p> | <p><b>Procedure:</b> <i>Visual of the air in India before and after the pandemic and Edmonton, AB normal day and covered in forest fire smoke</i></p> <p><b>Formative/Summative Assessments:</b> <i>Through classroom discussion</i></p> <p><i>What do you think caused the difference in the picture?</i></p> <p><i>Natural or man-made?</i></p> <p><i>Is there any problems caused by the pollution?</i></p> <p><b>Resources:</b> <a href="https://www.youtube.com/watch?v=7t4sGK8yxYA">visual of India air quality https://www.youtube.com/watch?v=7t4sGK8yxYA</a></p>  |

**Explore**

20 min



**STRAW ASTHMA DEMONSTRATION**

TIME: 15-20 minutes

REQUIRED RESOURCES: straws of different sizes (2 suggested; small/regular & stir stix)

**BEFORE YOU BEGIN:** talk to teacher and let them know there will be an activity that gets the kids physically active and simulates a circumstance where it is difficult to breathe – this serves as a qualifier for any children who may have asthma.

**DESIRED OUTCOMES:**

1. To understand the connection between air quality and health – air quality affect us
2. To encourage making a hypothesis and then testing it out
3. To encourage the use of the Air Quality Health Index (AQHI)

**PRE-STRAW ACTIVITY:**

1. Begin a discussion with students about how air quality affects us:

a. What do our lungs do?

We use our lungs breathe. When we breathe, we inhale oxygen and exhale carbon dioxide. Breathing supplies our blood with oxygen and takes away the carbon dioxide produced by our bodies.

Our blood then delivers the oxygen to all parts of the body.

“We could go days without food and hours without water, but we would last only a few minutes without air”

b. What are some of the things that can hurt our lungs?

Air pollution, smoking, inhaling toxic substances, inactive lifestyles, diseases.

c. What kinds of people would be more sensitive to pollution in the air?

Those with asthma, lung or heart disease, children (breathe faster/more often, are generally outside more), seniors, those with poor health).

“What is something kids do faster than adults?” - breathe

STRAW ACTIVITY:

1. Pass out straws to each student, asking them not to touch them just yet.
2. Instruct children to breathe normally and mentally note how it feels. Before going on, ask children first to hypothesize what they think will happen when we breathe through the different straws.
3. Have each student take the small/regular straw and breathe only through this straw. Ask for feedback on how it feels to breathe through this – harder, more difficult, less intake of air, etc.\*

[simulates breathing when air quality is poor – give examples of when that might happen – e.g. forest fire smoke]

4. Have each student take the stir stick and breathe only through this. Ask for feedback on how it feels to breathe through this – harder, not getting enough air, etc.

[simulates breathing when you have a health condition such as asthma – air flow is restricted due to constricted or narrowing of airways – like the reduction in straw size]

5. Ask the students:
  - a. Do any of the students have asthma?
  - b. Did breathing through the stir stick feel like an asthma attack?
  - c. How might air pollution outside affect someone with asthma?
6. Have students do jumping jacks while you count for ~ 30 seconds (this is where

anyone with asthma would want to sit out). Afterwards have them breathe through the straw again.

[simulates exercising and breathing under poor air quality conditions]

\*this activity simulates polluted (straw) and asthma/further restricted (stir stix), but could be done with just one straw size.

#### POST-ACTIVITY DISCUSSION:

1. What did you notice about breathing through different straw sizes? Were your hypotheses correct?
2. How might a lot of air pollution in the air affect our breathing?  
- mention that air quality is normally good, except if maybe there is forest fire smoke
3. What did you notice when we did the air pollution simulation (straw breathing) after you exercised? - everyone is different, so not everyone will notice a different when they exercise

**Resources:** [Straw Asthma Activity](#)

**Procedure:** Read "Why is Coco Orange"

|   |  |
|---|--|
| <p><b><u>Explain</u></b><br/>20 min</p>   | <p><b>Formative/Summative Assessments</b><br/><i>Have students answer questions on Page 28 of "Why Coco is Orange?"</i></p> <p><b>Resources</b><br/><a href="#">"Why is Coco Orange?" Picture Book</a><br/><a href="https://www.airnow.gov/why-is-coco-orange-publications/">Why is Coco Orange? video https://www.airnow.gov/why-is-coco-orange-publications/</a></p>   |
| <p><b><u>Elaborate</u></b><br/>90 min</p> | <p><b>Procedure:</b> <i>Air quality data collection</i><br/><i>Full Lesson</i> <a href="https://airquality.kcvs.ca/TWOSE/section3page1b.html">https://airquality.kcvs.ca/TWOSE/section3page1b.html</a></p> <p>Time Required • 90 minutes, plus data collection over 5 days Preparation • Gather all materials • Review teacher's background information, if necessary • Review PocketLab Air user guide, if necessary • Create data collection schedule</p> <p>Outline</p> <ol style="list-style-type: none"><li>1. Introduce the lesson.<ul style="list-style-type: none"><li>• Ask student to discuss the air quality in their community</li></ul></li><li>2. Discuss the Alberta AQHI scale<ul style="list-style-type: none"><li>• Show students the scale and graphics</li><li>• Discuss what each level means</li></ul></li><li>3. Discuss the Alberta AQHI online mapping tool<ul style="list-style-type: none"><li>• Show the students the map and discuss the types of information it can generate</li></ul></li></ol> |

4. Discuss fine particulate matter

- Have students recall what they learned about this pollutant in the previous lesson

5. Generate predictions about levels of particulate matter at the school

- Have students brainstorm where fine particulate matter levels might be higher around the school
- Collect predictions and record them on the board

6. Explain the activity and PocketLab Air

- Explain how to use the sensor to collect fine particulate matter data
- Explain the activity (using the sensor to collect fine particulate matter data at locations around the school)
- Divide students into groups and create a schedule for data collection

7. Debrief

- Discuss the data that the students collected; look for themes and trends
- Compare the data to the AQHI online mapping tool data for the same time frame (optional need to create a class schedule as there is only one air sensor. Students must record their data on the worksheet and return it to you at the end of the 5 days. Have students collect data over the course of the week. They should submit their observation sheet at the end of the week so you can compile the data in advance of the concluding discussion.

**Modifications :** If you do not have Pocketlab Air you get real time data from online air quality websites.

Alberta <http://www.airquality.alberta.ca/map> USA <https://aqicn.org/city/usa/>

**Formative/Summative Assessments**

|                 |   |
|-----------------|---|
|                 | <ul style="list-style-type: none"><li>• Students should actively participate in the experiment, follow instructions, and complete their worksheet independently.</li><li>• Students will make observations throughout the experiment and make connections between what is happening in the experiment and air pollution.</li><li>• Students complete the follow up questions provided with their worksheet. This assessment can be completed informally as a class discussion or formally by having each student submit their questions in writing.</li></ul> <p><b>Resources:</b> Pocketlab Air Sensor, Observation Sheet, <a href="https://airquality.kcvs.ca/TWOSE/section3page1b.html">https://airquality.kcvs.ca/TWOSE/section3page1b.html</a></p> |
| <b>Evaluate</b> | <p><b>Procedure: Air quality play</b></p> <p><a href="#"><i>The Day the Air Gremlins Came to Town</i></a></p> <p>Group activity</p> <p><i>Student will modify the play to add what they have learned through the unit using personal experiences.</i></p> <ul style="list-style-type: none"><li>• <i>Information about sources of air pollution</i></li><li>• <i>Use of AQHI</i></li><li>• <i>Reducing air pollution</i></li></ul> <p><b>Resources</b> <a href="#"><i>The Day the Air Gremlins Came to Town</i></a></p>   |

**Teacher Background:**

[ELA program of studies - Alberta](#)

[Science program of studies - Alberta](#)

[Mathematics program of studies - Alberta](#)

[Drama program of studies - Alberta](#)

[Sources of air pollution](#)

[The Day the Air Gremlins Came to Town](#)

[Air Quality Resources](#)      <https://www.alberta.ca/air-quality-health-index--resources.aspx>

**Fort McMurray Fires Cause Air Quality Issues**

<https://www.nasa.gov/feature/goddard/2016/fort-mcmurray-fires-cause-air-quality-issues>

The air quality around the entire Fort McMurray region remains very poor. The Alberta Health Services has issued warnings for the entire area with Health Quality Index of 10+ (very high risk of triggering health issues) reported in the area. As evidenced in these images from the morning and evening passes of the Terra and Aqua satellites respectively, huge amounts of smoke are still billowing into the atmosphere. The Alberta Health Services has issued an air-quality advisory for the Fort McMurray area, as well as a precautionary air-quality advisory for Edmonton and communities in the North Zone due to wildfires. Real-time air-quality data and information is available at: [www.environment.alberta.ca/apps/aqhi/aqhi.aspx](http://www.environment.alberta.ca/apps/aqhi/aqhi.aspx).

[NASA worldview](#) - forest fire and smoke locations – real time

### [Aura Mission NASA](#)

[https://www.nasa.gov/mission\\_pages/aura/main/index.html](https://www.nasa.gov/mission_pages/aura/main/index.html)

-- Understanding and Protecting the Air We Breathe

1. **Product Type:** Websites
2. **Audience:** Educators
3. **Grade Levels:** 5-8, 9-12, Higher Education

Read an overview of the Aura mission that is studying Earth's atmosphere and ozone layer.

### **The Air We Breathe Picture Book**

<https://www.nasa.gov/stem-ed-resources/the-air-we-breathe.html>

1. **Product Type:** Play and Learn
2. **Audience:** Educators, Students
3. **Grade Levels:** K-4

This colorful picture book is designed to introduce Earth's atmosphere and its importance to life on Earth. It's appropriate for students in grades K-4.