IN THE AIR
Tools for Learning About Airborne Toxics Across the Curriculum

6-8 EDUCATION MODULE

Developed By:
Missouri Botanical Garden's
EarthWays Center

www.intheair.org
Authors - Margaret Lilly and Eleanor Hall, Missouri Botanical Garden

Project Management and Editing - Glenda Abney, Missouri Botanical Garden, Marcus G. Rivas, U.S. EPA

Special Assistance - Emily Andrews, St. Louis Community Air Project, Deborah Chollet Frank, Nanka Harrell, Christopher Kalter, Jean Ponzi, Susanne Reed, and Kristin Regan

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Foreword

Most students will never be scientists or engineers. If we truly want the full spectrum of students and adults to gain greater understanding about air pollution and airborne toxics, using this knowledge to affect daily decisions, then we need to meet them in their non-science interest areas. *In The Air: Tools for Learning About Airborne Toxics Across the Curriculum* uses the multi-disciplinary breadth of education – reading and communication arts, mathematics, social studies, science, art, etc. – to explore how our individual and collective behaviors produce airborne toxics. The airborne toxics information used as the basis in the modules is from the perspective of the U.S. Environmental Protection Agency, the funder of this project.

The origin of these materials came from the discovery that there was very little available to help people understand airborne toxics. Activities on acid rain or climate change were easily found, but not on airborne toxics. The St. Louis Community Air Project and the North Side (St. Louis) Clean Air Project were looking for ways to help their communities understand and manage airborne toxics. Educational material goals were to increase knowledge about air pollution (as it related to airborne toxics) and to make connections between behaviors and air quality. They had no access to appropriate materials. New materials had to:

- be low/no-cost and be usable across all age and skill levels (Kindergarten through Adult);
- use engaging multi-disciplinary activities aligned with current educational needs and standards;
- be designed to be effectively used for environmental education, meaning to be fair, accurate, action oriented, instructionally sound, useable, of appropriate depth and with an emphasis on skill building;
- emphasize how one’s choices impact human health and include connections among air, water and soil.

A specialized science education is not needed to understand the concepts presented in these modules. Users will be able to understand and take specific actions to improve their air quality. We developed accessible and appropriate materials containing activities for all grade levels, formatted into the following modules: K-3, 3-6, 6-8, 9-12 and Adult. All materials have been correlated to National and Missouri education standards. The North American Association for Environmental Education’s *Environmental Education Materials: Guidelines for Excellence* were used to ensure the modules met the guidelines to be well-rounded environmental education materials. We established an extensive review process using four review panels: EPA science specialists, non-EPA science specialists, formal and non-formal educators, and community members. We greatly appreciate the 69 individuals who assisted in the review process. Visit [www.intheair.org](http://www.intheair.org) where you may download all materials for free as well as provide comments and suggestions for future additions. For more information about the modules you may also call 314-577-0220.

Each module has: A) Teacher’s Guide with a Module Overview, Goals, and Correlations; B) Pre- and Post-Activities; C) Core Activity—the primary activity for the module; D) One to five Connecting Activities—activities that supplement the concepts in the Core Activity, but they also stand alone as individual activities; E) Appendix—background information on airborne toxics such as key terms, risk assessment information, and a brief history on clean air efforts in the U.S.; F) Further reading and research references; G) Evaluation form.

Modules are coordinated so that all activities complement one another. The entire module may be implemented in the classroom as a unit, or you may choose to do just individual activities from one or more units as each group has different needs, interests and abilities.

Our greatest appreciation goes to the writers of these materials, Margaret Lilly and Eleanor Hall. Their creativity, incredible writing abilities and excellent understanding of the educational needs of all ages along with their belief in educating in this topic is what enabled these modules to be the exceptional materials they are today. Thank you, Margaret and Ellie.

Certainly a final thanks is due to those who choose to use *In The Air: Tools for Learning About Airborne Toxics Across the Curriculum* with their students. Without you, this excellent work goes nowhere. Each educator has the power to make a difference!

Glenda Abney, Missouri Botanical Garden
Marcus G. Rivas, U.S. Environmental Protection Agency
Project Managers
December, 2004
Dear Educators,

Humans are increasingly altering Earth’s land, water, and atmosphere on local, regional, and global levels. We all need to understand that our actions do impact our living planet. *In The Air: Tools for Learning About Airborne Toxics Across the Curriculum* addresses how individual actions specifically alter the air, which in turn affects other aspects of our environment including the soil, the water, and all plants and animals. Coupled with this understanding, the lessons in *In The Air* provide tools to better manage behaviors that can be implemented where we live – in our local towns and cities and in our homes. I encourage you to utilize these excellent materials with the students and adults you work with.

We’ve enjoyed working on this project with the fine staff at the U.S. EPA. With your help, the information and ideas in these materials will make a difference to people of all ages. Thank you for your efforts. What a great way to start making a positive and long lasting impact, educating others.

Sincerely,
Peter H. Raven
Director
Missouri Botanical Garden

Dear Educators,

The U.S. Environmental Protection Agency (U.S. EPA) and its partners have developed a new set of educational materials. These educational materials will help us all improve our personal health and become better stewards of the environment. Healthier air, cleaner water, and better protected lands describe our mission. *In The Air: Tools for Learning About Airborne Toxics Across the Curriculum* will enable us all to be more deliberate in our choices and behaviors for improved personal health and a better environment. The decisions we make regarding products we use and how we use them make lasting impacts on air quality. The learning and behavior changes that will result after presenting the activities in these modules will make a positive and long-lasting difference in your students.

We appreciate your interest in these exciting and effective materials. Without your help, these outstanding modules developed by the staff of Missouri Botanical Garden and U.S. EPA wouldn’t reach the intended audience. As an educator who uses these materials, you also are a critical part of this project. Thank you for using *In The Air: Tools for Learning About Airborne Toxics Across the Curriculum*.

Sincerely,
James B. Gulliford
Regional Administrator
U.S. Environmental Protection Agency
“IN THE AIR” PROJECT REVIEWERS & PARTNERS

U.S. Environmental Protection Agency

Michael Beringer
George Bollweg, Ph. D.
Patricia Bonner
Michael F. Davis
Arnold Den
Dave Guinnup, Ph. D.
James Hirtz
Martin Kessler
Pamela Kogan
Peter Murchie, MPH
Phuong Nguyen
Jacqueline Nwia
Nancy B. Pate, DVM, MPH
Marcus G. Rivas
Donna Rogers, M.E.M.
Sally Shaver
William A. Spratlin
Henry Topper, Ph. D.
Pam Tsai, Sc.D., DABT

Science Advisors

Albert Donnay, MHS Donnay Environmental Health Engineering, Baltimore
Andrew Gilfillan Tribal Environmental Department, Sac and Fox Nation of Missouri in Kansas and Nebraska
Gina Kneib Tribal Environmental Department, Sac and Fox Nation of Missouri in Kansas and Nebraska
Carol Prombo, Ph. D. Washington University
Sonja Sax, Sc.D. Harvard University School of Public Health
Jeff Reifschneider Tribal Environmental Department, Sac and Fox Nation of Missouri in Kansas and Nebraska
Karl B. Schnelle, Jr., Ph. D., FAIChe Vanderbilt University
Fernando Serrano St. Louis University School of Public Health
John Spengler, Ph. D. Harvard University School of Public Health
Julia Ashby Strassburger Johns Hopkins Bloomberg School of Public Health
Jay Turner, Ph. D. Washington University

Educators

Glenda Abney Missouri Botanical Garden
Barbara Addelson Missouri Botanical Garden
Christina Andrews Galludet School for Deaf Elementary, Missouri
Janet Crews Clayton School District, Missouri
Susan Flowers Washington University Science Outreach
Terry Henderson Retired Teacher
Bill Henske East St. Louis School District, Illinois
Christine Henske Southern Illinois University-Edwardsville
Jennifer Hope Missouri Botanical Garden
Dr. Shane Hopper St. Louis Public Schools, Missouri
Mark Kalk Washington University Science Outreach
Chris Kalter Missouri Botanical Garden
Lisa Granich-Kovarik Ritenour School District, Missouri
James D. Lubbers, Ed.D. Missouri Department of Natural Resources
Vicki May Washington University Science Outreach
Chris Mohr Washington University Science Outreach
Gholneccsrar Muhammad Cahokia School District, Illinois
Amy O’Brien Washington University Science Outreach
Educators (Cont.)

John Powers Cardinal Ritter Prep High School, Missouri
Joan Rivas Retired Teacher
Laura Schaefer Missouri Botanical Garden
Kristin Sobotka Washington University Science Outreach
Karen Spratlin Shawnee Mission School District, Kansas
Christine Turland Cardinal Ritter Prep High School, Missouri

Community Members

Emily Andrews St. Louis Community Air Project / St. Louis Association of Community Organizations
Douglas L. Eller Grace Hill Settlement House, Northside Clean Air Project
Gary Filmore St. Louis Community Air Project
Phyllis Fitzgerald Louisville Metro Air Pollution Control District, Kentucky
Kimberly Foster Missouri Department of Natural Resources
Susannah Fuchs American Lung Association of Eastern Missouri
La'Rhonda Garrett Missouri Department of Natural Resources
Carol Giles-Straight St. Louis Public Library
Alycia Green Grace Hill Settlement House, Northside Clean Air Project
Bruce Litzsinger, P.E. Metropolitan St. Louis Sewer District
Craig N. Schmid Alderman, City of St. Louis
David Shanks St. Louis Regional Chamber and Growth Association
Peter Shemitz Missouri Department of Natural Resources
Thomasene Tomlin-Filmore St. Louis Community Air Project
Pat Tracey Johns Hopkins Bloomberg School of Public Health
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<th>Module</th>
<th>Core Activity</th>
<th>Connecting Activities</th>
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</table>
| **K-3 Module** | **Core Activity:** Puppet Show | **Connecting Activity #1:** "Clean Air /Dirty Air Worksheet"  
Health, Science  
Students identify cleaner air choices.  
**Connecting Activity #2:** "Clean Up on Gloomy-Doomy"  
Health, Science  
Students match polluting situations with alternative actions.  
**Connecting Activity #3:** "Now You See It, Now You Don’t"  
Health, Science  
Students use their senses in identifying a potential pollutant. |
| **3-6 Module** | **Core Activity:** Chapter Book | **Connecting Activity #1:** "Now You See It, Now You Don’t"  
Health, Science  
Students use their senses in identifying a potential pollutant.  
**Connecting Activity #2:** "Pee Yew! Is That You?"  
Health, Science  
Students conduct a mapping activity that demonstrates the effect of wind on airborne pollution and mobile source pollution.  
**Connecting Activity #3:** "In A Shroud Of Smoke"  
Fine Arts, Language Arts, Social Studies  
Students analyze cartoon strips from the 1920’s to learn how pollution was perceived in St. Louis, then compare to our current air quality. |
| **6-8 Module** | **Core Activity:** Classroom Game | **Connecting Activity #1:** "Pee Yew! Is That You?"  
Health, Science  
Students conduct a mapping activity that demonstrates the affect of wind on airborne pollution and mobile source pollution.  
**Connecting Activity #2:** "Clean Air, Dry In Airless Weather"  
Health, Science  
Students identity cleaner air choices.  
**Connecting Activity #3:** "Making Puppets"  
Fine Arts  
Students make puppets. |
### 6-8 Module (cont.)

<table>
<thead>
<tr>
<th>Connecting Activity #1</th>
<th>Connecting Activity #2</th>
<th>Connecting Activity #3</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Are Household Chemicals Safe?”</td>
<td>“Tiptoe Through the Toxics”</td>
<td>Students construct a large grid in a gymnasium, large classroom or outdoor area throughout which several “pollutants” are scattered and mapped illustrating deposition. A watershed is then configured into the results.</td>
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### 9-12 Module

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<tr>
<th>Core Activity:</th>
<th>Connecting Activity #1</th>
<th>Connecting Activity #2</th>
<th>Connecting Activity #3</th>
<th>Connecting Activity #4</th>
<th>Connecting Activity #5</th>
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<tbody>
<tr>
<td>“Constructing a Continuum of Commonly Held Beliefs About the Magnitude of Airborne Toxics”</td>
<td>Belief: “The Magnitude and Urgency of Airborne Toxics Problems Have Been Greatly Overstated”</td>
<td>Students examine reasons for the differences of opinions about the seriousness of airborne toxics. In the process students study the ways scientists gather and interpret data and make predictions based on their findings.</td>
<td>Belief: “Airborne Toxics Are a Nuisance, But They Seriously Affect Only a Few People”</td>
<td>Belief: “Airborne Toxics Are a Serious Problem, But I’m Not Responsible”</td>
<td>Belief: “Airborne Toxics Are a Critical Problem; However, the Effects May Be Remediable”</td>
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<td>Students work in teams, to complete a “degree of accountability” worksheet. Examples of personal accountability are reinforced in a short humorous skit.</td>
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<td>Students work in small groups to learn about current efforts being made to improve air quality and reduce pollution by government, environmental organizations and individuals. After the presentation of their findings to the class, students draw conclusions as to the validity of this belief statement.</td>
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### Adult

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<tr>
<th>Core Activity:</th>
<th>Connecting Activity #1</th>
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<tr>
<td>“Detox Your Domicile”</td>
<td>Home Improvement Skit</td>
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IN THE AIR

6-8 Teacher’s Guide

MODULE OVERVIEW

In this module, students will explore the issue of airborne toxics, their sources within our communities, and simple steps people can take to protect the quality of our air. A multidisciplinary approach is used throughout this module. This module includes a Core Activity, three Connecting Activities that explore specific themes in greater depth, and suggested extensions. Sources of additional information are listed at the end of each activity and in the background section of this module.

MODULE THEME

Air pollution is a large and complex problem that negatively affects human health and degrades the environment. Throughout the module, emphasis is placed on the students’ personal experience and personal actions that are reasonable for them to take to reduce their exposure to air pollution.

MODULE GOALS

- To remove misperceptions about air pollution and to demonstrate the many sources of airborne toxics
- To explore the idea of health risks posed by the environment in a safe and familiar context
- To provide basic information about airborne toxics essential for carrying out the module activities
- To provide scientific background needed to understand the relationships between personal choices and impacts on the environment and human health

MODULE OBJECTIVES

At the completion of this module, students will be able to do the following:

- List the three categories for air pollution sources.
- Identify an everyday activity that causes air pollution.
- Identify a toxic as a substance that can harm human health.
- Describe the factors that contribute to risk from airborne toxics.
- Identify a personal action to reduce exposures to airborne toxics.
- Describe how an air pollutant can pollute land and water.
Important Notes to Teachers About This Module

A MULTIDISCIPLINARY APPROACH

This module consists of a Core Activity and three Connecting Activities.

Core Activity—Classroom Game
Cleaner Air Everywhere
(This game can be played in one session if you are not including the Connecting Activities.)
Communication Arts/Social Studies/Science
Students learn through playing this game, where they are participants in a town council, that personal actions and public policies affect the air we breathe. Students will choose actions that will lessen impacts on human health and the environment while attempting to balance costs and environmental health. Activities and extensions specific to each of the three rounds of play are included. The Connecting Activities can be used in conjunction with the Core Activity as a way to expand on the topics covered within each round of the game.

Connecting Activity One
Pee Yew! Is That You?
(This activity may be done by itself or inserted into Round One of the Classroom Game.)
Science/Geography
Students use a map and simple tool to measure concentrations of different pollutants at many locations. This activity demonstrates how wind is one factor that determines our exposure to pollutants, and that mobile sources are responsible for a major portion of our air pollution.

Connecting Activity Two
Are Household Chemicals Safe?
(This activity may be done by itself or inserted into Round Two of the Classroom Game.)
Health/Math
Second to tailpipe emissions from mobile sources, homes and small businesses are the next largest source of the volatile organic compounds released into our air. Many of these chemicals are toxic and contribute to ozone and smog. Students conduct a home inventory of household products and explore, through a classroom activity, the effectiveness of safer homemade alternatives to several commercial cleaners.

Connecting Activity Three
Tiptoe Through the Toxics
(This activity may be done by itself or inserted into Round Three of the Classroom Game.)
Social Studies/Science/Math
This activity may be done outside on a playground or in a large indoor area. A grid is constructed and breakfast cereal is used to represent pollutants in the environment. Students will graph the dispersion of pollutants and analyze how the watershed can spread air pollutants far beyond the point where they first entered the environment.
TIME CONSTRAINTS

In their daydreams, writers conjure up visions of stress-free educators happily teaching every precious word of their manuscripts to fascinated students. In real life, however, they know such a scenario is wishful thinking. This module on airborne toxics, therefore, is designed to fit many different circumstances and time frames. Each part of the module is designed to stand alone. The following are suggestions for modifying the module without sacrificing the previously stated goals.

- Play the game by itself in one session.
- Play the game in three shorter sessions.
- Play the game and insert one or more of the Connecting Activities in multiple sessions.

**Note:** If you choose to implement the Connecting Activities individually, the goals and objectives that apply are listed within the write-up for the activity.

**Correlation with National Education Standards Summary**

**Health Education Standards**

SOURCE: American Cancer Society

<table>
<thead>
<tr>
<th>CORE ACTIVITY</th>
<th>CONNECTING ACTIVITY #1</th>
<th>CONNECTING ACTIVITY #2</th>
<th>CONNECTING ACTIVITY #3</th>
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<td>“Pee Yew!”</td>
<td>“Are Household Chemicals Safe”</td>
<td>“Tiptoe Through the Toxics”</td>
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<tr>
<td>NPH-H. 5-8.1 .2</td>
<td>NPH-H. 5-8.1 .2</td>
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**Language Arts**

SOURCE: National Council of Teachers of English

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<td>“Tiptoe Through the Toxics”</td>
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<td>NL-ENG. K-12.3 .4</td>
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### Correlation with National Education Standards- (cont.)

#### MATHEMATICS

**SOURCE:** National Council of Teachers of Mathematics  

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#### SCIENCE

**SOURCE:** National Academies of Science  

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<td>NS. 5-8 .6</td>
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#### SOCIAL SCIENCES

**SOURCE:** National Council for the Social Sciences, Center for Civic Education, and the National Geographic Society  

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<tr>
<th>CORE ACTIVITY</th>
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<tr>
<td>NSS-C. 5-8 .5</td>
<td>NSS-C. 5-8 .5</td>
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<td>NSS-G.K-12 .1.5</td>
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</table>
PERSONAL HEALTH
- NPH.H.5-8.1: REDUCING HEALTH RISKS: Students will demonstrate the ability to practice health-enhancing behaviors and reduce health risks.
- NPH-H.5-8.2: HEALTH PROMOTION AND DISEASE PREVENTION: Analyze how the environment influences the health of the community.

LANGUAGE ARTS
- NL-ENG.K-12.3: EVALUATION STRATEGIES: Students apply a wide range of strategies to comprehend, interpret, evaluate, and appreciate texts.
- NL-ENG.K-12.4: COMMUNICATION SKILLS: Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), media techniques, figurative language, and genre to create, critique, and discuss print and non-print texts.

MATHEMATICS
- NM-PROB.REP.PK-12.3: Use representations to model and interpret physical, social, and mathematical phenomena.
- NM-DATA.6-8.1: Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.

SCIENCE
- NS.5-8.6: PERSONAL AND SOCIAL PERSPECTIVES: Science and technology in society.

SOCIAL SCIENCES
- NSS-C.5-8.5: ROLES OF THE CITIZEN: What are the responsibilities of citizens? How can citizens take part in civic life?
- NSS-G.K-12.1: THE WORLD IN SPATIAL TERMS: Understand how to use maps and other geographic representations, tools and technologies to acquire, process and report information from a spatial perspective.
## Correlation with Missouri “Show-Me” Standards

**MISSOURI ASSESSMENT PROGRAM:**
**FOUR PERFORMANCE STANDARDS & SIX KNOWLEDGE STANDARDS**


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<thead>
<tr>
<th>PERFORMANCE STANDARDS</th>
<th>CORE ACTIVITY “Cleaner Air Everywhere”</th>
<th>CONNECTING ACTIVITY #1 “Pee Yew! Is That You?”</th>
<th>CONNECTING ACTIVITY #2 “Are Household Chemicals Safe”</th>
<th>CONNECTING ACTIVITY #3 “Tiptoe Through The Toxics”</th>
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<td>Goal 1. Gather and Analyze Information</td>
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<td>Goal 2. Communicate Effectively</td>
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<td>Goal 3. Solve Problems</td>
<td>1, 2, 3, 5, 6, 8</td>
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<td>Goal 4. Make Decisions</td>
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<td>#6. Social Studies</td>
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Performance Standards

Students will demonstrate within and integrate across all content areas the ability to:

Goal #1 - Gather & Analyze Information
- #1. Develop questions and ideas to initiate and refine research.
- #2. Conduct research to answer questions and evaluate information and ideas.
- #6. Discover and evaluate patterns and relationships in information, ideas, and structure.
- #10. Apply acquired information, ideas, and skills to different contexts as students, workers, citizens, and consumers.

Goal #2 - Communicate Effectively
- #3. Exchange information, questions and ideas while recognizing the perspectives of others.
- #5. Perform or produce works in the fine and practical arts.

Goal #3 - Solve Problems
- #1. Identify problems and define their scope and elements.
- #2. Develop and apply strategies based on ways others have prevented or solved problems.
- #3. Develop and apply strategies based on one’s own experience in preventing or solving problems.
- #5. Reason inductively from a set of specific facts and deductively from general premises.
- #6. Examine problems and proposed solutions from multiple perspectives.
- #8. Assess costs benefits and other consequences of proposed solutions.

Goal #4 - Make Decisions
- #1. Explain reasoning and identify information used to support decisions.
- #2. Understand and apply the rights and responsibilities of citizenship in Missouri and the United States.
- #3. Analyze the duties and responsibilities of individuals in societies.
- #4. Recognize and practice honesty and integrity in academic work and the workplace.
- #7. Identify and apply practices that preserve and enhance the safety of self and others.
Students in Missouri public schools will acquire a solid foundation which includes knowledge of:

COMMUNICATION ARTS
- #1. Speak and write standard English (including grammar, usage, punctuation, spelling, and capitalization).
- #3. Read and evaluate nonfiction works and material (such as biographies, newspapers, technical manuals).
- #6. Participate in formal and informal presentations and discussions of issues and ideas.

HEALTH / PHYSICAL EDUCATION
- #5. Methods used to assess health, reduce risk factors, and avoid high risk behaviors (such as violence, tobacco, alcohol and other drug use).
- #6. Consumer health issues (such as the effects of mass media and technologies on safety and health).

MATH
- #1. Addition, subtraction, multiplication and division; other number sense, including numeration and estimation; and the application of these operations and concepts in the workplace and in other situations.
- #3. Data analysis, probability and statistics
- #6. Discrete mathematics.

SCIENCE
- #5. Processes and interactions of Earth’s biosphere, atmosphere, lithosphere and hydrosphere.
- #8. Impact of science, technology and human activity on resources and the environment.

SOCIAL SCIENCE
- #5. The major elements of geographical study and analysis and their relationships to changes in society and the environment.
- #7. The use of tools of social science inquiry.