

# 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](http://www.intheair.org)





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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  
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# "In The Air" MODULE MATRIX

[www.intheair.org](http://www.intheair.org)



CORE & CONNECTING ACTIVITIES		MAIN SUBJECT AREAS	DESCRIPTION OF ACTIVITY
<b>6-8 Module</b>	Core Activity: Puppet Show "Gloomy-Doomy Go Away!"	Health, Science, Language Arts, Fine Arts	Students participate in a puppet show to learn about the importance of clean air for personal health and safety.
	Pre-Activity #1 "Dirty Air Cards"	Health, Science	Students learn about some sources of air pollution.
	Pre-Activity #2 "Making Puppets"	Fine Arts	Students make puppets.
	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".
	Core Activity: Chapter Book "Matt Tackles Air Toxics"	Health, Language Arts, Science	Students read a chapter book in which a group of students explore the sources of pollution within their community and learn what choices people make to protect their air. Connecting activities are integrated within the story.
	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, Language Arts, Math, Science, Social Studies	Students conduct a mapping activity that demonstrates the affect of wind on airborne pollution and the pervasiveness of mobile source pollution while reinforcing the concept that we all share the same air. "Town Hall Meeting" skit allows students to examine how environmental issues interplay with other economic and social issues.
	Connecting Activity #3 "In A Shroud Of Smoke"	Fine Arts, Language Arts, Social Studies	Students analyze editorial cartoons from the 1930's to learn about an historic pollution event in St. Louis that impacted our nation's clean air efforts. Students develop their own editorial cartoon to draw attention to a current environmental issue that is important to them.
<b>3-6 Module</b>	Core Activity: Classroom Game "Cleaner Air Everywhere"	Health, Language Arts, Science, Social Studies	Students compete in a classroom game that demonstrates the impact of governmental and individual decisions on our environmental quality and pocketbook.
	Connecting Activity #1 "Pee Yew! Is That You?"	Health, Language Arts, Math, Science, Social Studies	Students conduct a mapping activity that demonstrates the affect of wind on airborne pollution and the pervasiveness of mobile source pollution while reinforcing the concept that we all share the same air. "Town Hall Meeting" skit allows students to examine how environmental issues interplay with other economic and social issues.
<b>K-3 Module</b>	Core Activity: Chapter Book "Matt Tackles Air Toxics"	Health, Language Arts, Science	Students read a chapter book in which a group of students explore the sources of pollution within their community and learn what choices people make to protect their air. Connecting activities are integrated within the story.
	Connecting Activity #1 "Now You See It, Now You Don't"	Health, Science	Students use their senses in identifying a potential "pollutant".



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# “In The Air” MODULE MATRIX

CORE & CONNECTING ACTIVITIES		MAIN SUBJECT AREAS		DESCRIPTION OF ACTIVITY
6-8 Module (cont.)	Connecting Activity #2 “Are Household Chemicals Safe?”	Health, Science		Students learn how to read a warning label and conduct a classroom investigation to determine if less hazardous cleaning products do an effective job.
	Connecting Activity #3 “Tiptoe Through the Toxics”	Health, Math, Science, Social Studies		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.
9-12 Module	Core Activity: “Constructing a Continuum of Commonly Held Beliefs About the Magnitude of Airborne Toxics”	Health, Science, Social Studies		Students construct a continuum of common beliefs about the seriousness of airborne toxics. Strong emphasis is placed on social themes including scientific ethics, corporate integrity, and personal responsibility. Connecting Activities examine the five belief statements in more detail. A creative arts pre/post activity is used as an assessment tool.
	Connecting Activity #1 Belief: “The Magnitude and Urgency of Airborne Toxics Problems Have Been Greatly Overstated”	Health, Science, Social Studies		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.
	Connecting Activity #2 Belief: “Why Worry About Airborne Toxics? What You Don’t Know Won’t Hurt You”	Health, Language Arts, Science, Social Studies		Students explore why people want to know about some unpleasant situations but not others. Students will look at the how the media can influence their ideas about personal risk.
	Connecting Activity #3 Belief: “Airborne Toxics Are a Nuisance, But They Seriously Affect Only a Few People”	Health, Science, Social Studies		Students review the hydrologic cycle and are introduced to the need for a multi-media (air water, soil) approach to pollution control.
	Connecting Activity #4 Belief: “Airborne Toxics Are a Serious Problem, But I’m Not Responsible”	Fine Arts, Health, Science, Social Studies		Students work in teams, to complete a “degree of accountability” worksheet. Examples of personal accountability are reinforced in a short humorous skit.
	Connecting Activity #5 Belief: “Airborne Toxics Are a Critical Problem; However, the Effects May Be Remediable”	Health, Language Arts, Science, Social Studies		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.
	Core Activity: “Detox Your Domicile” Home Improvement Skit	Fine Arts, Health, Science, Social Studies,		Adults participate in a simulated home tour presented in a home improvement show format. Moving from room to room, participants will learn the economics, health concerns, and social responsibility issues relating to airborne toxics within our homes. Participants will leave with tools and strategies for improving their personal and community environments.

# IN THE AIR

## IN THE AIR

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## Teacher's Guide

6-8 EDUCATION MODULE



 MISSOURI  
BOTANICAL  
GARDEN

# IN THE AIR

## Teacher's Guide



# IN THE AIR

## 6-8 Teacher's Guide

### MODULE OVERVIEW

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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

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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

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- 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

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

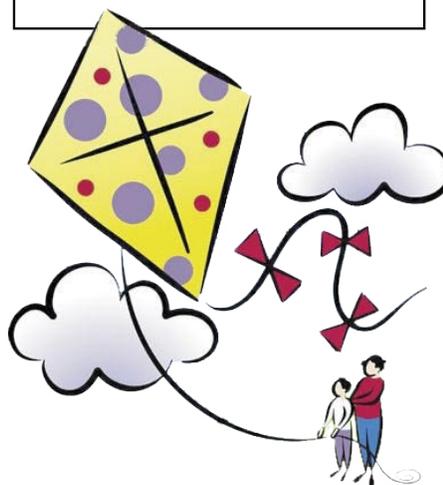
- List the three categories for air pollution sources.
- Identify an everyday activity that causes air pollution.
- Identify a toxic as a substance that can harm human health.
- Describe the factors that contribute to risk from airborne toxics.
- Identify a personal action to reduce exposures to airborne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

#### Preparation Time:

One to three hours will be needed to read the Teacher's Guide and to integrate connecting activities.

#### Presentation Time:

Time required varies depending on activities chosen.



### Important Notes to Teachers About This Module

#### A MULTIDISCIPLINARY APPROACH

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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

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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.

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**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

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SOURCE: American Cancer Society

<http://www.education-world.com/standards/national/nph/index.shtml>

CORE ACTIVITY "Cleaner Air Everywhere"	CONNECTING ACTIVITY #1 "Pee Yew!"	CONNECTING ACTIVITY #2 "Are Household Chemicals Safe"	CONNECTING ACTIVITY #3 "Tiptoe Through the Toxics"
NPH-H. 5-8.1 .2	NPH-H. 5-8.1 .2	NPH-H. 5-8.1 .2	

### LANGUAGE ARTS

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SOURCE: National Council of Teachers of English

[http://www.education-world.com/standards/national/lang\\_arts/index.shtml](http://www.education-world.com/standards/national/lang_arts/index.shtml)

CORE ACTIVITY	CONNECTING ACTIVITY #1	CONNECTING ACTIVITY #2	CONNECTING ACTIVITY #3
NL-ENG. K-12.3 .4			

### Correlation with National Education Standards- (cont.)

#### MATHEMATICS

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SOURCE: National Council of Teachers of Mathematics

<http://www.education-world.com/standards/national/math/index.shtml>

CORE ACTIVITY	CONNECTING ACTIVITY #1	CONNECTING ACTIVITY #2	CONNECTING ACTIVITY #3
	NM-PROB.REP. PK-12.3		NM-DATA 6-8.1

#### SCIENCE

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SOURCE: National Academies of Science

<http://www.education-world.com/standards/national/math/index.shtml>

CORE ACTIVITY	CONNECTING ACTIVITY #1	CONNECTING ACTIVITY #2	CONNECTING ACTIVITY #3
NS. 5-8.6	NS. 5-8 .6		NS. 5-8 .6

#### SOCIAL SCIENCES

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

[http://www.education-world.com/standards/national/soc\\_sci/index.shtml](http://www.education-world.com/standards/national/soc_sci/index.shtml)

CORE ACTIVITY	CONNECTING ACTIVITY #1	CONNECTING ACTIVITY #2	CONNECTING ACTIVITY #3
NSS-C. 5-8 .5	NSS-C. 5-8 .5 NSS-G.K-12 .1.5		NSS-G.K-12 .1.5

## **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.
- NSS-G.K-12 .5: ENVIRONMENT AND SOCIETY: Understand how human actions modify the physical environment.

### Correlation with Missouri "Show-Me" Standards

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

SOURCE: Show-Me Standards and the Missouri Assessment Program,  
Missouri Department of Elementary and Secondary Education, 1998.  
<http://www.dese.mo.gov/standards>

	CORE ACTIVITY "Cleaner Air Everywhere"	CONNECTING ACTIVITY #1 "Pee Yew! Is That You?"	CONNECTING ACTIVITY #2 "Are Household Chemicals Safe"	CONNECTING ACTIVITY #3 "Tiptoe Through The Toxics"
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#### PERFORMANCE STANDARDS

<b>Goal 1.</b> Gather and Analyze Information	1, 6, 10	6	2	
<b>Goal 2.</b> Communicate Effectively		3, 5		3
<b>Goal 3.</b> Solve Problems	1, 2, 3, 5, 6, 8	1	1	1
<b>Goal 4.</b> Make Decisions	1, 3	1, 2, 4, 7	1, 7	1, 4

#### KNOWLEDGE STANDARDS

<b>#1.</b> Communication Arts	1	6	1, 3, 6	
<b>#2.</b> Fine Arts				
<b>#3.</b> Health/Physical Education	5	5, 6	5	5
<b>#4.</b> Mathematics				1, 3, 6
<b>#5.</b> Science	8	8	8	5, 8
<b>#6.</b> Social Studies	7			5

## PERFORMANCE STANDARDS

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*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.

### KNOWLEDGE STANDARDS

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*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.