



# ***Air - The Search for One Clean Breath***

## **Educators' Guide** **Grades 6-12**

Presented by the



**Ventura County**  
**Air Pollution**  
**Control District**

February 2010

# Acknowledgements

*Air — The Search for One Clean Breath*, a documentary film  
**Barbara Page**, film Executive Producer and co-Project Manager for the Educator's Guide, Ventura County Air Pollution Control District

**Celeste Royer**, co-Project Manager for the Educator's Guide and Statewide Director, California Regional Environmental Education Community (CREEC) Network, San Luis Obispo County Office of Education

*Funding for the development of this Educators' Guide was provided through the support of the Ventura County Air Pollution Control District, Ventura, California*

*Thank you to the CREEC Network for its contribution to the development of this Guide. The CREEC Network provides educators with access to high quality environmental education resources to enhance the environmental literacy of California students. Visit [www.creec.org](http://www.creec.org) for more information.*

## **Ventura County Air Pollution Control District**

669 County Square Drive, Second Floor  
Ventura, California 93003  
(805) 645-1415  
[www.airthefilm.org](http://www.airthefilm.org)

## **Film Awards**

U.S. Environmental Protection Agency's Clean Air Excellence Award, 2008  
22<sup>nd</sup> Annual Mercury Communications Gold Award of Excellence, 2009

© Copyright 2010

By the Ventura County Air Pollution Control District (VCAPCD).

All rights reserved. This publication, or parts thereof, may not be used or reproduced without permission from the VCAPCD. These materials may be reproduced by teachers for educational purposes.

## **A MESSAGE TO EDUCATORS:**

Over the past few years, I have had the pleasure of producing the award-winning international film, *Air – The Search for One Clean Breath*. This environmental movie, filmed high definition, tells the story of air – up-close and personal. With its sweeping vistas and historical footage, it has received worldwide acclaim, including the coveted Clean Air Excellence Award from the United States Environmental Protection Agency.

But there's more. As part of our grant obligation, we have created an Educator's Guide to the film. The guide takes middle and high school students beyond the film by expanding on concepts we introduced in the movie. The lessons were created and field tested by California middle and high school instructors. Lessons deal with large themes: climate change, air transport, air quality and transportation, alternative energy, and many others. The lessons are correlated to the California content standards in Science and History/Social Science, the National Science standards, and the National Geography standards. They have been reviewed by our air quality experts here at the District. I hope these lessons give students environmental insights that will last them a lifetime. As was said in the film, "Since it's our air and we all have to breathe it, it's important that we help clean it up."

I hope you enjoy presenting this material to your students as much as we enjoyed creating it for you. We would appreciate it if you would complete the evaluation available at [www.airthefilm.org](http://www.airthefilm.org). And thanks for helping us spread the word about clean air to students all over this country.

**Barbara L. Page**, Executive Producer

*Air – The Search for One Clean Breath*

Ventura County Air Pollution Control District, Ventura, CA

February 2010

# Contributors

## Writing

**Debra Bereki**, Doctoral student in Science Education,  
University of California, Santa Barbara

**Commuter Match & Math**  
**Our Energy Diet**  
**Taking Action**

**Christine Gathman**, Oxnard Union High School District, Oxnard, CA  
Oxnard High School Science Teacher

**Analyzing Energy**  
**Effects of Global Warming**  
**Where Does Our Pollution Go?**

**Dave Massey**, Santee Unified School District, Santee, CA  
Chet F. Harritt Middle School, Retired Science Teacher

**Air Pollution Tragedy: A Case Study**  
**Carbon Dioxide in Ice Core Samples**  
**Navigating Opinion in Search of Factors**

## Editing

**Diana Barnhart**, San Luis Coastal Unified School District, Los Osos Middle  
School, Retired Science Teacher, California Teacher of the Year 2006

**Barbara L. Page**, VCAPCD  
**Celeste Royer**, CREEC Network

## Field testing

- **John Forte**, Atascadero High School
- **Mary Funk**, Burrel Union Elementary
- **Steve Gade**, Morro Bay High School
- **Nathan Inouye**, Adolfo Camarillo High School
- **Diana Petropulos**, Santa Paula Union High School
- **Josh Rubin**, Woodside High School
- **Mark Schmidt**, Ventura High School
- **Lorraine Wood-Newberry**, Rio Mesa High School

# Table of Contents

**Lesson 1: .....Air Pollution Tragedy: A Case Study**

**Lesson 2: .....Analyzing Energy**

**Lesson 3: .....Carbon Dioxide in Ice Core Samples**

**Lesson 4: .....Commuter Match & Math**

**Lesson 5: .....Effects of Global Warming**

**Lesson 6: .....Navigating Opinion in Search of Factors**

**Lesson 7: .....Our Energy Diet**

**Lesson 8: .....Where Does Our Pollution Go?**

**Lesson 9: .....Taking Action**



## Air: The Search for One Clean Breath Educators' Guide - Content Standards Matrix

Lesson	California Science Standards	National Science Standards	California History/ Social Science Standards	National Geography Standards	Education & the Environment Environmental Principles & Concepts
<b>Air Pollution Tragedy</b>	<b>HS 9-12 Ecology 6.b.</b> Students know how to analyze changes in the ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.	<b>HS 9-12 Science &amp; Technology Content Standard E.</b> Students should develop understanding about science and technology.		<b>Grades 9-12 Standard 14.3.b.</b> Students know the significance of the global impacts of human modification of the physical environment.	<b>Principle IV:</b> The exchange of matter between natural systems and human societies affects the long-term functioning of both. <b>Concept a.</b> Students need to know that the effects of human activities on natural systems are directly related to the quantities of resources consumed and to the quantity and characteristics of the resulting byproducts. <b>Concept b.</b> Students need to know that the byproducts of human activity are not readily prevented from entering natural systems and may be beneficial, neutral, or detrimental in their effect.
		<b>HS 9-12 Science in Personal and Social Perspective Content Standard F.</b> Students should develop understanding of personal and community health and natural and human-induced hazards.			<b>Same as above</b>
<b>Analyzing Energy</b>	<b>Grade 6, 6.a.</b> Students know the utility of energy sources is determined by factors that are involved in converting these sources to useful forms and the consequences of the conversion process.				
	<b>Grade 6, 6.b.</b> Students know the different natural energy and material resources, including air, soil, rocks, minerals, petroleum, fresh water, wildlife, and forests, and know how to classify them as renewable or non-renewable.				
	<b>HS Chemistry 7.b.</b> Students know chemical processes can either release (exothermic) or absorb (endothermic) thermal energy.	<b>HS 9-12 Science &amp; Technology Content Standard E.</b> Students should develop understanding about science and technology.			
	<b>HS Chemistry 7.c.</b> Students know energy is released when a material condenses or freezes and is absorbed when a material evaporates or melts.	<b>HS 9-12 Science in Personal and Social Perspective Content Standard F.</b> Students should develop understanding of natural resources, environmental quality, and science and technology in local, national, and global challenges.			

Lesson	California Science Standards	National Science Standards	California History/Social Science Standards	National Geography Standards	Education & the Environment Environmental Principles & Concepts
<p><b>Carbon Dioxide in Ice Core Samples</b></p>	<p><b>Grade 7, 4.a.</b> Students know Earth processes today are similar to those that occurred in the past and slow geologic processes have large cumulative effects over long periods of time.</p> <p><b>Grade 7, 4.b.</b> Students know the history of life on Earth has been disrupted by major catastrophic events, such as major volcanic eruptions or the impacts of asteroids.</p> <p><b>Grade 7, 4.c.</b> Students know that evidence from geologic layers and radioactive dating indicates Earth is approximately 4.6 billion years old and that life on this planet has existed for more than 3 billion years.</p> <p><b>Grade 7, 4.d.</b> Students know fossils provide evidence of how life and environmental conditions have changed.</p> <p><b>HS Earth Science 7.b.</b> Students know the global carbon cycle: the different physical and chemical forms of carbon in the atmosphere, oceans, biomass, fossils fuels, and the movement of carbon among these reservoirs.</p>	<p><b>Grades 5-8 Physical Science Content Standard B.</b> Students should develop an understanding of properties and changes of properties in matter.</p>			<p>Same as above</p>



Lesson	California Science Standards	National Science Standards	California History/Social Science Standards	National Geography Standards	Education & the Environment Environmental Principles & Concepts
<b>Commuter Match and Math</b>	<b>Grade 6, 6.a.</b> Students know the utility of energy sources is determined by factors that are involved in converting these sources to useful forms and the consequences of the conversion process.	<b>Grades 5-8 Science &amp; Technology Content Standard E.</b> Students should develop understanding about science and technology.		<b>Grades 5-8 Standard 14.2.c.</b> Students know and understand the role of technology in the human modification of the physical environment.	Same as above
	<b>HS Earth Science 7.b.</b> Students know the global carbon cycle: the different physical and chemical forms of carbon in the atmosphere, oceans, biomass, fossils fuels, and the movement of carbon among these reservoirs.	<b>HS 9-12 Science &amp; Technology Content Standard E.</b> Students should develop understanding about science and technology.	<b>Grade 11 U.S. History 11.11.</b> Students analyze the major social problems and domestic policy issues in contemporary American society.		
	<b>HS Ecology 6.b.</b> Students know how to analyze changes in the ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.				
<b>Effects of Global Warming</b>	<b>HS Ecology 6.d.</b> Students know how water, carbon, and nitrogen cycles between abiotic resources and organic matter in the ecosystem and how oxygen cycles through photosynthesis and respiration.				
	<b>HS Earth Science 6.c.</b> Students know how Earth's climate has changed over time, corresponding to changes in Earth's geography, atmospheric composition, and other factors, such as solar radiation and plate movement.	<b>HS 9-12 Science &amp; Technology Content Standard E.</b> Students should develop understanding about science and technology.		<b>Grades 5-8 Standard 14.3.b.</b> Students know the significance of the global impacts of human modification of the physical environment.	Same as above
	<b>HS Earth Science 6.d.</b> Students know how computer models are used to predict the effects of the increase in greenhouse gases on climate for the planet as a whole and for specific regions.				

Lesson	California Science Standards	National Science Standards	California History/ Social Science Standards	National Geography Standards	Education & the Environment Environmental Principles & Concepts
<p><b>Navigating Opinion in Search of Facts</b></p>			<p><b>Grade 12 American Democracy 12.3.</b> Students evaluate, take, and defend positions on what the fundamental values and principles of civil society are (i.e. the autonomous sphere of voluntary personal, social, and economic relations that are not part of government), their interdependence, and the meaning and importance of those values and principles for a free society.</p>		<p>Same as above.</p>
			<p><b>Grade 12 American Democracy 12.6.</b> Students evaluate issues regarding campaigns for national, state, and local elective offices.</p>		
			<p><b>Grade 12 Economics 12.1.</b> Students understand common economic terms and concepts and economic reasoning.</p>		
			<p><b>Grade 12 Economics 12.3.</b> Students analyze the influence of the federal government on the American economy.</p>		
			<p><b>Grade 12 Economics 12.5.</b> Students analyze the aggregate economic behavior of the U.S. economy.</p>		

Lesson	California Science Standards	National Science Standards	California History/Social Science Standards	National Geography Standards	Education & the Environment Environmental Principles & Concepts
<b>Our Energy Diet</b>	<p><b>Grade 6, 6.a.</b> Students know the utility of energy sources is determined by factors that are involved in converting these sources to useful forms and the consequences of the conversion process.</p> <p><b>HS 9-12 Ecology 6.b.</b> Students know how to analyze changes in the ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.</p>	<p><b>Grades 5-8 Science &amp; Technology Content Standard E.</b> Students should develop understanding about science and technology.</p> <p><b>HS 9-12 Science &amp; Technology Content Standard E.</b> Students should develop understanding about science and technology.</p>		<p><b>Grades 5-8 Standard 14.2.c.</b> Students know and understand the role of technology in the human modification of the physical environment.</p>	<p>Same as above</p>
<b>Taking Action</b>	<p><b>Grade 6, 7.d.</b> Students will communicate the steps and results from an investigation in written reports and oral presentations.</p> <p><b>Grade 7, 7.e.</b> Students will communicate the steps and results from an investigation in written reports and oral presentations.</p> <p><b>Grades 9-12 Investigation &amp; Experimentation 1.i.</b> Students will analyze situations and solve problems that require combining and applying concepts from more than one area of science.</p> <p><b>Grades 9-12 Investigation &amp; Experimentation 1.m.</b> Students will investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings.</p>	<p><b>Grades 5-8 Science &amp; Technology Content Standard E.</b> Students should develop understanding about science and technology.</p> <p><b>HS 9-12 Science &amp; Technology Content Standard E.</b> Students should develop understanding about science and technology.</p>	<p><b>Grade 11 U.S. History 11.11.</b> Students analyze the major social problems and domestic policy issues in contemporary American society.</p> <p><b>HS 9-12, 11.11.</b> Students analyze the major social problems and domestic policy issues in contemporary American society.</p>	<p><b>Grades 9-12 Standard 14.3.c.</b> Students know and understand how to apply appropriate models and information to understand environmental problems.</p> <p><b>Grades 5-8 Standard 14.2.c.</b> Students know and understand the role of technology in the human modification of the physical environment.</p> <p><b>Grades 9-12 Standard 14.3.c.</b> Students know and understand how to apply appropriate models and information to understand environmental problems.</p>	<p>Same as above</p>

Lesson	California Science Standards	National Science Standards	California History/Social Science Standards	National Geography Standards	Education & the Environment Environmental Principles & Concepts
<b>Where Does Our Pollution Go?</b>	<p><b>HS Earth Science 5.</b> Heating of Earth's surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds and ocean currents.</p>	<p><b>Grades 9-12 Energy and Space Science Content Standard D.</b> Students should develop an understanding of energy in the earth system.</p>			Same as above
	<p><b>HS Earth Science 5.a.</b> Student know how differential heating of Earth results in circulation patterns in the atmosphere and oceans that globally distribute the heat.</p>	<p><b>HS 9-12 Science &amp; Technology Content Standard E.</b> Students should develop understanding about science and technology.</p>			
		<p><b>HS 9-12 Science in Personal and Social Perspective Content Standard F:</b> Students should develop understanding of environmental quality, natural and human-induced hazards, and science and technology in local, national, and global challenges.</p>			