envirohealthlink

Summer Institute

A Professional Development Opportunity
for
Science and Health Teachers
at the Middle & High School Level

July 26 – 29, 1999

Sponsored by

Maryland Public Television

and

The Johns Hopkins University
School of Hygiene and Public Health
and
The Center in Urban Environmental Health

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1999 EnviroHealth Link Summer Institute Lesson Plan Binder*
Contents

1. Introduction
2. Biographies
3. Maryland Public Television Educational Services
4. Lesson Plans (*see table*)

Title	Grades	Subject
Don't Sit So Close to the TV!	6-12	Electric and magnetic fields (EMFs)
When Sun Gets in Your Eyes!	6-12	UV radiation, sun exposure, cataracts
Children's Health and Environmental Exposure to Toxic Substances	6-9	Toxic environmental hazards, children's unique susceptibility to hazardous substances
Smoke Gets in Your Eyes, Your Nose, Your Mouth, Your Lungs…	6-12	Exposure to and health effects of environmental tobacco smoke
Chlorine: The Miracle Cure Debate	7-12	Endocrine disruptors, chlorine compounds, environmental carcinogens
Are We Creating the Superbug?	6-12	Bacteria and viruses, antibacterial agents, microbial resistance
Thank You for Not Smoking!	6-8	Respiratory system, health effects of environmental tobacco smoke,
Biological and Chemical Weapons …Around Here?	8-12	Health and environmental effects of biological and chemical weapons
Cancer City, USA 10019	8-12	Investigating cancer clusters, probability
Organic Mechanic, Part I	7-12	Risks and benefits, health effects of pesticides, organic farming
Organic Mechanic, Part II	7-12	Organic farming, alternatives to pesticides
Pops Pops, Fizz Fizz, Oh What a Health Hazard It Is!	7-12	Health effects of persistent organic pollutants (POPs), dioxin, bioaccumulation
Smoking Without Choices	6-10	Environmental tobacco smoke, health effects in children
Those Silent, Hidden Environmental Dangers	6-12	Environmental carcinogens and toxic pollutants, endocrine disruptors, service learning projects
Tackling Toxic Waste	6-12	Hazardous waste, environmental carcinogens
Three Mile Mess	6-12	Environmental and health effects of nuclear radiation, nuclear accidents, risks and benefits of nuclear power

5. Internet Resources
6. Other Resources

*NOTE: All lesson plans are also available on the Internet at
http://www.mpt.org/learningworks/teachers/ehl/

INTRODUCTION

ABOUT ENVIROHEALTH LINK

We are all connected to our environment through an intricate and delicate web of complexity. Exploring that complexity has engaged top scientists around the world for quite some time as they look at questions such as: What is the link between cancer and our surroundings? Why are entire cities' water supplies being compromised by minute bacteria? Why are so many children becoming asthmatic?

As educators, we know that our students are asking these questions as well, with equal concern. How can we best encourage them to investigate these issues scientifically to form knowledge-able answers about the link between our environment and our health?

EnviroHealth Link was developed specifically to address this educational concern. It was conceived as a compre-hensive and on-going professional development opportunity for health and science teachers at the middle and high school levels to give them the resources they need to promote scientific and health literacy in their classes using today's technology.

Sponsored by Maryland Public Television and the Johns Hopkins University School of Hygiene and Public Health and the Center in Urban Environmental Health, EnviroHealth Link includes Summer Institutes for educators as well as online resources via the ***EnviroHealth Link*** website at: http://www.mpt.org/ehl/home.html to support a community of learners involved in environmental health issues, research, and technology.

SUMMER INSTITUTES

During these four-day seminars, teachers become learners again as Master Teachers present classroom lessons – completely integrated with a wealth of Internet resources, computer software, educational videos, and videotape and multimedia presentations – to demonstrate how effective these technologies can be as a way of enhancing their middle and high school students' work with environmental health issues, and as a personal resource to enhance their individual health and science curricula.

As they work through these lessons, participants will also meet with Johns Hopkins research scientists involved in environmental health research. These professionals will provide an enriched view of some of the issues raised in these lessons, such as current findings in the early detection of lung cancer.

ABOUT ENVIROHEALTH LINK

ENVIROHEALTH LINK
WEB SITE

The dialogue established at the Summer Institutes continues throughout the school year, as participants link electronically to an array of resources at the EnviroHealth web site <http://www.mpt.org/ehl/home.html>. There, teachers can receive important news updates from the environmental health field and receive timely feedback and additional classroom activities and projects from their fellow participants, access over 48 environmental health lesson plans, engage their students in two interactive web-based projects, and quickly access hundreds of environmental health web sites.

ABOUT THE JOHNS HOPKINS UNIVERSITY SCHOOL OF HYGIENE AND PUBLIC HEALTH

The School of Hygiene and Public Health at the Johns Hopkins University has been designated as an Environmental Health Sciences Research Center by NIEHS and offers multidisciplinary and interdisciplinary education and training in the basic and applied professional sciences in environmental health. It operates an innovative interdisciplinary professional education program to train practicing professional in the broad environmental issues of risk analysis, assessment, and management in relationship to national policy questions of importance to government, industry, and the general public in environmental health. It has a long tradition of institutional involvement with the health needs of the community, including twelve current prevention and training initiatives in area schools and health centers.

The School's Department of Environmental Health Sciences is one of the oldest and largest such departments in the world. It focuses on a variety of issues including the hygiene of water, air, and soil; food and drug adulteration; and the causation, spread, and prevention of transmittable diseases. The Department investigates these issues through mechanism-based research and the application of this research to explore the impact of toxic molecules from the environment on organs, tissues, cells, and DNA, as well as through studies to examine the risks to health in specific populations. These investigations lead to methods that identify susceptible individuals and the rational development of prevention strategies.

The School also encompasses a number of Centers engaged in multidisciplinary research. These Centers include the Environmental Health Sciences Center, the Research and Training Center in Environmental Health Sciences, the Educational Resource Center, and the Center for Occupational and Environmental Health. Researchers here are currently engaged in a number of projects including:

- the identification of the genes responsible for airway inflammation in subjects exposed to ozone
- the effect of electromagnetic fields on workers
- investigations of the impact of lead poisoning on the brain receptors
- assessment of ultraviolet light and its role in skin cancer
- early detection of lung cancer
- chemoprevention of liver cancer in human populations

ABOUT THE NATIONAL INSTITUTE OF ENVIRONMENTAL HEALTH SCIENCES

Human health and human disease result from three interactive elements: environmental factors, genetic susceptibility, and age. The mission of the National Institute of Environmental Health sciences is to reduce the burden of human illness and dysfunction from environmental causes by further understanding each of these elements and how they interrelate. The NIEHS achieves its mission through a multidisciplinary biomedical research program, prevention and intervention efforts, and a communications strategy that encompasses training, education, tech-nology transfer, and community outreach. The ultimate goal of these NIEHS activities is to define and understand the mechanism of action of toxic environmental agents on human health and to transfer this knowledge to the public.

The NIEHS is actively responding to the increasing desire of the public to understand the effects on human health of exposure to physical and chemical agents. Although the public is challenged daily to make decisions based on the risk and benefit of agents that permeate the environment, few programs prepare the public to meet this challenge. For example, in the past few years there have been media reports concerning the hazards of electromagnetic radiation, chemicals in drinking water, and pesticides in food.

While the scientific community has been tasked with making scientifically based reccomendations on the safety of chemical and physical agents, the general public has become increasingly involved in the regulatory decision making process. Therefore, there is a critical need to educate the general public about environmental health issues.

In recognition of this challenge, a public mandate in the 1900s is to reach out to students in grade school and high school to improve their scientific literacy. In 1992, the NIEHS established a priority to develop an environmental health sciences education program at the K-12 grade levels. The objectives of this program are to improve the understanding of environmental by all students and to expand career awareness for those interested in pursuing further education leading to research and service occupations in environmental health sciences. In addition to promoting the development of relevant instructional materials, the NIEHS seeks to advance the dissemination, utilization, and effective implementation of materials and curricula pertaining to environmental health science.

The NIEHS is one of eighteen institutes that comprise the National Institutes of Health.

ACKNOWLEDGEMENTS

We would like to thank the following for their support in making the EnviroHealth Link Institute a successful experience for teachers:

ENVIROHEALTH LINK PRESENTERS & SUPPORTERS

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ACKNOWLEDGEMENTS

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Gloria M. Petersen, Ph.D., FACMG, Associate Professor of Epidemiology, Johns Hopkins University, School of Hygiene and Public Health and Associate Professor of Oncology, Johns Hopkins University, School of Medicine

Jonathan Pevsner, Ph.D., Assistant Professor, Johns Hopkins University, Departments of Neuroscience, Medicine and Kennedy Krieger Institute

James R. Zabora, Sc.D., Associate Director for Community Research, Oncology Center, Johns Hopkins University, School of Medicine; Assistant Professor, Johns Hopkins University, School of Medicine; and Instructor, Department of Environmental Health Sciences, Johns Hopkins School of Hygiene and Public Health

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E/ The Environmental Magazine
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GPN-Great Plains National
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WGBH (Boston's PBS affiliate)

FOR RESOURCE MATERIAL DONATIONS

GPN-Great Plains National
Educational Innovations, Inc.
ERIC Clearinghouse on Information & Technology
E2: Environment and Education
LaMotte Company
U.S. Fish & Wildlife Service

BIOGRAPHIES

JOHNS HOPKINS STAFF

Martin D. Abeloff, M.D., is the Eli Kennerly Marshall, Jr. Professor of Oncology and Director of the Johns Hopkins Oncology Center and Oncologist-in-Chief of the Johns Hopkins Hospital and Health Systems in Baltimore, Maryland. Dr. Abeloff is a medical oncologist whose major research focus has been the management of solid tumors, particularly breast and lung cancer.

Dr. Abeloff received his M.D. degree from the Johns Hopkins University school of Medicine in 1966. He subsequently completed his residency training in internal medicine at the University of Chicago and the Beth Israel Hospital in Boston. In addition, he received research training in hematology at the New England Medical Center and in oncology at the NCI-Baltimore Cancer Research Center. In 1972, Dr. Abeloff joined the faculty at the Johns Hopkins University School of Medicine where he subsequently served as Director of Medical Oncology, Clinical Director, and Head of the Medical Oncology Training Program. He currently holds academic appointments in the Departments of Oncology and Medicine in the School of Medicine and the Department of Environmental Health Sciences in the School of Hygiene and Public Health.

Patrick N. Breysse, Ph.D., is an Associate Professor of Environmental Health Engineering and is the Director of the Industrial Hygiene Program. His research interests span environmental and occupational health issues including asbestos and man-made vitreous fibers, noise, electric and magnetic fields, airborne allergens, and children's environmental health.

Donald S. Coffey, Ph.D., is a prominent urological scientist and Professor of Urology, Oncology, and Pharmacology and Molecular Science at the School of Medicine. In addition, he serves as the Director of the Research Laboratories of the Department of Urology. His work in urological research has garnered him many accolades, including being named as a recipient for the First Society of International Urology's Yamanouchi Award. Dr. Coffey is also a member of the Principal Professional Staff at the Johns Hopkins University Applied Physics Laboratory.

Cecilia T. Davoli, M.D. is a Developmental Pediatrician who runs the Lead Poisoning Prevention Clinic at the Kennedy Krieger Institute in Baltimore, Maryland. She has extensive experience in the management and treatment of children with lead poisoning. She devotes much time to community outreach to educate others about childhood lead poisoning. Her primary clinical research at this time is participation in the long-term study, "Treatment of Lead-Exposed Children Clinical Trial", a multi-center trial of chelation in children with moderately elevated lead levels. Her faculty appointment is Assistant Professor in Pediatrics at the Johns Hopkins University School of Medicine and in Environmental Health Sciences at the Johns Hopkins University School of Hygiene and Public Health.

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Mark R. Farfel, Sc.D., Associate Professor in the Department of Health Policy and Management (Johns Hopkins Schools of Hygiene and Public Health), is Director of Lead Hazard Abatement Research at the Kennedy Krieger Research Institute. At KKRI, his research is focused on primary prevention of childhood lead poisoning via the conduct of community-based intervention studies. Current work includes a field study of the effectiveness of various interim control methods for controlling residential lead-based paint hazards; a study of residential demolitions and vacant lots as sources of lead exposure in the East Baltimore urban empowerment zone; and a comprehensive evaluation of Maryland's unique Reduction of Lead Risk in Housing Law which establishes enforceable and mandatory risk reduction treatments for over 160,000 pre-1950 rental housing units statewide. In addition to his work in Baltimore, Dr. Farfel is a visiting researcher at the JDC-Brookdale Institute, Health Policy Program, in Jerusalem where he is investigating the impact of national health insurance on the Israeli Arab population. His teaching and service activities are oriented to preparing students for community-based public health outreach, research, and practice. Dr. Farfel is the supervisor of InterAction, the student-run community outreach program of the School. Dr. Farfel's work contributes to the department's mission of disease prevention and providing a scientific basis for health policy.

William Michael Foster, Ph.D., is an Associate Professor in the Department of Environmental Health Sciences. He joined the Physiology Division of the Department in 1991 and in addition to the normal responsibilities of teaching and performing research, Dr. Foster currently serves as the CoDirector of the Health Effects Assessment Laboratory (HEAL). This laboratory is a federally funded lab designed to investigate the effects of airborne pollutants upon the human respiratory system. Dr. Foster has authored approximately 60 research publications and scientific book chapters on the response of the human lung tissue to inhalation of particulate and/or oxidant gases, such as ozone. The HEAL facility is excellent for performing safe and controlled exposure of humans to airborne pollutants and includes an exercise treadmill, EKG monitors, pulmonary function testing equipment, and a specialized radionuclide imaging camera for scanning the lungs of human subjects. The primary objectives of HEAL have been to identify in humans susceptibility factors for the development of environmentally induced airway diseases and the time course of recovery for lung tissues injured by ambient exposure to ozone.

John D. Groopman, Ph.D., P.D.F., is chair of the Department of Environmental Health Sciences and is Professor of Oncology and Associate Director of the Oncology Center for Cancer Prevention and Control. He received his academic training at MIT and NIH's National Cancer Institute's Laboratory of Human Carcinogenesis, where he was the recipient of the Institute's Career Development Award. In addition to his work at Johns Hopkins, he is chairman

JOHNS HOPKINS STAFF

of the Maryland State Legislative Committee of the American Association for Cancer Research, and a member of the Advisory Council of the National Institute of Environmental Health Sciences.

George J. Jakab, Ph.D., received his doctorate degree in Medical Microbiology and has performed research on the effects of air pollution on the genesis and exacerbation of acute and chronic lung diseases, publishing over 100 papers on the subject. Recently, he has become involved in education and teaches courses in "Environmental Health," "Food and Waterborne Diseases," "The Health Effects of Indoor and Outdoor Air Pollution," and "The Global Environment and Public Health," He is currently developing a web-based course on "Environmental Health." His consulting activities involve helping developing nations and former Soviet Union countries establish Schools of Public Health.

Clifford S. Mitchell, M.D., M.P.H., is an Assistant Professor in the Department of Environmental Health Sciences, with a joint appointment in the Department of Medicine of the School of Medicine. He is the Deputy Director of the Occupational Medicine Residency Program, and the Clinical Director of the NIEHS Human Exposure Assessment Laboratory (HEAL). For the past several years his research has focused on indoor environments, particularly schools, and on the effectiveness of prevention programs in occupational and environmental health.

William G. Nelson, M.D., Ph.D., is a trained medical oncologist who focuses his research efforts on the prevention and treatment of prostate cancer. Dr. Nelson is an expert in the areas of the molecular pathogenesis of human prostate cancer, the molecular epidemiology of prostate cancer, prostate cancer diagnosis and staging, and translational clinical trials in prostate cancer prevention and treatment. His laboratory has identified the most common somatic genome alteration associated with human prostate cancer, inactivation of the GSTP1 gene encoding a carcinogen-detoxification enzyme, and has collected recent data supporting the hypothesis that focal inflammatory lesions in the prostate may constitute prostate cancer precursor lesions. Current studies ongoing amongst Dr. Nelson's laboratory and several other collaborators include case-control epidemiological studies of prostate cancer risks associated with serum selenium levels and with SGTP1 gene polymorphisms.

Gloria M. Petersen, Ph.D., FACMG, is Associate Professor of Epidemiology in the Johns Hopkins School of Hygiene and Public Health, and holds a joint appointment in Oncology in the School of Medicine. Dr. Petersen was trained in human population genetics, earning her a Ph.D. degree in biological anthropology at UCLA in 1980. Her postdoctoral training at Harbor-UCLA Medical Center was in genetic epidemiology of complex diseases, along with clinical training for American Board of Medical Genetics certification. She is a founding fellow of the American College of Medical Genetics. Her research

JOHNS HOPKINS STAFF

program focuses on identification of cancer susceptibility genes using family-based studies to understand more about the genetic risks and etiologies of lung cancer, colorectal cancer, and pancreas cancer. She has also developed a translational research and clinical program to enhance the application of cancer genetics and cancer genetic testing, as principal investigator of the Mid-Atlantic Cancer Genetics Network. She is on the American Cancer Society Advisory Panel for Colorectal Cancer, and serves on task forces of the National Cancer Center Network and American Society of Clinical Oncology.

Jonathan Pevsner, Ph.D., received his undergraduate degree in psychology at Haverford, and the Ph.D. degree at Johns Hopkins School of Medicine. In graduate school he studies the sense of smell, and found a protein in the nose that binds odors. He did postdoctoral research at Stanford University, studying the basic biology of neurons. For the past 3-4 years, he has been at the Kennedy Krieger Institute, and is an Assistant Professor in the Department of Neuroscience at Johns Hopkins. His lab studies gene expression in the brain, with the mission to understand the molecular basis of brain disorders such as autism, Rett Syndrome (an autism-related disorder that affects girls), lysosomal diseases, and lead poisoning using techniques of cell biology, biochemistry and molecular biology. A major focus is the use of high density gene arrays to examine the expression of tens of thousands of genes in human brain samples.

Michael A. Trush, Ph.D., has served as Deputy Director of the Johns Hopkins Center in Urban Environmental Health since 1991. His current areas of research include chemical carcinogenesis, biochemical and molecular toxicity, bone marrow toxicity and leukemia, biochemical risk analysis, and inflammatory cell biology and toxicity. In addition to his scientific research, Dr. Trush is also interested in enhancing the educational process. To that end, he has served on numerous local and national committees designed to upgrade science education. Dr. Trush began his career in science education as a high school biology teacher.

James R. Zabora, Sc.D., is Associate Director for Community Research at the Johns Hopkins Oncology Center in Baltimore, Maryland. In addition, Dr. Zabora is an Assistant Professor on the faculty of the Johns Hopkins University School of Medicine, and an Instructor in the Department of Environmental Health Sciences at the Johns Hopkins School of Hygiene and Public Health. He is the co-editor of the Journal of Psychosocial Oncology and is a former president of the Association of Oncology Social Work. In 1994, Dr. Zabora received the Association's National Leadership Award. Dr. Zabora is the author of numerous chapters and articles related to the psychosocial care of cancer survivors and their families. In 1995, Dr. Zabora was the only staff member from Johns Hopkins to be honored by the Clergy United for Renewal in East Baltimore for

his contributions to the local community in cancer prevention and control. Within the Oncology Center, Dr. Zabora administers a breast cancer screening program for low income and high risk women from a number of minority populations. Based upon his success with this program such as the highest annual follow-up rate in the State of Maryland, he was appointed as Co-Director of Community Outreach and Education of the Johns Hopkins Center in Urban Environmental Health. He has also delivered numerous educational presentations on oncology-related issues including issues of minority health in the United States, Asia and Europe.

1999
ENVIROHEALTH LINK MASTER TEACHERS

Bill Barnes is the mathematics content leader at Ridgely Middle School in Baltimore County. Bill is a former MPT's National Teacher Training Institute for Math, Science, and Technology mater teacher. He has given presentations at the Maryland Council Teachers of Mathematics annual conference, Frostburg State University's Math Symposium, and at Baltimore County's professional study day. Bill is a member of Baltimore County's SSMART team, which provides staff development to middle and high school math teachers.

Bill has recently finished his master's degree in education from Johns Hopkins University and is going to begin a masters in mathematics at Towson University in the fall.

Jeremy Carlino has taught math and science in Baltimore County for four years. He is the Mathematics Content Leader at Perry Hall Middle School. Jeremy graduated from Towson State University with a B.S. degree in Mathematics. While teaching at Sudbrook Magnet Middle, he attended Johns Hopkins University, studying math/science education.

Jeremy has presented at several county and state workshops including the 1997 and 1998 Maryland Council for Teachers of Mathematics conferences. He also served as a Master Teacher at MPT's 1998 National Teacher Training Institute for Math, Science and Technology. Jeremy will be teaching a course in the fall at the College of Notre Dame in Maryland.

Jennie Discepolo, originally from North Carolina, holds an undergraduate degree in Elementary Education, a BS in Special Education and an MS in Environmental Education. She is currently a Master Science Teacher in Montgomery County teaching science at the middle school level. She teaches at Mark Twain, a special school for emotionally disturbed adolescents. At Twain, she is Science Department Chair of the middle school as well as the two high schools housed in the same building. Jennie was invited back for a second year as an EnviroHealth Link Master Teacher, after having participated in the first EnviroHealth Link Summer Institute in 1997.

Jennie has done extensive curriculum revision work over the past two years as part of the National Science Foundation's Science Connections Project in Montgomery County. She is also certified as a trainer for the National Geographic Society's Kids Network curriculum. This year, the Montgomery County Chamber of Commerce recognized Jennie as Outstanding Middle School Teacher of the Year in Montgomery County.

Doug Fireside has been teaching for seven years. He started teaching science in New Orleans and moved 5 years ago to teach Baltimore City. He currently teaches at Robert Poole Middle School in an advanced academic program "The Ingenuity Project". Doug teaches 6th, 7th & 8th grade science along with computer science to his 8th graders. He has his students fully integrate technology into almost every unit.

1999
ENVIROHEALTH LINK MASTER TEACHERS

Doug has been a presenter at many different conferences including regional Teach for America conferences in Baltimore and Washington, D.C. He has also twice been a Master Teacher at Maryland Public Television's National Teacher Training Institute for Math, Science & Technology. Doug enjoys working with teachers, "There is no better way to grow professionally than to sit with other educators and share ideas. I get more from presenting at conferences then I ever think I could give."

Janet Henke is currently the science content leader at Old Court Middle School in Baltimore County. She has completed 26 years of teaching for the Baltimore County Public Schools. Janet returned to teaching in September 1992, after serving for five years as the AIDS Prevention Specialist for the Maryland State Department of Education. Before going to MSDE she was the Science Department Chairperson at Sparrows Point High School, also in Baltimore County.

In addition to teaching science, Janet has taught health education courses in grades 6-12 and served as a member of the writing team that produced ***Health Education: A Maryland Curricular Framework***. She also directed the writing of the ***Maryland Learning Outcomes in Health Education***. Janet has delivered numerous presentations on health education at state and national conventions and institutes, including the first EnviroHealth Link Institute in 1997, and is actively involved in teacher training by teaching in-service courses in health education.

Rosetta Jackson has twenty-six years of experience teaching middle school science and health in Baltimore City Public Schools (BCPS). As a recipient of the Baltimore City School System, Rosetta obtained a Master's degree in Science Education. She is a graduate of the Governor's Academy for Mathematics, Science and Technology and Lockheed Martin Marietta Graduate Fellows Program. Her current position is Science and Health Department Head at Roland Park Middle School, a recently recognized Maryland State Blue Ribbon School. Rosetta also serves as Director of Camp Intervention, an elementary school integrated science program whose approach to learning is through hands-on interactive activities.

In her role as an educator, Rosetta has presented at local and state conferences and workshops. She completed several research internships at Nova Pharmaceutical Company Department of Molecular Biology and The University of Maryland Hospital, Department of Cardiology. She has served as mentor and supervising teacher for university students and BCPS new teachers. Rosetta was invited back for a second year as an EnviroHealth Link Master Teacher, after having participated in the 1998 EnviroHealth Link Summer Institute.

Among the numerous awards for outstanding leadership and dedication to the teaching of science, Rosetta describes her most significant accomplishment and reward is when her students successfully complete high school and college and take their place in the work force as productive citizens and leaders.

1999
ENVIROHEALTH LINK MASTER TEACHERS

Felicity Ross is a sixth, seventh and eighth grade mathematics teacher for "The Ingenuity Project" at Robert Poole Middle School in Baltimore City. "The Ingenuity Project" is a rigorous mathematics, science and technology program located in three Baltimore City middle schools and one Baltimore City high school. Two years ago Felicity was a master teacher for MPT's National Teacher Training Institute for Math, Science & Technology.

Felicity is particularly interested in gender equity in mathematics education. In 1997, Felicity Ross was awarded an Eleanor Roosevelt Teacher Fellowship from the American Association of University Women. This fellowship was awarded to her based on the math, science and technology program she designed for a group of at-risk African-American girls. You can read more about this program in the article Felicity wrote for the Sept/Oct. '99 issue of ***New Moon Network***: "For Adults Who Care About Girls and Their Dreams." This summer, Felicity will be among 12 women who were selected to participate in the Genderwise Working Conference to learn about issues surrounding girls and mathematics.

Felicity completed her undergraduate studies at the University of Michigan earning a Bachelor of Science degree in mathematics and psychology. She is currently working on her Masters Degree at Loyola College in Baltimore.

Evelyn Walls, a science teacher at Francis Scott Key Elementary Middle Technology Magnet School, has worked as a science teacher in the Baltimore City Public School System for 23 years. Evelyn has served on the FSK's School Improvement Team and as team leader of the Tigers Team.

Evelyn is also a participant in the Baltimore Learning Community (BLC). As a participant in the BLC project, her classroom has Internet access. She has widely shared information about the BLC project and her use of technology in instruction. Evelyn was a presenter at the District Of Columbia Public School's: Mathematics, Science, and Technology Initiative Conference (DCMSTI), where she demonstrated how the computer, internet, digital camera, CD-ROMS, and other high-tech materials are serving as highly motivational and vital resources for her students in the science classroom. Evelyn has also presented at The Maryland Technology Showcase/97. This past June (as part of the Baltimore Learning Community, <http://www.learn.umd.edu>) Evelyn will be a presenter at NECC '99, the National Educational Computing Conference in Atlantic City, New Jersey.

Evelyn's classrooms have been host to a Discovery Channel film crew, College of Notre Dame, Southern Area Principal's, visitors from The Baltimore Urban Systemic Initiative, visitors from The University of Maryland College Park, and others. Evelyn is also a Net-Vision Mentor Teacher, and an instructor for The Office of Technology and Media-Baltimore City Public Schools, where she administers workshops on "Beginning Webpage Design" for teachers and other professionals. She loves working and sharing with

other teachers and was a part of Maryland Public Television's National Teacher Training Institute for Math, Science and Technology (NTTI) where she presented with Ron Evry on the "Integration of Technology and the Internet in the Classroom." Evelyn was also an Internet and Technology presenter at the 1998 EnviroHealth Link Institute, and she received Maryland Public Television's 1999 NTTI Teacher of The Year Award.

Evelyn's classroom has an open door policy and she is always eager to share what she and her students are doing. She has worked with her students in the completion of a project on which the students themselves presented at The Environmental Symposium in New Hampshire. Her students demonstrated real mastery in combining their knowledge of technology and their familiarity with the scientific method and showed great facility in controlling video, digital images, web sites, laser pointers, and traditional graphics. Developing a project-based classroom that utilizes all types of technological resources, Evelyn's students are participating in an actual NASA Space Shuttle Mission through the ***EarthKam Project*** at <http://www. earthkam.ecsd.edu/>. They are also continuing their efforts to help the environment by working as Student Bay Savers in the Oyster Corps: <http://www. savethebay.cbf.org/sbs/about_sbs.htm>.

Evelyn also works with Francis Scott Key Technology Magnet School's curriculum coordinator in the development and updating of their school's Web Site <http://www.fsk.org>. She has also been developing her own Web Site: ***Tech-Phobia Zone for Teachers*** <http://www.geocities. com/CapeCanaveral/Hangar/1152/ewalls.html>. Evelyn and the curriculum coordinator were featured as the "School Spotlight" on the Discovery Channel School Web Site, April 20, 1998. The Discovery ***School Spotlight*** URL is http://school.discovery. com/schoolspotlight/ where you will find the page in the Discovery Channel's archive of "Schools in the Spotlight" section.

INTERNET & MULTIMEDIA WORKSHOP PRESENTERS

RON EVRY

An educator, writer, and programmer, Ron has been actively working with the Internet and education for years. He has finished his sixth year of running the computer lab at Antietam Elementary School in Woodbridge, Virginia. Kids at Antietam regularly use HyperStudio and video input to create interactive multimedia presentations, program their own web pages using raw html code, and grab resources off the internet to use in word processing and desktop publishing. Kids from second grade onward do plenty of hands-on work with Logo, databases, and spreadsheets in custom designed lessons.

Ron has been involved with CD-Rom creation, and has been producing video for web sites using *QuickTime* and *Real Media*. He is an author and a contributing researcher to the first two editions of The Internet Kids Yellow Pages from McGraw-Hill/Osborne, and other books. Ron has written for a number of national magazines on comics, sports, and computers, had his own newspaper column for two years, and has hosted, written and produced television programs for syndication and WNVT in Northern Virginia.

He was the creator and first editor of the National Cartoonists Society web pages (http://www.reuben.org), and continues to contribute to it as an active member. Ron also designed the shareware comic book font, "Witzworx," (available at http://surf.to/witzworx), which is used by thousands of professional and amateur cartoonists worldwide. Ron believes that even the most complex computers are truly simple for anyone to use. He can be reached by email at revry@clark.net.

ELLEN ENGLAND

Ellen has been teaching with PC's since 1982. She holds a BS in Health Education and Maryland State Advance Professional Teacher Certification for Health and Secondary Math. While teaching Health and Math in an alternative Prince George's County Public High School, she had the opportunity to work with some of the earliest Apple computers available. After studying computer programming at the community college during the evenings and summers she concluded that teaching, not programming, was her calling in life. Beginning in 1984 she spent 12 years training and consulting PC users in many different settings. The company she created, *Software Support Specialists*, provided hands-on-training customized to the users' needs. Over the years she has trained hundreds of PC users in a wide variety of application and operating system software.

In 1996 Ellen joined the faculty of St. John the Evangelist School in Silver Spring, Maryland as a part-time computer teacher for grades 1 – 8. She has overseen the expansion of the Technology Program to include a second computer lab, a part-time computer teacher for grades 1 – 3 and a third teacher who assists Ellen with the students in grades 4 – 8 for a part of each day. Along with developing curriculum, she also provides support and training for the staff and faculty. She is particularly

INTERNET & MULTIMEDIA WORKSHOP PRESENTERS

proud of an in-service she organized during which students from grades 6 and 8 helped the teachers learn to use *Excel, Print Artist, Cross Word Weaver* and the Internet. This year Ellen taught HTML to students in grades 7 and 8. Together they launched the school's web site. Next year, under her guidance, the 8th grade students will serve as "web masters" for the school. As presenters at the Montgomery County Catholic Schools Professional Day last March, Ellen and a middle school English teacher shared their experience piloting a program to integrate Technology and Sixth Grade English. Ellen was a participant in MPT's 1998 EnviroHealth Link and 1999 National Teachers' Training Institute for Math, Science, and Technology.

MELANIE SWIECONEK

Melanie is an Art/Graphics teacher at St. John the Evangelist School in Severna Park, Maryland. She has been teaching grades K-8 for over 16 years. Computer technology has become one of her passions. She uses multimedia to enhance the students' creativity. She has been selected to be a 21st Century Teacher, which requires instructing her school's faculty and staff in how to use technology as a teaching tool in the classroom. Melanie works with the teachers, in preparing and carrying out cross-curriculum lessons plans that include the use of art and computer graphics in all subject areas. Her students work with *HyperStudio, Power Point, Claris Works, Photo Shop, Aldus SuperPaint* among others. Melanie is head of the technology committee and is the computer technology coordinator for St. John's.

Last year, Melanie was one of 40 teachers selected from around the U.S. (and one of 2 Maryland teachers selected) to create innovative, standards-based "Challenges" for the U.S. Olympic PBS Cyber School web site.

Melanie has been a graphic artist since 1993 and has won several awards for her photography work including:

- a 1995 Kodak International Contest Special Merit Winner.
- a 1995 Capital-Gazette Photo Contest B/W – First Place
- a 1994 Capital-Gazette Photo Contest B/W – Second Place

This past spring Melanie worked with the United States Field Hockey Association on designing logos for this summer's leagues. Also, a new banner designed and made by her is currently on display at Central Michigan University's new athletic center.

Melanie returns for a third year to Johns Hopkins as EnviroHealth Link's Summer Institute multimedia workshop presenter. She has also conducted this workshop for the past two years at MPT's National Teacher Training Institute for Math, Science & Technology for Maryland K-16 teachers.

MPT EDUCATIONAL SERVICES

MARYLAND PUBLIC TELEVISION AND EDUCATION

For more than two decades, Maryland Public Television has served the educational needs of people across the state and across the nation. Throughout the years, we have steadily increased the number of people we serve, broadening our services to meet the ever more complex needs of students of all ages. Nevertheless, our mission has always remained constant. MPT is dedicated to providing quality educational programming and services to teachers, children, and families to enrich their education and their lives.

- MPT's College of the Air program has one of the highest enrollments in the nation with twenty-eight area colleges enrolling approximately 18,000 students each year.

- MPT continues to expand its professsional development programs for teachers. MPT's Mathline and Scienceline trains mathematics and science teachers in Maryland in yearlong programs designed to improve students' math and science performance. We also hosts MPT's National Teacher Training Institute for Science and Technology. For the past three years, we have also worked with The Johns Hopkins University School of Public Health and Hygiene to present EnviroHealth Link, a comprehensive program to help teachers incorporate environmental health science topics into their classroom lessons. In 1999, MPT will also add another professional development offering, working as part of the Maryland Teaching and Learning Consortium to develop a series of best practice videos and teacher training institutes to enhance classroom use of television, video, and computers.

- MPT supports the state's youngest learners through as series of projects, MPT's Ready to Learn and Ready to Grow. These two projects help child care providers learn how to best use MPT's extensive educational programming as the basis for active learning experiences, helping children enter school ready to learn and ready to grow.

- With its skilled production staff and excellent facilities, MPT also creates its own award winning educational programs, available for students in Maryland and throughout the country. And, taking advantage of everchanging technology, MPT offers online services on the World Wide Web to enhance and broaden its educational programming.

- Each year, MPT supports K12 teachers in their efforts to motivate students by providing educational videos, classroom materials and teacher guides to 1,200 schools that serve 812,000 students across Maryland.

Technology has transformed how people receive and process information. We have changed, too, in how we create and distribute our educational services. However, one aspect of our service remains the same: MPT is committed to helping students reach their full potential by offering services that will motivate, enlighten, and inform them.

PROFESSIONAL DEVELOPMENT

Public television's original mandate was to teach, and public broadcasting has always recognized the medium's power to inspire and inform. MPT is using its telecommunications resources and information technology to provide Maryland teachers with programs to keep their information current, their ideas fresh and their enthusiasm high.

NATIONAL TEACHER TRAINING INSTITUTE

Each spring, MPT offers the National Teacher Training Institute for Science and Technology (NTTI), a program designed to increase the use of technology in math and science in K12 classrooms. Teachers from across the state attend a twoday workshop hosted by MPT where they learn how to use television, computers, and other technologies to improve science and math classroom instruction. In addition, NTTI offers other resource products, such as a telecourse for teachers on NTTI methodology, an online NTTI Forum, and workshops at national and regional conferences.

> *The speakers were inspirational, the master teachers were great, and the materials a treasure.*

> *It was terrific. Keep them coming. I needed this twenty years ago.*

> *Thank you, thank you, thank you on behalf of educators and children.*

MATHLINE & SCIENCELINE

Mathline and Scienceline are telecommunications-based professional development services designed to help schools reach their goals in mathematics and science education and achievement. These are year long programs that use online communication and videos of actual classroom instruction to provide teachers opportunities to learn at times and locations they find convenient. Maryland math and science teachers facilitate each project, training and advising thirty selected mathematics or science teachers throughout the state. Online, teachers can also interact and collaborate with other teachers from across the country, sharing ideas and building a network of professional peers. Teachers particularly like the quality of the materials, the ongoing support that each program offers, and the ability to participate according to their own schedules.

> *The variety of lessons and topics cover a wide spectrum of the NCTM Standards, but the best part is the opportunity to discuss from a professional standpoint what is happening in each lesson, ideas for extending the lesson, educating families about the need for reform and a multitude of other issues. Each evening, I have a professional development experience online!*

PROFESSIONAL DEVELOPMENT

ENVIROHEALTH LINK

MPT, in partnership with the Johns Hopkins University, maintains a professional development program to provide teachers with new scientific information and technology skills so they can better incorporate environmental health sciences topics into their classroom curricula. The program keeps teachers uptodate with current information on this science, and offers strategies to transfer complex scientific information to their students in an understandable and usable way. The program consists of video teleconferences with select master teachers and research scientists, weeklong Teacher Training Institutes to provide handson lab and field experience, and netcourses with access to an online community where teachers can get immediate answers to questions, updated information, and feedback from other teachers about classroom activities.

THE MARYLAND TEACHING AND LEARNING WITH TECHNOLOGY CONSORTIUM

MPT participates in this Consortium along with representatives from the State Department of Education, local education agencies, higher education institutions, and the business community to provide high-quality professional development experiences to Maryland educators as part of a five-year federal Technology Innovation Challenge Grant. In meeting the goals of the Grant, the Consortium's projects are designed to provide professional development opportunities for educators working with middle and high school students who are educationally disadvantaged because of poverty, limited English proficiency, or disability. Partnering with Montgomery, Baltimore, and Prince George's County Public Schools, MPT is responsible for producing a series of best practices videos and offering teacher training institutes focused on the integration of television, video, and computers.

EARLY CHILDHOOD EDUCATION

CHILDREN'S PROGRAMMING

From its inception, MPT has strived to serve the entire spectrum of the educational community. People of all ages use MPT as an educational resource and service, particularly young children.

Engaging the minds of children with quality, commercial-free programming that parents can trust has always been part of MPT's mission. In 1993, MPT created the Children's Channel, with more than fifty hours each week of programs designed to help children learn social and intellectual skills while being entertained. Longtime favorites like SESAME STREET and newer programs like the MPT-produced KRATT'S CREATURES, WIMZIE's HOUSE, and ARTHUR offer preschool children innovative, nonviolent, and entertaining television shows.

> *Our whole family loves you! We turn to you as an alternative to Saturday morning cartoons. We're so glad our children have a place that has good clean fun and learning, too!*

READY TO LEARN

In 1995, MPT became a Ready to Learn station. PBS's Ready to Learn project was developed in response to the first National Education Goal: that, by the year 2000, all American children will enter school ready to learn. As a member station in this initiative, MPT has developed an array of services built upon the excellence of its strong children's programming schedule. MPT-trained coordinators travel throughout the state to conduct intensive workshops for child care providers and families. Workshop attendees learn how to use MPT programming as the starting point for a host of child-centered activities that encourage pre-literacy skills and reading. They leave these workshops with extensive hands-on experience in creating projects that help stimulate learning, as well as abundant print resources to help them in their work. These training sessions have also been accredited by the Maryland Department of Human Resources to help fulfill licensing requirements for day care providers.

As part of the Ready to Learn project, MPT also broadcasts educational messages between programs that urge children to be creative, curious, and cooperative learners.

READY TO GROW

MPT's innovative Ready to Grow Project extends the scope of the Ready to learn Project to a new community learners: school-age children in before and after school settings. Ready to Grow is based on programs such as BILL NYE THE SCIENCE GUY, READING RAINBOW, WISHBONE, and ZOOM. These outstanding programs become the springboard for an assortment of learning activities of all manner and stripe, from hands-on science to physical games with a purpose. As in the Ready to Learn project, trainers introduce this resource to before- and after-school care providers throughout the state.

FIRST BOOKS

First Books is a project funded by the Corporation for Public Broadcasting, distributing books to children who might not otherwise be able to own one. As a member station in this project, MPT distributes over 2500 first books to children throughout the state each year, starting them on the road to literacy and a lifelong enjoyment of reading.

EDUCATIONAL SERVICES

K-12 SERVICES

MPT provides educational videos and teacher guides to 1200 schools throughout Maryland. Each year, we air more than 340 hours of instructional programming for teachers and media specialists to record and use in classrooms. The courses range from foreign languages to economics to cultural diversity. DIFFERENT AND THE SAME, for example, is designed to help teachers talk about, understand, and combat racism. 3-2-1 CLASSROOM CONTACT brings the exciting world of scientific discovery into the classroom. WHAT'S IN THE NEWS uses current events to teach geography, map skills, economics and other curriculum. MPT's Online Educational Video Resource Schedule provides program descriptions and broadcast times of all the instructional series offered. Teacher manuals are generally available for each series. They provide activities and information to help teachers reinforce and integrate the video into a total lesson plan.

> *As a home schooling family, we are grateful for the many fine programs on MPT that help to supplement our educational program.*

> *Each month I send out a bulletin of selected MPT K-12 programs of interest to students and teachers. The response is always excellent.*

GED ON TV

Each year since 1975, an average of 150,000 students have used the GED series in 48 states. MPT offers this series to meet the needs of high school dropouts who want to take the General Equivalency Development (GED) test and receive their high school equivalency certificates.

GED On TV is a television tutorial with workbooks that supplements traditional adult education classes. More than one million adults have passed the GED exam after viewing the GED series.

> *GED is very flexible. It makes it a lot easier to combine school with a work schedule and family and all the other things that we have in our lives.*

COLLEGE OF THE AIR

College of the Air is a partnership involving MPT and twenty-eight colleges and universities in Maryland, Northern Virginia, Delaware, and Pennsylvania. Through distance learning, students earn credits that are transferable as required core courses or electives. In 1994, area colleges also began offering AA degree programs through MPT's **Going the Distance** project. Telecourses are a convenient and practical alternative to on-campus classes. There is a wide selection of courses, from accounting to philosophy to chemistry. Academically equivalent to on-campus classes, a telecourse is an integrated learning system of weekly TV programs, a study guide, a textbook, and an instructor. Although telecourse students earn these college credits at home, they have access to the same support services and privileges as on-campus students do.

Since taking a telecourse requires only minimum on-campus attendance, it has become one of the most popular alternatives to traditionally taught classes. Each year, 15,000 students earn college credits toward a degree through College of the Air.

> *Telecourses worked great for me because of my situation, because of my physical limitations and because of my work schedule.*

TECHNOLOGY AND EDUCATION

In the last decade, technological advances have changed the way we communicate with each other. MPT is using these new technologies to their fullest to broaden the way students learn.

MARYLAND ELECTRONIC FIELDTRIPS

MARYLAND ELECTRONIC FIELDTRIPS is an annual series of live electronic visits to places that make our state unique. Field trips are a favorite part of school for students. Through MARYLAND ELECTRONIC FIELDTRIPS, teachers have a chance to take their students far-reaching parts of the state without leaving the classroom.

Each Fieldtrip is broadcast live throughout the state on MPT's six-channel network. Through extensive media connections, students can talk with experts at the site. To prepare students for the trip, MPT has created project activities accessible on the World Wide Web. Classes can use the online activities and the interactive capabilities of fax, modem and telephone to pose question, suggest solutions and collaborate with students across the hall and across the state. A Fieldtrip Teacher Guide is also available, offering teachers lesson planning opportunities. The first Fieldtrip took students to St. Mary's city to celebrate Maryland Day on March 25, 1996, as the *Pride of Baltimore II* set sail from this historic city to retrace the route taken by the *Ark* and the *Dove*, the two ships that brought Maryland's first colonists across the Atlantic. Students met historians and archeologists for a more complete picture of colonial life. They also had the chance to talk to the crew of *Pride II*. The second Fieldtrip visited Calvert Cliffs along the Chesapeake Bay, where students had a chance to study fossils, endangered species and Maryland's environment. A third Fieldtrip gave students throughout the region a chance to tour a first-ever exhibition of Picasso's earliest works as an artist at the National Gallery of Art in Washington, D.C.

This series of Fieldtrips gives students to explore the cultural, historical, and scientific fabric of the region and offers teachers the opportunity for handson learning.

> *My students were mesmerized. The fieldtrip package was an incredible activity. We hope that you will have some next year.*
>
> *I'm proud of the work my students did and the spirit of cooperation in which they worked. Thank you for giving us this opportunity.*

MPT ONLINE AT HTTP://WWW.MPT.ORG

MPT Online offers Marylanders an in-depth, up-to-date, and relevant resource for information about our broadcasts, educational services, and other outreach projects. With special interactive sections for children and adult viewers, the web site also includes explorations of the programs broadcast on MPT, a look at special initiatives such as Celebrating our Diversity and Healthy Communities, a glimpse inside the organization and people that guide MPT, and a daily, on-demand schedule of programs. MPT's Learning Center is a special place on MPT's site for learners of all ages, from the youngest to the oldest. The information here covers all the educational services MPT offers, as well as comprehensive sites devoted to MPT educational productions and Fieldtrip experiences.

TECHNOLOGY AND EDUCATION

TECH TREK

Tech Trek gives young women from around the region a needed leg-up in building their scientific literacy. MPT partners with the Maryland Science Center and the Girl Scouts of Central Maryland in this effort. Tech Trek sessions, held in MPT studios and at the Maryland Science Center, focus on the science of optics, looking at cameras as the Aeyes@ of television. In addition, attendees conduct their own scientific experiments in this discipline. Tech Trekkers also meet people whose careers are focused on this conjunction of science and technology. The program was designed especially for adolescent women, who often start to under-perform in the sciences and mathematics at this point in their lives.

C.L.A.S.S.

The C.L.A.S.S. project was designed to help students become part of the technological age by making them more familiar with computers and related communications hard and software. C.L.A.S.S., which stands for Computer Literacy in After School Settings, involves elementary, middle, and high school students in C.L.A.S.S. Club meetings at their schools after the dismissal bell has rung and before their parents return home from work – a time of great vulnerability. At these Club meetings, students encounter facilitators trained by MPT who will guide them through technology and applications to help them develop the computer skills they need now and in the future. MPT partners with the Northwestern Cluster of Community Schools, Prince George's County, in this effort.

EDUCATIONAL PRODUCTIONS

MPT has earned a national reputation for high quality programming that meets the needs of children, adults and families. Over the years, MPT has created thousands of hours of instructional programming on topics as diverse as Constitutional history, space education and mathematics. These award-winning series are the collaboration of MPT's skilled production staff and leaders in the field of education and are used by schools across the country. Some recent productions include:

NUMBERS ALIVE!

NUMBERS ALIVE! is a tenpart series designed to help children develop number sense, a commonsense approach to using numbers. Content is based on the standards set forth by the National Council for Teachers of Mathematics. Each show models authentic mathematics situations that students can apply to their own lives. The series focuses on Beyond Zero, a high school rock band with an affinity for numbers. Whether they are touring the country or having fun closer to home, they use mathematics to solve the problems they encounter. They ponder probability while playing games at an amusement park; they work with statistics as they track their results in a "Battle of the Bands" contest; they deal with fractions and measurement as they frantically try to prepare food for a surprise party. Shot on location around the country, the band's "tour spots" include a ghost town in Montana, the Everglades, New York City and an amusement park in Ohio. Each show ends with a music video that reinforces the mathematical content of the program.

The students' reactions were paramount. They loved the videos, their discussions were animated and the results were clear to me they learned the material!

The snappy music presents an attention - grabbing way to involve/interest students in math.

LITERARY VISIONS

Students embrace the great richness and diversity of literature through this series of twentysix halfhour programs. Organized around the major genres of literature–fiction, poetry and drama – individual lessons focus on the elements of these genres: plot and structure, character, setting, style, symbolism, and myth and theme. Hosted by Shakespearean actress Fran Dorn, the programs blend dramatization of literary works with commentary by literary critics. A highlight of the series is interviews with authors nationwide. Students hear writers reading and interpreting their own work, as well as explaining how and why they write.

Literary Visions represents a renaissance for the study of some of the world's most important works. The dramatizations are a compelling draw for the student and the viewer, and the discussions open the door for a new level of interpretation and understanding.

ENVIROMYSTERIES

ENVIROMYSTERIES explores the relationship between our health and the environment. Students are introduced to environmental health concepts through the eyes of three high

school journalists. As reporters for their high school environmental television program, they investigate the mystery surrounding an outbreak of an acute waterborne illness. Something has made members of their community sick, and all the clues lead to the local seafood served at a community fair. But are the clues misleading? Their exploration mirrors the scientific efforts of the local health department as they try to solve the mystery.

MPT instructional programs have won numerous awards, including a Cine Golden Eagle, Silver Awards from the Chicago International Film Fest, Gold and Silver from the National Educational Film and Video Fest, Bronze Telly Awards, New York Festival Category finalist, and Peabody Awards, the most prestigious in television.

LESSON PLANS

Don’t Sit so Close to the TV
Exposure to Electric and Magnetic Fields
(Grades 6-10)

Table of Contents

Overview

In the 1990's, the availability of high-tech luxuries such as personal computers and cellular phones has become commonplace. With this phenomena came questions about the safety of such products. Everyone was told as a child to "not sit so close to the television." Police officers have been diagnosed with cancer stemming from their use of radar when monitoring speed limits. Are similar ailments going to stem from our close proximity to the computer monitor or a cell phone? Scientists are currently debating this issue. Some say that the health side effects are inevitable citing cancer rates of those that live near power line towers. Others say that there is no laboratory evidence supporting that claim so there is little to worry about. In this lesson, students will measure exposure levels of electric and magnetic fields (EMF's) with regard to common household objects. They will use Internet and printed resources along with data collected from an experiment to investigate levels of EMF's. Students will compare articles written by those who believe that EMF's pose no health threats with articles that feel that research will eventually show that cancer and possibly birth defects could be a result of everyday exposure. Hopefully students will finally understand why mom or dad said, "Don't sit so close to the TV!"

Back to Table of Contents

Technology Resources

Internet Sites:

EMF-Link:
http://infoventures.com/emf/
This site provides substantive information on biological and health effects of electric and magntic fields from common sources such as power lines, electrical wiring, appliances, medical equipment, communications facilities, cellular phones, and computers.

Power Lines and Cancer: Questions and Answers
http://www.mcw.edu/gcrc/cop/powerlines-cancer-FAQ/toc.html
This extensive question and answer site discusses current research and potential health hazards of exposure to EMF. The site provides objective information and is a source that will provide answers to just about any question that can be thought of regarding EMF's. (Neu)

Environ News by Topic
http://ehis.niehs.nih.gov/topic/emfs.html

This government site, supported by the National Institute for Environmental and Health Sciences (NIEHS), is pointed toward the most recent information regarding EMF's. Reports can be read which support either position of potential health risks associated with EMF's.

EMF: Electric and Magnetic Fields:
http://www.niehs.nih.gov/oc/factsheets/emf/emf.htm
This is a link from the previous page, which provides information through a question and answer format. Viewers can investigate levels of exposure to EMF in several areas of the typical home. (Neu)

Questions and Answers about EMF and Electric Power:
http://infoventures.com/private/federal/q&a/cover.html
This site provides some of the same information reported by the people at NIEHS. It also offers links regarding potential cancer cluster connection. (AR)

NIH Report Labels EMF as Possible Human Carcinogen:
http://www.lessemf.com/niehs.html
This site reports on an article released by NIEHS stating a clear connection to EMF's and cancer. This startling article caused a public relations nightmare. You can read a summary of the article or link and read the full report from this site. (AR)

WDIV-Cell Phone Dangers:
http://www.wdiv.com/cellphone.html
This is a transcript of a television piece done by Lila Lazarus of Michigan News station WDIV. The report suggests connections between cell phones and cancer. (AR)

Are Cell Phones Bad
http://www.redlandshospital.com/html/healthtips/cellphone.html
This short Web site hints at potential risks involved with exposure to EMF's.

Electromagnetic Fields and Your Health
http://ourworld.compuserve.com/homepages/mpm_mo/
This site strongly suggests a correlation to EMF exposure and cancer.

Software Resources *Microsoft PowerPoint:*
http://www.microsoft.com/powerpoint/

Videos Resources:
Video tape of Internet sites

Calculators:
TI-83 Graphing Calculators
TI-83 Overhead Projection Gel Screen

TI Calculators & Educational Solutions
http://www.ti.com/

Back to Table of Contents

Teacher Background Information

Power lines, electrical wiring, and electrical equipment produce electric and magnetic fields (EMF's). EMFs are invisible lines of force that surround any electrical device. Voltage and increase in strength produce electric fields as the voltage increases. The electric field strength is measured in units of volts per meter (V/m). Magnetic fields result from the flow of current through wires or electrical devices and increase in strength as the current increases. Magnetic fields are measured in units of gauss (G). Electric fields are shielded or weakened by materials that conduct electricity (including trees, buildings, and human skin). Magnetic fields, on the other hand, pass through most materials and are therefore more difficult to shield. Both electric and magnetic fields decrease as the distance from the source increases.

Although both electric and magnetic fields are present around electrical equipment and power lines, most recent research has focused on potential health effects of magnetic fields. This is because some epidemiological studies have reported an increased cancer risk associated with estimates of magnetic field exposure. No similar associations have been reported for electric fields.

Back to Table of Contents

Learning Objectives

Students will be able to:

- **Compare** and **Contrast** articles about EMF's and potential health risks.
- **Organize** and **Analyze** data using a scatter plot and curve of best fit.
- **Demonstrate** an understanding of EMF's and their role in our world by completing a presentation using Microsoft's ***PowerPoint*** and ***TI-83 Graphing Calculators***.

Back to Table of Contents

MSPAP/Core Learning Goals

(MSPAP vocabulary is highlighted within the learning objectives above.)

- **Goal 1: Skills and Processes:** The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information.
  Expectations 1, 2, 3, 4, 5, 6, 7

- **Math Goal 3: Data Analysis and Probability:** The student willCollect, organize, & display data; interpret information obtained from displays, and write reports based on statistical information. **Expectation 2.2**

- **Goal 2: Concepts of Earth/Space Science:** The student will demonstrate the ability to use scientific skills and processes to explain the physical behavior of the environment, earth and the universe. **Expectation 2**

Back to Table of Contents

Vocabulary

Electric and Magnetic Fields: invisible lines of force that surround any electrical device
Gauss: the unit of measure for EMF exposure.

Back to Table of Contents

Equipment and Materials

Per class:

- Dr. Gauss Meter
- Computers with Internet Access (3)
- Computers with PowerPoint (5)
- VCR and Monitor
- Videotape of Internet Sites
- Internet Articles (2)
- Overhead Projector
- Hair Dryer
- Cell Phone
- Digital Clock
- Electric Pencil Sharpener

Per Investigative Team of 4:

- TI-83 Graphing Calculator
- Student Activity Packet
- Scoring Guidelines Sheet
- Web Site Listings Sheet

Procedures

This three-day lesson takes a great deal of preparation by the teacher. For this lesson, students will have to be divided into an investigative team of four. The classroom or computer lab will have to be divided into 6 stations labeled A-F; 3 Internet stations (A, B, C), 1 VCR station (D), 1 experiment station (E), and one TI-83 graphing calculator station (F). Students can begin at stations A-E and rotate alphabetically in 15-minute intervals. (Note: Students cannot start at station F because they will not have collected data to analyze.) For each station, students will respond to questions in their activity packets at this station. Each station should be set up and monitored as follows:

Stations A-C: The Internet stations should be organized so that one station is centered on a "no-risk" Website; one is reserved for "at-risk" Website; and one is set for students to gather information through the question and answer formats. (Neutral sites) The Internet sites are organized by persuasive stance with the ratings NR, AR, and Neu representing "no-risk", "at-risk", and "neutral" respectively. Each station should also include printed Web pages that support the station's theme. These hard copy pages are included to ensure that students focus on the appropriate information for that station. The major thrust of this portion of the lesson is to have students gather information that supports both opinions on the health risks of EMF's.

- Station A
- Station B
- Station C

Station D: This interactive VCR station will allow students to gather specific information by watching a video of Internet Sites. Videotape information that supports both sides of the debate.

- Station D

Station E: Students will use the Dr. Gauss Meter to measure levels of EMF on common electrical items such as a television, a computer screen, a cell phone, a pencil sharpener, a clock, and a hair dryer. Students will gather reading from distances in 2cm intervals. Data will be recorded in the Student Activity Packet.

- Station E

Station F: Students will use TI-83 graphing calculators to create a scatter plot and curve of best fit in order to make predictions about levels of EMF exposure.

- Station F

Students will rotate through the stations for 2 class periods. (50 minutes) On the third class period, students will plan their assessment presentation. (Described in the Assessment Section)

Back to Table of Contents

Extensions

Math
Students could study trends in areas of the country with high cancer rates. Students could trace the cancer rates over time as different technologies have become mainstreamed.

English
Students could write a persuasive essay to their school's principal or a letter to their congressman for the purpose of explaining why EMF's are or are not a health concern.

Social Studies
Students could study the impact of environmental health groups on society. Students should investigate groups that are specific to EMF's and research how they help introduce new legislation into Congress. Students could form debate teams to argue their position on EMF's.

Art
Students could create posters that inform the public about EMF's. Students could try to persuade their audience to be fearful of products or they could attempt to ease tensions regarding EMF's.

Field Trips
Students could visit their local power plants to see how electrical energy is used in their community. Students could prepare questions for a plant employee directed at the impact of EMF's on environmental health.

Internet
Encourage students to search for additional information on EMF's. Students should e-mail site operators requesting additional information on the subject.

Back to Table of Contents

Assessment/Evaluation

Students will work to complete a creative presentation of the facts that they have gathered on EMF's. Investigative teams will have to defend one of the following positions: 1) Exposure to EMF's causes significant health problems or 2) Exposure to EMF's causes no health problems. Students will have to either videotape their presentation or create a PowerPoint presentation. The presentations will be graded using the rubric handout.

1999 EnviroHealth Link Master Teacher Team: Bill Barnes and Jeremy Carlino

Don't Sit So Close to the TV: Student Activity Packet

Names:

_____ _____
_____ _____
_____ _____

Directions: Rotate to each station as directed by the teacher. Complete the activity packet page that corresponds to the letter of the station. Use the information gathered at each station and the scoring guidelines below to create a presentation either videotaped or created using PowerPoint. **Note**: When you go to station E, experiment on only one appliance as directed by your teacher.

Scoring Guidelines

A. **8 points**: Present in a clear voice; Make eye contact with the camera/students in the class.
B. **8 points**: Integrate technology appropriately.
C. **8 points**: Each team member presents an equal share of the presentation.
D. **8 points**: Creativity.

Content

A. **34 points:** Presenters defend one of the following statements:
    1. Exposure to EMF's poses serious health risks.
    2. Exposure to EMF's poses no health risks.
B. **34 points**: Presenters use and explain appropriate vocabulary in their explanation of the topic. Presenters provide specific information from a variety of resources.

Station A: Web Station #1

Directions: Read each question below then surf the Internet sites listed below to gather information for the answers to each question. Be sure to note any extra information you feel will aid in your presentation. State the question in the answer and cite facts from the Web sites.

Web Sites

A. **Questions and Answers about EMF and Electric Power:**
http://www.niehs.nih.gov/oc/factsheets/emf/emf.htm

B. **Power Lines and Cancer: Questions and Answers:**
http://www.mcw.edu/gcrc/cop/powerline/s-cancer-FAQ/toc.html

Focus: To gather general information about EMF's.

Questions:

1. What are EMF's? Why are EMF's a "hot topic" in the world of health science? Use specific details from the Web site to support your response.

2. Which position do the authors of the Web site take regarding the potential health risks from exposure to EMF's? Support your response with specific details from the Web sites.

3. What is some other information that you think will be important for your presentation?

Station B: Web Station #2

Directions: Read each question below then surf the Internet sites listed below to gather information for the answers to each question. Be sure to note any extra information you feel will aid in your presentation. State the question in the answer and cite facts from the Web sites.

Web Sites:

Questions and Answers about EMF and Electric Power:
http://infoventures.com/private/federal/q&a/cover.html

NIH Report Labels EMF as Possible Human Carcinogen:
http://www.lessemf.com/niehs.html

WDIV-Cell Phone Dangers:
http://www.wdiv.com/cellphone.html

Are Cell Phones Bad?:
http://www.redlandshospital.com/html/healthtips/cellphone.html

Electromagnetic Fields and Your Health
http://ourworld.compuserve.com/homepages/mpm_mo/

Focus: To identify the role of NIEHS.

Questions:

1. What is the NIEHS? How is this organization related to EMF's? Support your responses with specific details from the Website.

2. Which position do the authors of the Web site take regarding the potential health risk from exposure to EMF's? Support your response with specific details from the Web sites.

3. What is some other information that you think will be important for your presentation?

Station C: Web Station #3

Directions: Read each question below, then surf the Internet sites listed to gather information for the answers to each question. Be sure to note any extra information you feel will aid in your presentation. State the question in the answer and cite facts from the Web sites.

Web Sites:

A. **Enviro News by Topic:**
http://ehis.niehs.nih.gov/topic/emfs.html

B. **EMF: Electric and Magnetic Fields:**
http://www.niehs.nih.gov/oc/factsheets/emf/emf.htm

Focus: To identify the role of EMF's.

Questions:

1. What common items in your world produce EMF's? Do certain items seem to cause more health concerns than others do? If so, which items? Support your response with details from the Web sites.

2. Name a few current health studies that are researching EMF. Summarize the current findings of each.

3. What is some other information that you think will be important for your presentation?

Station D: Videotaped Internet Sites

Directions: Use the VCR to view different Web sites. Each Web site provides a different stance on the issue of health concerns resulting from EMF exposure. PLAY, PAUSE, and REWIND the tape to supplement your research with any information you may have missed at Stations A-C. State the question in the answer and cite facts from the Web sites.

Focus: To gather more information on EMF's and potential health risks.

Questions:

1. List some new information about EMF's below.

2. >Describe the most interesting piece of information you have found regarding EMF's.

Station E: Data Collection

Directions: Use the Dr. Gauss Meter to measure the amount of EMF that is being released by the common household item assigned to your group. Begin by taking a reading from 0 cm and increase the distance by 2 cm until a measurement of 0 gauss is rendered. Fill in the following table with the data.

1. Which common household item are you measuring? _____

2. Fill in the table with data collected from the Dr. Gauss Meter.

Trial	***Distance***	**Reading**	
1	**0 cm**		
2	**2 cm**		
3	**4 cm**		
4	**6 cm**		
5	**8 cm**		
6	**10 cm**		
7	**12 cm**		
8	**14 cm**		
9	**16 cm**		
10	**18 cm**		
11	**20 cm**		
12	**22 cm**		
13	**24 cm**		
14	**26 cm**		
15	**28 cm**		

Station F: Data Analysis

Directions: Answer each of the following questions in order to make sense of the data your group collected at Station E.

1. Using a graphing calculator, create a scatter plot of the data collected at Station E. Sketch your graphing window in the rectangle.

2. Find the equation of the line or curve that best models the data. _____

3. According to your model, at what distance is your item best used? _____

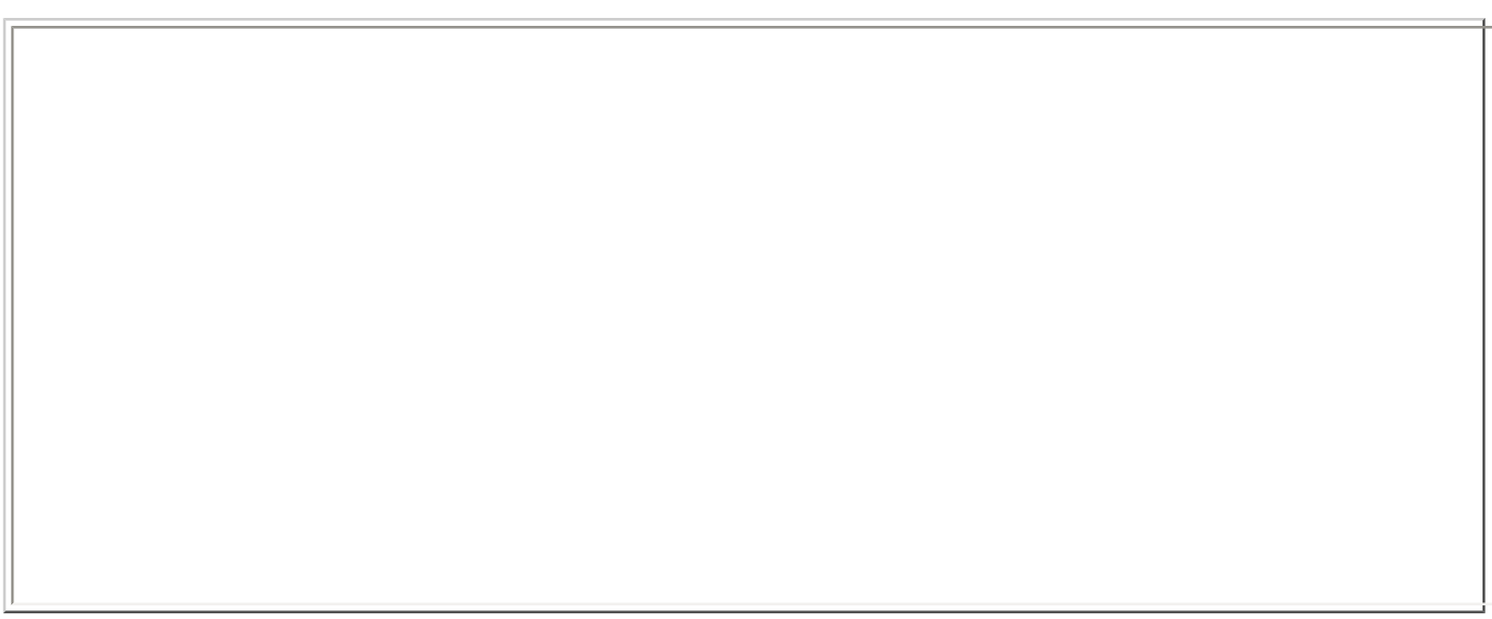
4. Is this safe distance reasonable for the use of your item? _____

5. Over which interval was the change in EMF levels the greatest? _____

6. Using your model, predict the EMF level of your item at 50 cm. _____

7. Explain which method you used to answer question six.
   _____
   _____
   _____

8. Design a warning label for consumers based on your results. Place that label in the rectangle below.



When Sun Gets in Your Eyes!
UV Radiation & Cataract Growth
(Grades 6-12)

Table of Contents

Overview

This lesson focuses on the connection between exposure to UV radiation and cataract growth. This issue is becoming more of a concern as we learn more about the harmful effects of the sun's rays. Current scientific research does show a connection between exposure to UV radiation and cataract growth. Currently, almost all sunglasses come with stickers indicating the UV protection offered.

Students will conduct a number of activities that will take them from a basic understanding of what the effects of cataracts are, to an in depth look into the structure of the eye. Students will use a variety of technologies to learn about the eye. The culminating activity is an eye ball dissection.

Back to Table of Contents

Technology Resources

Internet Sites:

Ask Jeeves
http://www.askjeeves.com
This is a new type of search tool that allows a question to be asked in full sentence form. Not only does this site have a large base of its own information but this site will also search other search sites based on your query.

Ask Jeeves For Kids
http://www.ajkids.com
The sister site to ***Ask Jeeves***. This site is geared towards young people.

Yucky Body Site
http://www.nj.com/yucky/body/index.ssf?/systems/sight/
This is listed as the grossest site on the web. It contains information on a number of body processes. A wonderful site for young and old alike.

Second Hand Smoke
hhttp://www.caregroup.org/Heart/second.htm
Provides background information and an on-line slide presentation on the effects of secondhand.

The Exploratorium Museum
http://www.exploratorium.com
This site contains the instructions students will need when conducting the eye ball dissection. If you do not have access to ***WebTV*** or some other way to show the whole class the Internet while doing this activity, have students record the steps and listen to the audio during the Web Search activity. Students can then use their notes during the dissection. You might also want to make a dissection instruction packet from the information contained on this site.

Yahooligans Web Search
http://www.Yahooligans.com
This is a search tool designed specifically for young people. It contains many useful sites. It is the first site students will use on their Internet search. A quick note: Internet sites change frequently.

Eyenet
www.eyenet.org/public/anatomy/anatomy.html
This site gives you clear drawings with labels of the eye along with information and vocabulary.

Computer Software Resources:

Cow Eye Primer 256
This is freeware available from the Exploritorium web site. It is a matching game that allows students to see and define vocabulary for the parts of the eye. This is a good tool to use after the dissection and before a vocabulary quiz.

The Ultimate Human Body
Dorling Kindersley Multimedia
This CD ROM contains many wonderful images that you can use for taking an inside look at the human eye. Besides the standard pictures and illustrations, this CD offers sound and animation files. Available from DK Multimedia, 95 Madison Ave., New York City, NY 10016; (800) 356-6575; http://www.dk.com

Back to Table of Contents

Teacher Background Information

A clouding of the natural internal lens of the eye that reduces visual acuity is considered a cataract. Some degree of cataract formation is an inevitable consequence of aging, since almost everyone will develop cataracts if they live long enough. Normally, the human lens remains clear until age 40 or later. However, it is estimated that nearly 20 percent of those between the ages of 65 and 75 have cataracts that interfere with vision. And nearly half of everyone over 75 has cataracts.

The cause of cataract development is unclear, but it is thought to be, in part, due to damage to the human lens proteins, which reduces the clarity of the previously transparent lens. Over-exposure to the sun's damaging ulta-violet rays is also a risk factor for developing cataracts.

Few, if any symptoms are noted in the early stages of cataracts formation. But eventually, individuals may complain of glare from bright light at night or even during the day. Progressive loss of vision may occur, though the rate of vision loss may vary. Cataracts may result in a variety of other subtle symptoms. Patients with cataracts may begin to have difficulty driving particularly at night, when glare produced by the cataract may be at its worst. Many patients may be reluctant to relinquish the freedom and independence of driving and may present a hazard to themselves or others. Cataracts may also result in a decrease contrast that degrades the quality of vision. Loss of acuity and contrast has been linked to an increase in traumatic injuries caused by falls in the patients with cataracts.

Despite the popular belief that there are quick fixes or miracle cures, the only way to remove a cataract is through surgery. Cataracts can not be removed with a laser. Cataract surgery has advanced dramatically over the past 20 years. Today micro-surgical techniques allow cataracts to be removed quickly and easily with the procedure performed on an outpatient basis under local anesthesia. Cataract surgery is highly successful, and over 95 percent of patients regain good vision.

UV and Blue Violet sun rays increase the risk of developing cataracts. There are over 951 different references to back up the claim that sun light is the primary cause of cataracts. Studies have shown that people who spend a great deal of time outdoors are three times as likely to develop cataracts. A good pair of sunglasses which blocks 100% of UVA and UVB and block at least 85% of blue violet sun rays are essential to protect the eyes from the harmful effects of the sun. On sunny days a wide brim hat should also be worn.

Back to Table of Contents

Learning Objectives

Students will be able to:

- **Define** vocabulary related to the structure of the eye.
- Dissect and **identify** the parts of the eye and compare the structure of the human eye to that of a cow's eye.
- **Explain the connection** between the sun's light and cataract growth.
- **Explore** and **explain** the damaging effects of the sun's light.

Back to Table of Contents

MSPAP/Core Learning Goals

(MSPAP vocabulary is highlighted within the learning objectives above.)

- **Goal 1: Skills & processes:** The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate and communicate information. **Expectations 1, 2, 3, 4, 5**
- **Goal 3: Concepts of biology:** The student will demonstrate the ability to use scientific skills and processes and major biological concepts to explain the uniqueness and interdependence of living organisms, their interactions with the environment, and the continuation of life on earth. **Expectations 2, 5, 6**

Back to Table of Contents

Vocabulary

Aqueous humor:A clear fluid that helps the cornea keep its rounded shape.
Blind spot: The area where the optic nerve leaves the retina. Each eye has a blind spot where there are no photoreceptor cells.
Blood vessels: Tiny arteries and veins that carry blood to the retina.
Ciliary body: Muscles that control the shape of the lens for near and far vision.
Cones: One type of photoreceptor cells in the retina. They are responsible for daylight and color vision.
Cornea: A clear, tough covering over the iris and the pupil that helps protect the eye and begins focusing the light.
Fovea: A dimple in the retina where cones are concentrated and vision is most acute.
Iris: A muscle that controls the amount of light that enters the eye. It is suspended between the cornea and the lens.
Lens: A clear, flexible structure that adjusts the eye's focus, allowing us to see objects both near and far. It is responsible for about 20 percent of our focusing.
Optic nerve: The bundle of nerve fibers that carries information from the retina to the brain.
Retina: The layer of light-sensitive cells lining the inner eyeball. It detects images focused on the back of the eye by the lens and the cornea. The retina is connected to the brain by the optic nerve.
Rods: One type of photoreceptor cells in the retina. They respond to dim light. **Sclera:** The thick, tough, white outer-covering of the eyeball.
Suspensory ligaments: Fibers that connect the Ciliary body to the lens.
Tapetum: The colorful, shiny material located behind the retina. Found in animals that have good night vision, it reflects light back through the retina.
Vitreous humor: The thick, clear jelly that helps give the eyeball its shape.

Equipment and Materials

Per class:

- Computer with modem and Internet access (preferable) WebTV or some other large screen connection.
- A pair of old sunglasses or two.
- Colored construction paper.

Per investigative team of 2 to 4 students:

- Cow eyeballs (available from either a local slaughter house - check the Yellow Pages - or from a science supply company such as Carolina Biological, 2700 York Road, Burlington, North Carolina, 27215)
- Meat Trays (Styrofoam from the grocery store)
- Newspaper (to cover tables with)
- Petri Dish (each team needs only one half of the dish)
- Vaseline (just a small amount - I usually put it in old film containers)
- Eye Chart (worksheet)

Per student:

- Internet Search Should You Wear Your Sunglasses At Night?
- Internet Eye Search worksheet
- Rubber Gloves (Latex - NOTE some students are allergic to latex)
- Scissors (sharp - pointed ones work best)
- Cataracts Background Information

Back to Table of Contents

Procedures

ACTIVITY 1
In this activity students will get a chance to work with a partner to "see" what life would be like if they had a cataract. Students will work with a partner to read an "eye chart" twice - once with their vision unimpaired and once with a petri dish that has a very thin layer of Vaseline smeared on it in front of their eyes. Each student should work with a partner who can record how many of the symbols they identified correctly and how many they identified wrongly. The partner should also record the smallest line that the student can read. Through this short activity, students will be introduced to this unit.

Once students have completed and shared their experiences with the class, collect the eye charts and petri dishes. Tell the students that they are about to investigate the eye and cataracts.

ACTIVITY 2:
This activity is designed to have students use the World Wide Web to collect some background information on cataracts. Students are going to start out on the web site ***Ask Jeeves*** http://www.askjeeves.com which is a search tool designed to be used by asking questions. Students will need to be familiar with how to use a Web browser and how to use a mouse. The Internet search worksheet can be easily followed, but please note that Web site addresses change frequently, so make sure you do the search yourself a day or two before you are going to give it to your students. Also, depending on how "Web savvy" your students are, you might just want to ask them to research cataracts on their own and see if they can build a Web search worksheet from what they find.

For this activity you can team students up into groups as large as three, although even groups that are small tend to get restless when they are trying to use the computer to locate information.

Distribute the worksheet "Should You Wear Your Sunglasses at Night? to each student and have them complete the first section on their own (or in small teams). Also review the terminology with students before you begin.

ACTIVITY 3:
This next activity will take a few days to complete. First, allow students a chance to discuss their experiences with cataracts. Many students might have an older relative who has cataracts. Tell students that one of the possible contributing factors is sunlight. Tell students that you are going to set up a little demonstration to see if sunglasses really can help block some of the harmful effects of the sun. Place a pair of sunglasses on a bright sheet of paper in front of a window. This activity will take a few days and is designed to show students how the sun can cause discoloration of the paper and how sunglasses can block some of that damage.

Students should be encouraged to use either the Internet or to use magazines or newspapers to investigate the link between sunlight and cataract growth. If the Internet connection is not available, give students the information sheet called ‘UV and Your Eyes." Allow them to read through it and discuss the information. If you can have them use the Internet, I suggest using ***Ask Jeeves*** http://www.askjeeves.com, as this site allows you to type in a question (such as what is the connection between cataracts and sunlight) and it will find the answers for you.

ACTIVITY 4:
Next, students are going to investigate the structure of the eye through the use of the Internet. Students will complete the Internet search and will complete the Internet search worksheet "The Eye Ball Search". Allow students to either work in teams or to work independently to complete this activity (depending upon resources available) Through this activity students will gain a basic understanding of the structure of the eye. Students will also get an introduction to the eye dissection activity that is coming up.

ACTIVITY 5:
This is where students will compare what the structure of the eye looks like to the images they have seen on the web or in their textbooks. This activity takes a good deal of planning but is well worth it. I suggest beginning by reviewing lab and safety procedures. Students should all be wearing gloves AND safety goggles. Remind students about contamination.

I used the WebTV to complete this activity and had the *Exploratorium* Web site up and running so we could use that as a guide. Go to the following site:
http://www.exploratorium.com/learning_studio/cow_eye/

Follow the link to Step-By Step: "Dissecting a Cow's Eye"

Here you will find the steps, plus *RealAudio* instructions for how to complete this activity. Students should have copied down the steps in the Web search and you may use this as a guide as well. There is also a printable PDF version of the activity available on the site if you do not have classroom access to the web.

To complete this activity, tape newspaper to the tables and have one eyeball for each pair of students. If you are going to use *Exacto* blades or some other sharp knife, I strongly suggest reviewing safety procedures with students. I used utility knifes, which I got at a dollar store. I kept a bucket with mixed bleach and water for students to deposit their knives in after they were finished.

Ask students to bring in meat trays the week before the dissection. If this does not work you can go to a local supermarket and they will donate the trays. This, along with the newspaper, makes clean up a whole lot easier.

If at all possible, get the eyes the same day you do the dissection, as fresh eyes are a lot easier to cut (and they smell better!)

When you are finished, make sure that students clean up and wash their hands.

ACTIVITY 6:
Follow up to the dissection is a matching game available for free from the *Exploratorium* Web site. This game allows you to make sure students have learned the basic eye structures. Download this game from the web site. It is available for Macintosh, Windows 3.1 and Windows 95. I used it while some students were cleaning up from the dissection.

ACTIVITY 7:
Now that students have conducted an in-depth investigation into the structure of the eye, the causes of cataracts and some ways to protect the eye, they are going to create an "information brochure" for fellow students to alert them to the dangers of not protecting their eyes. Students may either create their presentations on the computer-- *PowerPoint* or *Hypercard* to make slideshows--or they may complete them using paper and art supplies. Give them the following prompt:

You have just completed a unit on cataracts and the eye. You are being asked by your teacher to construct an informational brochure on cataracts and what young people can do to prevent getting them.

Before you begin think about what a cataract is and how they form. Think about what some of the effects of having cataracts are. Finally, think about the causes of cataract growth and what can be done to protect yourself from the damage that cataracts can cause.

Now, begin to create your brochure on cataracts.

Back to Table of Contents

Extensions

Science
Invite an ophthalmologist into the classroom to discuss eye care.

Health
Have someone from a local eye care center come in to give everyone an eye test.

Math
Have students survey their families and school to find out how many people wear glasses and what the median age that people begin wearing them. Have students create a box and whisker plot with that information.

Computer Science/Language Arts
Have students present a *PowerPoint* presentation to other classes.

Back to Table of Contents

Assessment/Evaluation

This activity has a number of built in assessments: The web search, lab packets and writing prompt/activity should all be collected and graded.

A suggested rubric for the writing activity:

- *4 Points:* Students have included at least:
- Clear description of what a cataract is and how cataracts form.
- Three ways that cataracts can adversely effect daily life.
- Two factors that have been shown to promote cataract formation.
- Three things people can do to protect themselves.
- Information about the (4) structures of the eye and the function of those structures.

- *3 points:* Students have included at least:
- Clear description of what a cataract is and how cataracts form.
- Two ways that cataracts can adversely effect daily life.

- *2 points:* Students have included at least:
- Clear description of what a cataract is and how cataracts form.

Further, there are plenty of vocabulary terms that can be quizzed.

Back to Table of Contents

1999 EnviroHealth Link Master Teacher Team: Doug Fireside & Felicity Ross

Eye Chart

A. E W M 3

B. M 3 E W 3 W

C. 3 W M E M W

D. 3 W E W M 3 M W E

E. M W M 3 E W M W 3 M E

F. W E M 3 M 3 W E M W 3 M E W M 3 M W M 3

Name: _____ Date: _____

Should You Wear Your Sunglasses at Night?

Introduction: This activity is designed to give you some background information on cataracts. You will be using the Internet to search for and record information. When you complete this activity you should be able to:

- Identify some of the causes of cataracts
- List the symptoms of cataracts
- Discuss ways to treat cataracts

Your teacher will discuss and use the following vocabulary with your class as you use the Internet. If there are any words you are not familiar with, make sure you raise your hand and have those words explained.

Vocabulary: Search Engine, Click, Address Bar, Back Button, Web Browser

1) Make sure that your Web browser is up and running. Go to the search engine ***Ask Jeeves for Kids*** http://www.ajkids.com. This search engine allows you to type in a question and it will search for the answers. If we are trying to find out information on cataracts, what are two questions you might type in?

_____
_____
_____

2) Try this question: What causes cataracts? Type this question into the search box and click ASK. How good was the search? How many sites did it find total? _____ Since ***Ask Jeeves*** looks at other search engines, you should be able to tell how many matches were found at ***AltaVista.Com.*** List that number here: ____ What was the first site about at ***AltaVista***?

_____
_____

3) Now, let's try another search engine called Yahoo! To get there, click in the address bar of your Web browser and type in http://www.yahoo.com. This search engine works in a different way than ***Ask Jeeves***. For this tool we are going to type in just words (not a complete sentence) to see what information this engine can find. First try just "Causes of Cataracts" without the quote marks. How many sites did you find? _____ Now, try adding the quote marks to your search. How many did you find this time? _____ Let's try the second link "What is a cataract?" http://www.chironvision.com/cat1.htm. Read through the information on this page and try to answer the questions:

a) What age group is most likely to be affected by cataracts? _____ Why is that?

_____

_____

b) After reading about how cataracts develop, why do you think some people who have cataracts might not be aware of them at first?

_____

_____

_____

c) Let's click on the FAQ. A FAQ is a frequently asked question area for some Web sites. According to this Web site, what treatment is there for cataracts and how successful is it?

_____

_____

_____

Click the back button twice to get back to your search results from ***Yahoo!*** Click on the link for "Your Pet and Cataract Surgery" http://www.vetmed.ufl.edu/sacs/Ophtho/cataract.htm and compare how cataracts grow in animals to how they grow in humans:

_____

_____

_____

_____

Now compare what you already know about the symptoms in humans to symptoms in animals:

_____

_____

_____

_____

Now, work on your own and see what information you can find on the Web using either ***Ask Jeeves for Kids*** **or** ***Yahoo!***, studying the connection between sunglasses and cataracts. List every Web site you find that has information others might be interested in reading:

_____

_____

_____

_____

_____

_____

_____

_____

Cataracts Background Information

What else can be done?

Sunlight

UV and Blue Violet sun rays increase the risk of developing cataracts. There are over 951 different references to back up the claim that sun light are the primary cause of cataracts. . Studies have shown that people who spend a great deal of time outdoors are three times as likely to develop cataracts. A good pair of sunglasses which block 100% of UVA and UVB and block at least 85% of blue violet sun rays are essential to protect the eyes from the harmful effects of the sun. On sunny days a wide brim hat should also be worn.

Smoking

If you smoke please do everything possible to stop. Smoking tobacco, especially more than 20 cigarettes per day, increases the risk of cataracts by more than 2 times. The risk in ex-smokers is 50 percent higher compared to non smokers. Each cigarette also robs the body of 25 mg of vitamin C. Smokers have an increase in lipids (both fat and cholesterol) which increase the risk of severe cardiovascular disease. These factors produce narrowing of the retina blood vessels that carry valuable nutrients to the eye.

Alcoholic Consumption

High intake of alcohol more than doubles the risk of developing cataracts. More than 7 drinks per week will increase the risk, while moderate use does not seem to increase the risk.

Sugar and Cataracts

Diabetics develop cataracts at an earlier age than non-diabetics. An accumulation of sorbitol and fructose in the lens can induce osmotic swelling of the lens, which will lead to the development of a cataract. A significant number of adults who develop cataracts have undiagnosed diabetes. If you have diabetes, every effort should be made to keep your blood sugar under control. There have been several studies to show that vitamin C can help reduce the level of sorbitol and reduce the incidence of cataracts formation.

Vitamins and Nutrients

There have been many large-scale studies to show the effectiveness of vitamins on reducing the incidence of cataracts. A Canadian studied showed that patients over the age of 55 who consumed vitamin C and E supplements reduced their risk of developing cataracts by over 50%. A double blind study involving 30,000 patients performed at the University of Helsinki also demonstrated the beneficial effects of vitamins.

Glutathione
Loss of glutathione occurs in all forms of cataracts. Since 1912, researches have shown that reduced levels of glutathione precedes the development of cataracts. With increasing age the levels of glutathione content of the human lens decreases by 4 to 14 times. Glutathione supplements are available but it is questioned weather this large molecule can pass through the digestive tract. N-acetyl-cysteine, a stable amino acid, has been shown to raise the levels of glutathione. Cysteine is found in protein rich eggs. Completely avoiding eggs may rob the body of this amino acid, which may have anti-cataract properties.

Vitamin C
The lens of the human eye is bathed in a vitamin C rich aqueous solution which is 30 times more concentrate than the human blood. It appears that vitamin C acts as an ultraviolet filter preventing the harmful effects of ultraviolet light. With age the levels of vitamin C begin to decrease and this may contribute to the formation of the senile cataract. There are several studies which have shown that high dosages of vitamin C (1000 mg/day) will reverse the development of some cataracts.

Riboflavin (Vitamin B2)
Riboflavin helps to make a substance called flavine adenine dinuceotide which is necessary for the production of glutathione. High levels of glutathione have been shown to keep the human lens clear and prevent the development of cataracts. In one study, 81 percent of patients with cataracts were deficient in riboflavin.

Cineraria Maritima
Cineraria is an Herb which when applied topically to the eye increases circulation and improves metabolism. Studies have shown that this tincture may check and even abort the early development of cataracts. In one study, 22.5% of cases of advanced cataract had beneficial results. The government of India's Central Council for Research in Homeopathy, Ministry of Health and Family Welfare have stated that tincture of Cineraria Maritima Succus is the drug of choice which prevents the development of cataract. The recommended dosage is one drop in the affected eye twice a day.

Children's Health and Environmental Exposure to Toxic Substances

(Grades 6-9)

Table of Contents

Overview

Along with the current use of more than 70,000 chemicals to support the explosion in technology and material use, children today face an array of exposures to potentially toxic environmental hazards. Hazardous substances have found their way into the homes, schools, and playgrounds of our children. One in every four Americans lives within four miles of a hazardous waste site.

More than 10 years of public health assessments, epidemiological studies, toxicological investigations, and reviews by expert workgroups have confirmed that children have unique characteristics and activities that often place them at greater risk of adverse health effects when exposed to toxic substances from hazardous waste sites or chemical releases. Children who live near hazardous waste sites may have greater exposures, greater potential for health problems, and less ability to avoid hazards than do adults. Exposure to hazardous substances can cause growth and development problems in children, such as learning disabilities, mental retardation, cerebral palsy, and hyperactive airways, as well as cancer.

This lesson is a compilation of interdisciplinary and technology-infused activities that focus on the often complicated and sometimes controversial issues related to toxic chemicals in children's environment. Special emphasis is placed on the effects of toxic chemicals on living things, toxic chemicals released in the community by local manufacturers, and the unique vulnerabilities of children to environmental toxicants.

Back to Table of Contents

Technology Resources

Internet Resources:

How Hazardous Substances Affect People
http://www.epa.gov/superfund/students/clas_act/haz-ed/act05.pdf
This site maintained by the Environmental Protection Agency provides several classroom activities and lessons for understanding hazardous waste.

HAZ-ED: Classroom Activities for Understanding Hazardous Waste
hhttp://www.epa.gov/superfund/students/clas_act/haz-ed/hazindex.htm
Maintained by the Environmental Protection Agency. Classroom activities provided at this site are designed for students in grades 7-12. Excellent site for locating environmental activities that will help students develop MSPAP skills in critical thinking, problem solving, and decision making. Activities provided at this site increase environmental awareness and encourage an environmental ethic in students.

Hazardous Waste Sites and Children's Health Risks
http://atsdr1.atsdr.cdc.gov:8080/child/chw497.html#childhws
This site maintained by the Agency for Toxic Substances and Disease Registry Office of Children's Health places special emphasis on policies, projects, and activities that promote health in children.

Preventing Child Exposures to Environmental Hazard: Research and Policy Issues
http://www.cehn.org/cehn/symposium.html
Provides 52 pages of reports from the first symposium to address a national research and policy agenda for pediatric environmental health.

An Introduction to Children's Environmental Health
http://www.cehn.org/cehn/WhatisPEH.html
Maintained by the Children's Environmental Health Network. Provides a brief overview of why children are more vulnerable than adults to environmental exposures, what types of exposures affect children, and which children are at particular risk.

Scorecard
http://www.scorecard.org/
An information service provided by the Environmental Defense Fund. Provides detailed data reports on chemicals being released from any of the 8,800 zip codes, 50 states, or the entire country.

Software Resources:

1987-1993 Toxic Release Inventory (CD-ROM) and Teachers Guide
Environmental Protection Agency
Office of Pollution Prevention & Toxics
401 M. St., S.W.
Washington, DC 20460
(202) 260-1531

Back to Table of Contents

Other Resources

Books:

Getting Started-"A Guide to Bringing Environmental Education Into Your Classroom"
Published by The National Consortium for Environmental Education and Training School of Natural Resources and Environment, University of Michigan, Ann Arbor, MI 48109-1115 (313) 998-6726. Designed to help educators broaden their education programs on environmental issues.

Bags, Beakers, and Barrels: An Action Curriculum Toward Solving Hazardous Materials Issues for Middle and High School Students
Published by Industrial States Policy Center, 1987. Industrial State Policy Center, 17 Brickel, Columbus, OH 43215, (614) 224-4111. This guide enables teachers to help students understand hazardous materials, their usefulness, dangers, and their typical disposal pattern.

Back to Table of Contents

Teacher Background Information

Patterns of illness in American children have changed dramatically in this century. The ancient infectious diseases have largely been controlled. The major diseases confronting children now are chronic and disabling conditions termed the "new pediatric morbidity": asthma mortality has doubled; leukemia and brain cancer have increased in incidence; neurodevelopment dysfunction is widespread; hypospadias incidence has doubled. Chemical toxicants in the environment as well as poverty, racism, and inequitable access to medical care are factors known and suspected to contribute to causation of these pediatric diseases. Children are at risk of exposure to hundreds of thousands of high-production-volume synthetic chemicals, nearly all of them developed in the past 50 years and integrated into every aspect of our lives. The production of synthetic chemicals has increased from 1.3 billion pounds in 1940 to 320 billion pounds in 1980, with an additional 300 new chemicals introduced each year. Many of these chemicals are used in industrial facilities in our local communities and are dispersed in the environment. More than half of these chemicals are untested for toxicity. For the majority of these chemicals, the toxic effects on children, particularly long-term effects, are largely unknown.

In the late 19th and early 20th centuries, miners would send canaries into untested mines to determine the safety of the air quality. If the canaries died, the environment was known (assumed) to be unsafe for humans. Have our children become the modern day canaries? Chemicals are ubiquitous in our environment worldwide, and traces of man-made chemical compounds (toxicants are found in all humans and animals).

The Agency for Toxic Substances and Disease Registry Office of Children's Health estimates that of the 1,255 National Priority List sites, 1,127,563 children under the age of 6 years of age (about 11% of the potentially affected population) live within 1-mile borders of the sites. Women of childbearing age account for about 24% of the population near waste sites.

Children are not just "little adults" when it comes to environmental exposures. The unique susceptibility and characteristics of children make them extremely vulnerable to hazardous substances in the environment. They are more likely to be exposed because they play vigorously outdoors (splashing, digging, and exploring) and they often bring food into contaminated areas. They are smaller than adults, which means they get higher doses per body weight. Their developing body systems can sustain permanent damage if toxic exposures occur during critical growth stages. Most importantly, children depend completely on adults for risk management decisions, housing decisions, and access to medical care. Organizations for children's health have concluded that these unique vulnerabilities of infants and children demand special emphasis in communities faced with contamination of their water, soil, air, or food. There is equally compelling need to educate children and their parents, as well as health advocates, to prevent hazards to children's health from site-related substances.

Back to Table of Contents

Learning Objectives

Students will be able to:

- **Discuss** how scientists conduct studies to obtain information on toxic substances.
- **Analyze** and **interpret data** in an experiment that illustrate the impact of hazardous substances on living things.
- **Research** information on the Internet to construct a profile of the toxic chemicals released by a manufacturing company in their community.
- **Describe** why certain characteristics and activities make children vulnerable to toxic chemicals.
- **Write** a letter to a top-rank polluter in the community addressing toxic chemicals in their community.
- **Construct** a graph that illustrates the disproportionate risk of children for exposure to environmental hazards.

Back to Table of Contents

MSPAP/Core Learning Goals

(MSPAP vocabulary is highlighted within the learning objectives above.)

- **Goal 1: Skills and Processes:** The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information.
  Expectations 1,2,3,4,5,6

- **Goal 2: Concepts of Biology:** The student will demonstrate the ability to use scientific skills and processes and major biological concepts to explain the uniqueness and interdependence of living organisms, their interactions with the environment, and the continuation of life on Earth.
  Expectation 2

- **Goal 4: Concept of Chemistry:** The student will demonstrate the ability to use scientific skills and processes to explain composition and interactions of matter in the world in which we live.
  Expectations 5, 6

Back to Table of Contents

Vocabulary

Acute Exposure: A single exposure to a hazardous substance for a short time.
Carcinogen: A chemical substance or other agent that causes cancer.
Chronic Exposure: Exposure that occurs over a long period of time, usually with repeated exposures in small amounts.
Emissions: Substances given off into the air, as a smokestack or automobile gasoline engine.
Epidemiology: The study of the occurrence of disease among people. Epidemiology studies groups of people to try to discover the cause of a disease, or where, when and why diseases occur.
Fugitive Air Releases: Releases that do not occur through a confined air stream. Sometimes called Non:point sources.
Hazardous substances: Substances or mixtures that are toxic, corrosive, flammable, explosive, or reactive. In general, they pose a risk to living things and/or the environment
Recognized Toxicants: Chemicals that are identified and known to cause specific adverse health effects.
Stack Air Releases: Releases to air that occur through confined air streams, such as stack, vents, ducts or pipes. Sometimes called point source.
Suspected Toxicants: Chemicals that are may cause specific adverse health effects.
Total environmental release: The sun of air releases, water releases, underground injection, and land releases.
Toxic: Of, relating to, or caused by, a poison or a poison itself
Toxicology: The study of the effects of poisons on living organisms.

Back to Table of Contents

Equipment and Materials

Per class:

- Overhead Projector
- Transparency of Polluter Locator Scorecard (sample letter)
- Transparency of Ethylene Glycol-Consumer Products

Per investigative team of 4-5: Activity 1

- Small plastic cups (5 per group)
- Three empty one-liter plastic soft drink containers with caps
- Refrigerated tap water
- Automobile antifreeze (ethylene glycol)
- Live, *fresh-water black (hair) worms (sold as fish food in pet stores)
  **If worms are not available, use brine shrimp or some fresh water invertebrate*
- (50 or more worms per group)
- 16-ounce measuring cup
- 1-ounce measuring cup (used to measure doses of cough syrup)
- Plastic wrap
- Tape and markers
- Latex gloves

Per investigative team of 2-3:

- Computer with modem or Internet access

Per student:

- Eye goggles
- Xerox copies of:
  - Student Handout: "Community Check-Up for Toxic Substances"
  - Student Activity Sheet: "Community Check-Up"
  - Student Background Sheet: "A Look at How Toxic Substances Affect Living Things"
  - Student Directions Sheet: "Toxic Substance and Black Worm Experiment"
  - Student Activity Sheet: "Toxic Substances and Black Worm Experiment"
  - WebQuest Handout: "The Unique Susceptibility of Children to Environmental Toxicants"
  - WebQuest Activity Sheet: "We Are Not Just Little Adults"
  - Student Handout: "Sample letter for Grace Davison Co."
  - Student Handout: "Consumer Products that contain Ethylene Glycol"
  - Rubric for Student Graphs

Back to Table of Contents

Procedures

ACTIVITY 1: "A Look at How Toxic Substances Affect Living Things"

This exercise not only promotes a fundamental understanding and appreciation for how scientists determine the human health effects of toxic substances, it also provides hands-on opportunity for students to use laboratory skills that support MSPAP and Science Core Learning Goal 1: Skills and Processes

Note: This activity involves the exposure of worms to a hazardous substance (antifreeze). Some students and/or school systems may object to this type of activity on ethical or moral grounds. Teacher discretion is recommended in using this activity.

Detailed instructions for teacher preparation and procedures for this activity can be found at the following Internet site: http://www.epa.gov/superfund/students/clas_act/haz-ed/act05.pdf

Procedures for opening

1. Distribute copies of Activity l, Background Information Sheet: "A Look at How Toxic Substances Affect Living Things" to each student.
2. Discuss the purpose of this activity: To determine the effect of a chemical substance on a fresh-water worm.
3. Using the information in the Teacher Background Information section, discuss the different ways scientists conduct studies to get information on toxic substances.
4. Discuss the definition of a toxic substance.
5. Point out to class this activity involves the exposure of worms to a toxic substance (antifreeze). Make sure all students are comfortable with the experiment. Make necessary adjustments if required.
6. Give each student a copy of the handout (directions) called "Toxic Substance and Black Worm Experiment".
7. Have students respond orally to the following questions:

- Why do you think scientists use test animals instead of humans to conduct experiments of this nature?
- What is the name of the toxic substance you will use in this activity? What chemical does antifreeze contain? (Refer students to "Student Directions Sheet" for answer)
- What are some products located in the classroom and in your home that contained the chemical found in antifreeze? Give students a copy of the "Ethylene Glycol-Consumer Product" handout. Have student refer to this handout for answers.

Procedures for experiment

1. Divide the class into cooperative teams of 4 to 5 students. Caution students to wear eye goggles and gloves when handling the antifreeze.
2. Provide each team with five clean plastic cups, tape, and a marker
3. Give each team member a copy of the Student Activity Sheet, "Toxic Substances and Black Worm Experiment".
4. Each member of the team is responsible for recording his or her own data on the activity sheet.
5. Have the students label the first container "low dose," the second "medium dose," and the third "high dose." Have students label the fourth container "control pre-test" and the fifth "control post-test."
6. Give each team some live worms. Have each team pour just enough cold water into the "control pre-test" container to barely coat the bottom. Too much water will drown the worms.
7. Have the students place about 10 worms in the water and watch for any behavioral changes, recording the results at the end of 4 minutes on the Student Activity Sheet. Instruct students to leave the worms in the container.
8. Have teams pour just enough antifreeze solution into each container to barely coat the bottom, using the solutions you prepared in advance *(see Internet site indicated above for preparation instructions).* Have half of the teams start with the "low dose" container first and proceed in order to the "high dose." Have the other teams start with the "high dose" container first and proceed in order to the "low dose" container.
9. Have the students conduct each test one at a time, using different worms for each container (about 10 per container). Remind teams to record their observations for each test on the Student Activity Sheet.
10. Have all groups end the experiment by pouring just enough cold water to barely coat the bottom of the "control post-test" container. (**Note:** Control observations at the beginning and end of the experiment are intended to help rule out effects not related to the antifreeze, such as water temperature.)
11. After the experiments, have each group describe the behavior of the worm they observed during each test and discuss the answers to the questions on the Student Activity Sheet.
12. Make sure students dispose of the antifreeze solutions properly, according to the information you received from your local sanitation or health department.

ACTIVITY 2: "Community Check-up" This activity involves students using the ***TRI (Toxic Release Inventory)*** online database to conduct research on the toxic chemicals released by companies in their local communities and learn how these chemicals affect human health.

If assess to computers with modems are not available, this online ***TRI*** database is available in CD-ROM format. Provided with the CD-ROM is a teacher's guide that contains a series of lessons designed to help students learn about the chemicals released in local watersheds and airsheds and then apply the data to activities that cover biology, chemistry, and environmental science.

Steps:

1. Divide class into small groups of 2-3 students.
2. Provide each student with a copy of the Student Handout- "Community Check-Up for Toxic Chemicals".
3. Instruct class to read silently the section called "Did You Know".
4. Ask students if they know of any manufacturing sites in their community that release toxic chemicals into the environment.
5. Point out to the class that this online activity will give them an opportunity to find out which manufactures are releasing toxic chemicals in their neighbors. Also they will learn the names of the chemicals released and how they affect human health.

Have students follow the five steps listed on their Student Handout Sheet and record their data on the Student Activity Sheet: "Community Check-Up".

1. Using the data from the web site, have students write a letter to one of the manufacturers addressing their concerns for the toxic chemicals releases in their neighborhood.
2. Before students start writing their letter, allow them additional time to browse around the web site to check out other information available. Instruct students to take notes to use in helping them compose their letter. *For example:* after locating the list of substances released into their neighborhood, students can click on a particular chemical substance on the list to find out what it is, how it is released, how it gets into the body, how it affects the body, and how it is tested, etc.
3. Have students use the same letter format as illustrated in the sample letters shown at the Internet site or distribute copies of the Grace Davison sample letter provided.
4. Summarize this lesson by conducting an oral discussion on students' completed Activity Sheets and by having students share their letters with the class. **Note:** Consider mailing or faxing letters to the companies.

ACTIVITY 3: WebQuest: "The Unique Susceptibility of Children to Environmental toxicants"

Children today live in an environment that is vastly different from that of previous generations. Chemicals are ubiquitous in our environment worldwide, and traces of man-made chemical compounds (toxicants) are found in all humans and animals. While exposure to some environmental hazards have decreased because of new regulations and standards, children continue to be exposed toxicants in the air, water and food.

This WebQuest really gives students a chance to put their "thinking caps" on as they examine reasons why children are more vulnerable to environmental toxicants than adults. Using the information from the Internet site:

> An Introduction to Children's Environmental Health
> http://www.cehn.org/cehn/WhatisPEH.html students will complete several activities that focus on the susceptibility of children to environmental toxicants.

Steps

1. Make sure students have a clear understanding of the following terms: Vulnerable and Characteristics. Have students give some examples that illustrate both words.
2. Distribute xeroxed copies of the WebQuest Handout: "The Unique Susceptibility of Children to Environmental Toxicants" and the WebQuest Activity Sheet: "We Are Not Just Little Adults".
3. Explain to students they are to follow all directions on both sheets to complete the activities.
4. Students will need graph paper to complete this activity.
5. Before students start constructing their graphs, review assessment rubric for graph with the class.
6. Summarize lesson by having an oral discussion on student's complete Activity Sheets.

Back to Table of Contents

Extensions

Math: (Recommended for upper grades)
"The Numbers Game" is an activity in which students gain an appreciation for the part-per-million and part-per-billion units used to measure contaminant concentrations in the environment. This activity gives students an opportunity to use their math skills to learn how to calculate these ratios and analyze a sample chemical spill to determine if cleanup action is necessary. Visiting the following Internet web site can download this activity: HAZ-ED: Classroom Activities for Understanding Hazardous Waste
http://www.epa.gov/superfund/students/clas_act/haz-ed/hazindex.htm

Social Studies: Congress has enacted a series of environmental laws that work together to protect our health, our environment, and our future. Have students research the following environmental laws using the Internet and/or library. Inform students their research has to be written in report form and presented to the class.

- Clean Air Act (CAA)
- Resource Recovery and Conservation Act (RCRA)
- Toxic Substances Control Act (TSCA)
- Emergency Planning and Community Right-to-Know Act (EPCRA)
- Federal Insecticide, Fungicide Rodenticide Act (FIFRA)

Back to Table of Contents

Assessment/Evaluation

The graph constructed in Activity 3 will be used as an assessment tool for that activity. The assessment will focus on one skill, **graphing**. Areas of assessment are Graph-data, Graph-data points, and Graph-intervals. The sheet entitled "Rubric for Graph" will be used to assess the graph.

Back to Table of Contents

1999 EnviroHealth Link Master Teacher Team: Rosetta Jackson & Jennie Discepolo

Student Handout, Activity 2

Community Check-up for Toxic Chemicals

Did You Know?

About one in four American children live within 4 miles of a manufacturing site which releases toxic chemicals into the environment in which they must live, play and attend school.

Chemicals affect our everyday lives. They are used to produce almost everything we use, from paper and plastic to medicines and food to gasoline, steel and electronic equipment. More than 70,000 chemicals are used regularly around the world. Some occur naturally in the earth or atmosphere, others are synthetic, or human-made. When toxic chemicals are disposed of improperly, they can create hazardous health risks for people (especially children) and damage the environment.

To discover WHAT manufacturing plants are releasing which toxic chemicals into your community, follow the steps below:

STEPS:

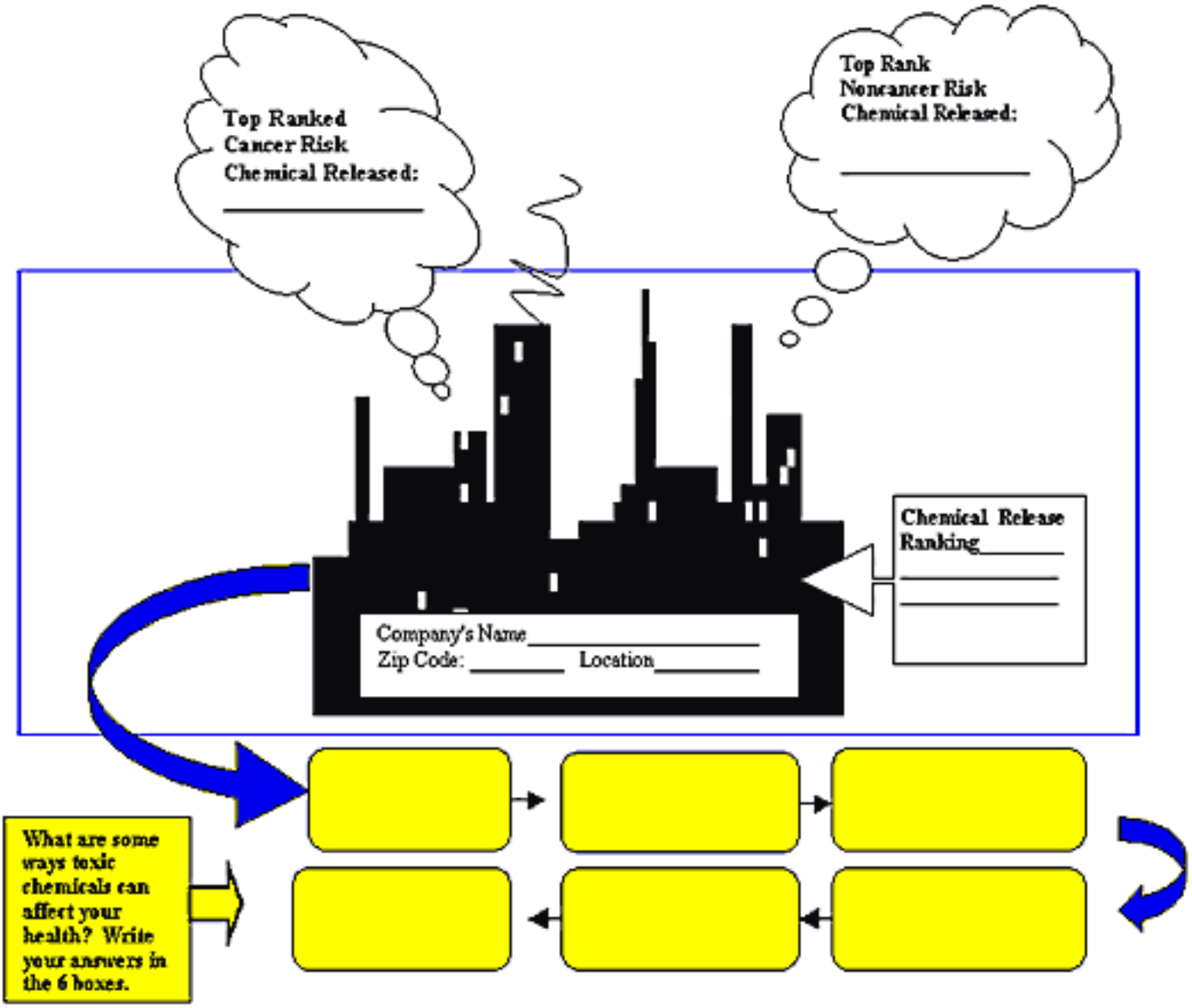
1. Use your web browser and type in the following URL: http://www.scorecard.org/
2. Click on the box located in the space called "Find Your Community."
3. Type your ZIP CODE in the box and choose "GO."
   (Notice: Your zip code and community will appear on the top of the Scorecard Community Center page.)
4. To find out WHO is releasing toxic chemicals into your community, CLICK on the article called "Who is Polluting Your Community."
5. Use the information from this summary scorecard to lead you directly to more information about toxic chemicals.

Now you are ready to start your investigation. Use the information from the scorecard web page to help you complete Activity #2. By clicking on the name of the chemical, you can discover more detailed information.

Name _____ Date _____

Community Check-up

Directions: Using the information from your Scorecard web page, fill in the spaces below to complete a profile of the manufacturing plant releasing toxic chemicals into your community.



If an industrial chemical is allowed by law to be released into the environment, most people assume that it must have been test and is perfectly safe to humans, animals, and the environment. Locate on the scorecard the section called "What We Don't Know About Chemical Safety and Harm". Using the data provided in this section to assess the safety of the chemicals released into your community, complete the following sentence: *(Note Use the back of this paper to write your answer)*

I believe the toxic chemicals released into my community's air and water are/ are not safe to living things because

_____

_____

Name _____ Date _____

Background Information Sheet

A Look at How Toxic Substances Affect Living Things

Children, as well as, adults and other living things are at risk of exposure to over 70,000 toxic substances in the environment. **A toxic substance is a human-made chemical or mixture that presents a risk of death, disease, injury or birth defects in organisms if swallowed or absorbed through the skin.** These chemicals are used widely in consumer products and are dispersed in the environment.

Toxicology is the study of the effects of poisons on living organisms. Although scientists conducts a variety of studies to discover toxicological information about hazardous substances, more than half of the chemicals released into our environment are untested for toxicity. Two of the most common types of studies are (1) **epidemiological studies** (matching disease and other **adverse health effects** in humans with possible causes) and (2) animal **toxicological studies**. These studies are not always conclusive because it is difficult to determine the exact amount of the chemical or chemicals contaminating the site to which human population have actually been exposed (had contact with). Many times health histories are incomplete, and potentially exposed populations are too small for statistical analyses. In addition, many uncontrolled variables-such as genetics, exercise, diet, or cigarette use--may complicate detecting the effects of hazardous substances.

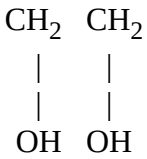
When epidemiological studies cannot be done, well-designed animal studies can provide a wealth of information. This information can be used to predict effects in humans over a range of **exposure** levels--from **acute**, a single exposure to a hazardous material for a brief length of time, to **chronic**, continuous or repeated exposure to a hazardous substance over a long period of time.

Name _____ Date _____

Student Directions Sheet

Toxic Substance and Black Worm Experiment

The purpose of this experiment is to determine the potential effect of three concentrations of antifreeze (ethylene glycol) on fresh-water worms. Follow the following five steps to complete this activity:



ethylene glycol

Materials Needed:
(per group)

- Five small, clean plastic cups
- Live, fresh-water black worms (hair worms)
- Tape and markers
- Five copies of a Student Worksheet for recording your observations
- Antifreeze (ethylene glycol) solutions of 6%, 12%, 24%
- Refrigerated tap water
- Goggles and latex gloves
- 5 copies of Worksheet

Steps

1. Make sure your team has all the materials listed above.
2. Label one cup "low dose," the second cup "medium dose," the third cup "high dose." Label the fourth cup "control pre-test" and the fifth cup "control post-test."
3. Add just enough cold tap water to barely cover the bottom of the container marked "control pre-test," and place about 10 worms in the water. *(DO NOT SUBMERGE THE WORMS: THEY WILL DIE.)* Observe the worms for 4 minutes and watch for any changes in their behavior. Record the results on the appropriate line of your Worksheet. Set the "control pre-test" aside, but do not throw it away.
4. After recording the behavior of the "control pre-test" group, conduct similar observations on different worms (about 10 per cup) in order from "low dose" to "high dose" or from "high dose" to "low dose" depending on your teacher's directions. Use the appropriate antifreeze mixture prepared by your teacher for each dose level. Use the Worksheet to record the behavior of each group of worms at the end of 4 minutes.
5. After you have observed the results from all 3 solutions, repeat the control test by again adding barely enough cold water to cover the bottom of the cup labeled "control post-test," and place about 10 worms in the water. Observe for 4 minutes for any behavioral changes. Record the results on the Student Worksheet.
6. At the end of the experiment observe the total time and take one last look at the worms' behavior in all of the cups.
7. ANSWER the questions on your Student Activity Sheet.

Name _____ Date _____

Student Activity Sheet

Toxic Substance and Black Worm Experiment

TEST	Behavior after 4 minutes	Behavior at end of experiment	Total time from start of experiment
Control pre-test			
Low dose			
Medium dose			
High dose			
Control post-test			

Answer the following questions:

1. Were there obvious differences between the control groups and the antifreeze-exposed groups? If yes, describe. If no, why do you think there were no differences?

2. Did the concentration of antifreeze in the water influence the degree of behavioral change? If yes, describe.

3. Was there a safe level of exposure? In other words, was there an antifreeze concentration that did not appear to cause an effect over the 4-minute observation period? How could you tell?

4. Does the acute (rapid, short-term) effect of antifreeze on the worms indicate anything about what the long-term or chronic (lifetime) effects might be?

5. Is behavior the only possible measure of effect? Why or why not?

6. Can you determine from this experiment the cause of death of the worms? Give reasons to support your answer.

7. Is it possible that while antifreeze affects the health of worms, it has no effect on humans? (Is it also possible that antifreeze has no effect on worms but adversely affects humanhealth?) If yes, describe.

Student Handout, Activity 3

Children Are Not Little Adults: The Unique Susceptibility of Children to Environmental Toxicants

Children are not just "little adults." Your biological sensitivity, exploratory behavior, and a diet very different from that of adults make you particularly vulnerable to the effects of chemicals released into your environment. Not only do you differ from adults, but also you are different from each other. There is more to growth than just getting bigger. In this activity, you will learn about the special characteristics and activities of children that make them more susceptible than adults to health problems triggered by toxic chemicals in the environment.

Directions:

1. Use your Internet browser to **visit** the following web site: http://www.cehn.org/cehn/WhatisPEH.html

2. Scroll down to the section called *"Why are Children Not Just 'Little Adults' When It Comes to Environmental Exposures?"*

3. After you finish reading the article, complete the Activity Sheet called "We Are Not Just Little Adults."
    a. In column two of the activity sheet, briefly describe how each characteristic or activity makes children vulnerable to toxic chemicals than adults.

4. **Select one** of the questions from the list of questions below. Answer the question using the information given on the web page.

Questions

1. Are children being exposed or likely to be exposed to toxic chemicals? Are the parent's work clothes likely to be a source of exposure? Give reasons to support your answers.

2. Does the susceptibility of children to toxic chemicals differ from that of adults? In what way(s)? Explain why?

3. Is the developmental process of children altered by toxicants? Describe the health effects that have been observed in children?

Name _____ Date _____

Activity 3 Student Activity Sheet

WE ARE NOT JUST LITTLE ADULTS

PART A

CLUES	Use the clues, activities, and characteristics illustrated in the boxes to briefly describe why children are more vulnerable than adults to toxic chemicals.
Growth and Development 	
Diet and Eating Habits 	
 **Breathing**	

Excretion 	
 **Behavior & Play**	
Calcium & Bones 	
Hand to Mouth Contact 	

PART B

1. Now use your mouse to scroll down to the section called **"Which Children Are Most Affected?"**
2. After reading the information in this section, answer the following questions:

Questions

1. Explain why children living in poverty and children in racial or ethnic communities are more affected by exposure to environmental hazards and toxins than other children. Make sure you include data from the web page to support your answers.

2. Use your graph paper to make a graph showing the percentage of children affected by exposure to an environmental hazard. Make sure your graph is properly titled and labeled. Your graph will be evaluated on the following items: Labels, Data Points, Intervals, and Accuracy of Data.

Hint: Use lead poisoning

Rubric for Graph

Criteria	Novice (1)	Developing (3)	Standard (3)	Exemplary (4)
Label	Student did not use any labels on graph	Student labeled title but not label both axis.	Student accurately and clearly labeled title and one axis or both axis labeled but no titled	Student accurately and clearly labeled title and variable on horizontal and vertical axis.
Data points	1/4 or fewer data points are accurately plotted.	1/2 of data points are accurately plotted.	3/4 of data points are accurately plotted.	All data points are accurately plotted.
Intervals	Student does not accurately use intervals on either axis.	Student accurately uses intervals on one axis.	Student accurately uses intervals on both axis.	None expected

Sample Letter

from Scorecard
Environmental Defense Fund

Send a Fax: Here's the kind of letter you can send to GRACE DIVISION in Baltimore, MD. Faxing from this Web site: http://www.scorecard.org/env-releases/facility-fax.tcl?tri_id=21226WRGRC5500C is free, provided as a community service by EDF. However, you will have to register as a Scorecard user in order to send FAXes because otherwise we won't be able to sign your letter.

August 12, 1999

GRACE DAVISON, 5500 CHEMICAL RD., BALTIMORE, MD

Dear Manager:

I just reviewed a detailed, online description of your environmental emissions, and I am writing to express several important concerns. First, I understand that you have reported to the U.S. Environmental Protection Agency that your facility emitted:

1534386 pounds of total environmental releases in 1997
12563103 pounds of total production-related waste in 1997.

I also learned that this facility ranks among the worst performing facilities in the US in regard to its total environmental releases.

I was also surprised to learn that many of the toxic chemicals covered by EPA's reporting requirements do not have government-established safety levels, making it impossible for those of us who may be exposed to know whether present-day exposures are safe or not.

According to the online "Scorecard" prepared by the Environmental Defense Fund (http://www.scorecard.org/), 98% of the toxic chemicals released to air by your facility in 1997 couldn't be assessed for safety because key information hasn't been compiled or is unavailable to the public.

As a neighbor potentially affected by emissions from your facility, I ask you to provide me with information showing that these chemicals, and other chemicals which your facility produces and releases to the environment, are in fact safe.

Finally, I would like information on your efforts to prevent pollution in the first place by changing your use of these chemicals. Experience has shown that there are a number of process and product changes that can substantially reduce toxic chemical use and the generation of toxic chemical waste. If you do not have any in-house expertise in pollution prevention, are you taking advantage of state and private technical assistance in this area?

I look forward to your prompt response. The situation portrayed by your official reports to the U.S. EPA is not reassuring to those of us who are, or may be, affected by chemicals that your facility is emitting.

Sincerely,

your name and address

Bill_Pease@edf.org

Scorecard

http://www.scorecard.org/chemical-profiles/consumer-products.tcl?edf_substance_id=107%2d21%2d1

Envrionmental Defense Fund

About the Chemicals: Consumer Products
Chemical: Ethylene Glycol
CAS Number: 107-21-1

What Kinds of Consumer Products May Contain This Chemical?

Aerosol paint concentrates
Agricultural chemicals
Antifreeze preparations
Automobile body polish and cleaners
Caulks, modified and unmodified oil base
Disinfectants (nonagricultural)
Flat water thinned interior paints and tinting bases
Floor polish
Fungicides for agric., garden and health service use
General performance sealants (PVAC, butyl, vinyl, etc.)
Glass window cleaning preparations
Herbicides for agric., garden and health service use
Household hard surface cleaners (liquid)
Lubricating oils
Misc. tire repair materials
Miscellaneous paint-related products
Nonstructural caulking compounds and sealants
Other art materials incl clay, water & tempera colors, finger paint, etc.
Other automotive chemicals
Other industrial chemical specialty products
Other interior water thinned coatings
Other laundry aids, icluding ironing aids and dry cleaning spotting pre
Other miscellaneous allied paint products, including brush cleaners
Other polishing preparations and related products
Other specialty cleaning and sanitation products
Oven cleaners
Packaging inks: solvent types
Refillable ball point pen
Semigloss, eggshell, satin water thinned int paints and tinting bases
Specialty performance sealants
Synthetic resin and rubber adhesives
Water thinned ext paints and tinting bases, incl barn and roof paints
Water thinned exterior stains
Water thinned exterior undercoaters and primers
Water thinned interior undercoaters and primers

Bill_Pease@edf.org

Smoke Gets In Your Eyes, Your Nose, Your Mouth, Your Lungs...

(Grades 6-12)

Recognized for excellence by

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http://www.scilinks.org/criteria.htm

Table of Contents

Overview

Tobacco smoke contains about 4000 chemicals including 200 known poisons. Every time someone smokes, poisons such as benzene, formaldehyde and carbon monoxide are released into the air, which means that not only is the smoker inhaling them but so is everyone else around him. Many studies now show that environmental tobacco smoke (ETS) can have harmful effects on nonsmokers and even cause them to develop diseases such as lung cancer.

Americans are beginning to recognize how hazardous smoking can be to everybody's health. National surveys show that most non smokers - and even the majority of the smokers themselves - believe that people should not smoke when they are around nonsmokers. Clearly, in our society, causing other people to be exposed to secondhand smoke is becoming less and less acceptable.

In the lesson which follows, students will use the Internet to explore their family and community risk factors and determine their own health risks to make appropriate life style changes. Using Smoke-Check Badges, students will collect and record data about their own exposure to ETS. They will use this data to make predictions and ask questions, to develop scientific ideas, to inform their debates about community issues, and to ask further questions.

The classroom activities and individual research in this lesson will require approximately three weeks to complete.

Back to Table of Contents

Technology Resources

Internet Resources:

Toxicology Problem Set
http://science-education.nih.gov/col
This site maintained by the National Institutes of Health offers a password protected curriculum for students ages 12-18. The curriculum emphasizes the application of biomedical information to personal health. It integrates the use of Internet technology for access to current scientific and health information. The topics currently include diabetes, cardiovascular disease and cancer. This program is password-protected to allow only educators to access the teacher's side of the program that includes answers to questions, labs, and instructions. An instruction manual is being distributed to schools and organizations that wish to participate in the program.

BioMed Net Library
http://www.biomed.com
You will need to request membership (no charge) for this No. 1 resource for biological and medical research on the Internet. The many facilities available to members include: free Medline, an online magazine the HMS Beagle, and BioMedLink a comprehensive, evaluated database of medical and scientific websites on the Internet.

National Cancer Institute Information Resources
http://www.nci.nih.gov
NCI's primary website contains information about the Institute and its programs, as well as news, upcoming events and educational materials.

Envirofacts Warehouse Maps on Demand
http://www.epa.gov/enviro/html/mod/index.html
The EPA's Maps on Demand offers World Wide Web-based mapping applications to generate maps that display environmental information for the entire United States.

CancerNet
http://cancernet.nci.nih.gov
This site contains material for health professionals, patients, and the public about cancer treatment, screening and a bibliographic database.

American Cancer Society (ACS)
http://www.cancer.org
The ACS provides smoking education, prevention, and cessation programs and distributes pamphlets, posters and exhibits on smoking.

Smoke Free Maryland
http://www.smokfreemd.org
A coalition for tobacco control offers information on how to take immediate action to contact legislators, discusses bills under consideration, etc.

American Lung Association (ALA)
http://www.lungusa.org
Conducts programs addressing smoking cessation, prevention, and the protection of nonsmokers' health and provides a variety of educational materials for public and health professionals.

American Heart Association (AHA)
http://www.amhrt.org
Promotes smoking interventions at schools, workplaces, and health care sites.

Indoor Air Quality Tools for Schools
http://www.epa.gov/iaq/schools/tfs/guidef/html
Reviews ETS Effects on Children, offers recommendations for protecting children, and details current legislation.

Software Resources

National Geographic Kids Network
Available from National Geographic Society, this science curriculum moves the study of science into the 21st century as it meets national standards, has built in assessment tools, is collaborative and hands-on and easy to use. It allows students to collect, organize, manipulate and share scientific data on the Internet. Originally, telecommunications based, the high quality program is undergoing changes this spring and will reappear in the fall on the NGS WebSite - no more $80 memberships. Teachers quides will be available on the Net or purchased in hard copy. The program will be up and running all year long with teachers signing on much like Scholastic. New modules are being created with funding from NSF focusing on science, language arts and reading activities. For more information, call toll free 1-800-368-2728 or check out the NGS homepage at: http://www.nationalgeographic.com

Back to Table of Contents

Teacher Background Information

Environmental tobacco smoke (ETS) is the combination of two forms of smoke from burning tobacco products. Sidestream smoke, or smoke that is emitted between the puffs of a sidestream smoke, contains essentially all of the same carcinogenic and toxic agents that have been identified in the mainstream smoke inhaled by the smoker, but at greater levels.

The exposure of nonsmokers to ETS is referred to as involuntary smoking, passive smoking, and secondhand smoke. Nonsmokers who are exposed to ETS absorb nicotine and other compounds just as smokers do, and the greater the exposure to ETS, the greater the level of these harmful compounds in the body.

Although the smoke to which an involuntary smoker is exposed is less concentrated than that inhaled by smokers, research has demonstrated that the health risk from inhaling smoke is significant. For example, scientists estimate that ETS causes about 3,000 lung cancer deaths a year. In 1986, two reports were published on the association between ETS exposure and adverse health effects in nonsmokers: one by the U.S. Surgeon General and the other by National Academy of Sciences. Both reports concluded that:

- ETS can cause lung cancer in healthy adult nonsmokers;
- Children of parents who smoke have more respiratory symptoms and acute lower respiratory infections, as well as evidence of reduced lung function, than do children of nonsmoking parents; and
- Separating smokers and nonsmokers within the same air space may reduce but does not eliminate a nonsmoker's exposure to ETS.

In light of the widespread presence of ETS in both the home and the workplace and its absorption into the body, the US Environmental Protection Agency (EPA) released a report in l992 in which ETS was classified a Group A carcinogen – a category reserved only for the most dangerous cancer-causing agents in humans.

Back to Table of Contents

Learning Objectives

Students will be able to:

- **Clarify** and explain why they need oxygen to live
- **Compile** factors that keep the body from getting enough oxygen
- **Summarize** the effects of tobacco use on others
- **Formulate a feeling** about tobacco use
- **Investigate** local issues which **relate** to respiratory and circulatory health problems
- **Research information** on the Internet to **describe** sources of indoor and outdoor air pollution
- **Describe diseases** and health conditions which relate to air pollution
- **Identify** some of the social and legal consequences of smoking cigarettes
- **Compile** a list of the health dangers of ETS
- **Design** action steps to reduce or prevent exposure to ETS
- **Interpret** concepts related to health promotion and disease prevention
- Use interactive Internet technology to **compile** scientific and health related information regarding environmental tobacco smoke
- **Interpret** the level of exposure to ETS using the Smoke Check Badge monitor strip
- **Draw a conclusion** based on the percentage of students in the class who are in favor of a ban on smoking in public places and the percentage of those who are against the ban.

Back to Table of Contents

MSPAP/Core Learning Goals

(MSPAP vocabulary is highlighted within the learning objectives above.)

- **Goal 1: Skills and Processes:**The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information.
  Expectation 3

Back to Table of Contents

Vocabulary

Benzene - a flammable, poisonous liquid used as a solvent.
Carbon Monoxide - a highly poisonous gas produced by incomplete combustion of products that contain carbon.
Carcinogen - A substance known to cause cancer
Environmental Tobacco Smoke (ETS) - the smoke given off by the burning end of a cigarette, pipe or cigar, and the smoke exhaled from the lungs of smokers. Also called secondhand or passive smoke.
Mainstream Smoke - smoke which is inhaled into the lungs from smoking the cigarette, depositing large particles in the larger airways of the lungs
Passive Smoke - Nonsmokers' exposure to tobacco smoke .
Sidestream Smoke - may come from someone else's tobacco or one's own, from the burning end of the cigarette between puffs, or while it is lying in an ashtray. It is made up of a mixture of irritating gasses and carcinogenic tar particles that reach deeper into the lungs because they are small. It is dirtier and chemically different from mainstream smoke.
Tobacco - the leaves of plants from the genus Nicotiana and the products made from these leaves, such as cigarettes.

Back to Table of Contents

Equipment and Materials

Per class:

- Overhead Projector
- Tape player
- Spray Bottle filled with water
- Tar stained handkerchief
- "Lungs Normal and Damaged" overhead transparency
- Shoe box and top for ballot box
- Chart paper or chart board
- "How Many Cigarettes" graph transparency
- Audio cassette: "Smoke Gets In Your Eyes"

Per investigative team of 4:

- Computer with modem or Internet access
- Clean Air Puzzle Pieces
- Smoke-Check Badges and clips (these badges may be purchased in bulk from Assay Technology Co. Palo Alto, California 1-800-833-1258 for a cost of $5.00 per badge)
- Plastic bag and twist tie
- Butcher paper
- "Second-Hand Smoke Etiquette" Activity Sheet

Per student:
Xerox copies of the following activity sheets:

- "Smoke Alarm"
- "It's My Body"
- "Smoke Free Zones"
- "Should Smoking Be Banned in Public Places?"
- "Instructions for Smoke-Check Badge test"
- "Clean Air Puzzle Question Sheet"
- "Health and Passive Air"
- "Imagine That Creative Writing Sheet"
- *Time Magazine* article - position statement
- Reading materials about local issues
- "Portfolio Cover Sheet"

Additional materials per student:

- Pen, pencils, and paper
- Note paper to use as ballots
- Internet articles for Extension activities
- Tag board or construction paper
- Scissors
- Paste
- Crayons or markers

Procedures

ACTIVITY 1: "The Big Picture"

This activity will provide a two-part overview of major issues of air pollution, and can be completed in one ninety-minute class period. Investigative teams of students gather information about the necessity of oxygen for life and consequences of air pollution. After reviewing the information the students will investigate sources of indoor and outdoor air pollution in their own neighborhoods.

Have students think about all of the things they breathe in or inhale from the air. Allow time for sharing ideas, and ask: "Why the body needs oxygen. On the chart write, "why we need oxygen" and record student responses.

Next ask "What might keep us from getting oxygen?" and list responses on a chart of Oxygen Blockers.

As a closing discussion, ask students how communities can ensure that every one gets enough oxygen.

As homework, have students ask adults what they think are the main thing that might prevent members of the community from getting enough oxygen. They should write the responses and be prepared to share.

As the second part of this activity, divide the class into groups of 6. Have each member count off from 1 to 6. Give each student the Clean Air Puzzle piece that corresponds to his number. Have those with the same number piece meet together for 15 minutes to read the information and decide how to present it to their original group members. As members return to their original group, they explain the material from their respective puzzle pieces. Using Clean Air Activity sheet the groups will now use the information they learned to answer questions. End the activity by having the groups use tagboard and art materials to mount puzzle pieces on stiff paper and cut them out. They should assemble the jigsaw puzzle and decorate the pieces to depict what they have learned about air pollution and health. If time allows, each group may present to the class.

ACTIVITY 2: "My Part of the Puzzle"

This ninety minute activity will allow time for the students to share and categorize information gathered as part of their homework investigations. As students share the results of the question regarding oxygen blockers in their neighborhood, allow them to categorize the items on the board. List the following headings on the chart paper: air pollutants, personal behaviors, and physical disorders. Encourage students to look for related articles in local newspapers, contact members of the city council, request information from local chapters of ALA ,AHA, and ACA for helpful literature. Using the charts allow students to explain how each item prevents individuals from getting enough oxygen. They should use related information to support their decisions. To conclude this part of the activity, have a student read aloud the issues on the chart which relate to tobacco smoke. Show the "Lungs Normal and Damaged" transparency with the damaged lungs covered. Ask students to predict what the smokers lung might look like. Show the damaged lung and ask the students to use details of the picture to explain how tobacco might keep the body from getting enough oxygen.

After students have shared their ideas, give the Health and Passive Smoke handout to study. As students complete the reading, have them list some of the immediate effects of smoking on a non-smoker. To challenge students to view cigarette smoking from another point of view, have them complete Imagine That creative writing activity. Ask volunteers to share any new perceptions they arrived at as a result of the exercise. Give each group a copy of Second-Hand Smoke Etiquette and have them discuss the situations in each activity. The students will write their opinion and add notes on the paper. Then, the class as a whole will use this information to brainstorm and develop a "Bill of Rights for Non-Smokers".

As a homework assignment, students should read the excerpts from the New York Times article, and mark the scale at the bottom of the page to reflect their position about what they have read. On another sheet of paper, they should write one page of facts and feelings to support their opinion.

ACTIVITY 3: "Up in Smoke"

This activity which includes small group investigations as well as interactive work on line will require approximately one week to complete.

Begin the activity by moving among the students, while spraying a water bottle in the air. Ask students how they would feel if you were spraying perfume, a deadly poison, a virus, or environmental tobacco smoke categorized as a Group A carcinogen - a category reserved only for the most dangerous cancer-causing agents in humans. Show the tar-stained handkerchief to students and ask if this smoke has already been in the smokers lungs, what must this mean about exhaled smoke and the non-smoker? Have students generate a working definition for ETS and brainstorm about the effects on non-smokers. List both on the chart paper. Distribute Smoke Alarm handout and have students supplement the original list as they read the selection aloud. Have students discuss other ways that tobacco use affects friends and relatives, the economy, the medical care profession, insurance rates, law enforcement activities and relationships. Following the discussion have a Gallery Walk. As you play they tape "Smoke Gets In Your Eyes" . (Chart paper for each topic is posted around the room. As groups move from one to the other, they will write their own recollections on the appropriate chart and read what others have written before.) Introduce the class to the ***Health Science Curriculum*** on line and set up a schedule for individuals to login and select the scenario entitled "Maggie's Spring Break". The student will make a diagnosis from the clues collected as he/she progresses through the story. This interactive scenario about Maggie emphasizes the negative impact of environmental tobacco smoke on health. As students complete this interactive program, encourage them to add to and correct any information they have gathered so far re:ETS. Students should be encouraged to use the links provided to add to their collection of research on the topic of ETS and its health effects.

ACTIVITY 4: "Let's Clear the Air"

The collection and presentation of data in this activity will require one week to complete.

Begin by dividing the class into investigative teams composed of 4 students each and distribute the Instructions for Smoke-Check Test. Explain that the class will start a test for ETS today. A volunteer from the group will wear the badge for 4 days. Later the class will examine the badges for exposure to environmental tobacco smoke and use their findings to help them decide whether smoking should be banned in public places.Read over the direction sheet carefully and be sure the volunteer understands their responsibilities. Make sure you save one badge for the control experiment. Each volunteer should clip the badge to their clothing. Write the final date of the 4 day period on the board and have the students record the date as well. Explain that volunteers should remove the badges after 4 days and store them in plastic bags provided. Discuss the control experiment and have the class locate a smoke free area in which to place the monitor for the next 4 days. The color strip on the control should remain white because it has not been exposed to tobacco smoke. If the color strips on the other badges have darkened, the class can conclude that they have been exposed to tobacco smoke.

During the next 4 days, bring out the charts which have been completed during the previous activities. Display the charts where the students can read and discuss them during the activity. On the 4^{th} day follow the procedure for reading and recording the badges (use the handout "Should Smoking Be Banned"). Check the control.

On the chalkboard, make a chart with two columns. At the top of the first column, write "Color Square." At the top of the second column, write "Cigarette Equivalents."

While the groups are recording data from their badges, record the results from the control badge on the chalkboard. Allow the students to enter their data on the class chart. Once the class table is complete, give students time to look at the results. (At this point, students may be given the option of using ***NGS Works*** data analysis software to design a data table of their test results.) Then ask them to briefly share their ideas about environmental tobacco smoke, based on the class data collection.

In the final part of this investigation, students will consider the pros and cons of smoking in public places. They will have an opportunity to use their Smoke-Check badges to test their ideas. Explain that everyone will vote on whether smoking should be banned in public places. Students may use a secret ballot and place votes in the ballot box. Follow the procedure on the handout for tallying the votes.

Back to Table of Contents

Extensions

Field Trip or Guest Speaker
Arrange a visit from a local doctor, nurse or paraprofessional. Many technical hospitals have outreach programs that include school visits. If a visit doesn't work out, try to arrange for students to make conference calls to a health professional so they can ask their questions.

Mapping Activity - Geographic Patterns This extension incorporates ***EPA Map Maker*** or National Geographic Society, ***NGS Works*** module of data analysis activities for middle grades entitled "What Stories Do Our Data Tell?". For this particular activity, the focus should be on the human/environmental theme to address the question of how smoking environments affect people. Using activity sheets provided in the module, the students will use the ***Map Maker*** from ***NGS Works*** to zoom in on their home state. They can then copy the map into the Painter and decorate it by adding colors, words, stamps or other data collected at the ETS data collection sites. Students can also use this software to design their own stamps or icons to use on their maps. Using their data and maps, students can predict how human concerns about air pollutants and behavior vary geographically and evaluate those predictions using actual findings. They will probably find a variety of patterns. With concerns about ETS and smoking showing a random geographic distribution.

Social Studies:

- *The Law*

Have students collect data from the Internet as well as local sources regarding national and local laws and ordinances regarding public smoking. This research may be presented in a written history of related laws or in a timeline format.

- *Cultural Concerns and ETS*

Not all countries have the same concerns about smoking or have smoke free environments. Using the Internet, have students collect data from around the world regarding viewpoints about ETS and smoking in general. Make a chart or graph to show country and viewpoint. Using a mapping tool, construct a map from the data to show high, medium and low concern level for smoking by country.

Math/Social Studies

- *Economic Impact of Smoking Bans:* Students may role-play a county council meeting. Using facts, and research to support their position, students may take on the roles of : physician, smoker, non-smoker, restaurant/bar owner, nursing mother, pregnant lady, young child and mother, concerned students from outside science class, the mayor, etc. Each participant will testify before the council and provide visuals and handouts to support their point of view. End the meeting with a vote to ban or not to ban smoking in public areas.
- *Survey Extension:* Conduct a survey like the one in activity 4 with different populations (grandparents, parents, neighbors, young children, etc.) Try to survey a variety of age groups, sexes and ethnic groups. Predict the results. Collate the data and generate graphs on the computer showing age and gender related data. Have students create both actual tally graphs those using percentages, and decide which is more accurate for comparing results. Discuss the idea of "messaging the statistics" to prove your point. Use the graphs to support debates at the town council role-play meeting.

Technology

- *Architecture and Design:* As students visit restaurants and other public places with smoking and non-smoking areas during the monitoring activity, have them sketch the floor plan of the restaurant. They should include entrances, food prep areas, bathrooms, etc. After shading in the smoking areas, and determining air flow patterns, they should attempt to answer the question: Are non-smoking patrons subjected to second-hand smoke? If they are, students can design a better seating plan for the restaurant.

Back to Table of Contents

Assessment/Evaluation

Learning Logs

Using student learning logs as a formative assessment, will check for understanding of daily activities as the student summarizes each day's activities. In addition, by allowing the student to rank or evaluate the activities by identifying which parts he liked or disliked, the students move to a higher level of thinking.

Student Portfolios

A portfolio is a selection of related pieces of work that demonstrates the student's effort, progress and achievements. It also communicates what the student has learned and why it is important.

Throughout the unit, have students save their work in project binders. At the end of the unit, have students select work from their project binders to include in their portfolios.

Distribute the Portfolio Cover Sheet and allow time for reflecting on the work samples they have selected. Encourage students to use the sheets to evaluate their own performance, and use the comments on the sheet to discuss the work with the student. You might want to consider including the student in the grading process by asking them to recommend a grade for themselves.

Back to Table of Contents

1999 EnviroHealth Master Teacher Team:
Jennie Discepolo & Rosetta Jackson

Clean Air Puzzle Pieces

On large piece of construction paper or tag board, design a jigsaw puzzle with six large parts. Cut and paste each of the following readings onto one part of the puzzle. Cut out the pieces for use by the students.

Reading Passages:

Clean Air Puzzle Piece 1: Most of us take air for granted. We forget that we depend upon air to live. Human beings breathe at least 12,000 quarts of air every 24 hours. Air provides all living things with the chemicals needed for life. Air is made up of 28 gases. Oxygen, nitrogen, carbon dioxide, hydrogen, ozone and neon are some of the gases in the air. When we take a breath (inhale), air enters the body through the nose and mouth. Oxygen in the air is carried to the bloodstream. The air travels down the windpipe and through smaller branches of the windpipe called the bronchi and bronchioles. It finally reaches the tiny air sacs (alveoli) in our lungs. When we breath out (exhale), carbon dioxide passes back up through the respiratory system to exit through the mount and nose.

Puzzle Piece 2:
Most outside air pollution comes from cars, trucks and buses. Fumes and smoke from coal or oil burned by factories and power plants also pollute the air. The burning of coal, oil, wood or natural gas to heat homes and offices also contributes to air pollution. The burning of garbage in open dumps and incinerators is another cause of air pollution. How clean the air you breath is depends on where you live. If you live in the country, the air is usually cleaner than if you live in the city.

Puzzle Piece 3:
The major source of indoor air pollution is cigarette smoke (or other tobacco smoke). Cooking smoke is another source of indoor air pollution. Fumes from the products used to clean rugs, ovens, glass, toilets and tubs can also pollute indoor air. Products like baking soda, lemon juice and vinegar will do many cleaning jobs without polluting the air. Green houseplants can help reduce indoor air pollution. But the best way to get rid of indoor air pollution is to get air moving. Open windows and doors and let the inside air out and fresh air in.

Puzzle Piece 4:
Most of us breath about 25,000 times a day without even thinking about it. We need air to live. But can the air around us hurt us -- or even kill us? If there is a lot o f pollution in the air we breath, the pollution is absorbed into out bodies through our lungs and through our skin. Over time, breathing polluted air can cause diseases. Asthma, bronchitis, pneumonia and lung cancer are some of the disease that are related to breathing polluted air. Air pollution can also cause heart and skin diseases and allergies.

Puzzle Piece 5:
The air that surrounds us is part of the atmosphere that covers the entire earth. When one part of the planet is polluted, the pollution in the air spreads across the entire planet, carried by the wind. Polluted air is harming the ozone layer. This is a band of ozone (a |special form of oxygen) in the atmosphere, miles above the earth's surface. This layer protects our planet from the sun's ultraviolet rays. Polluted air is thinning out this layer of protection. A hole was discovered in the ozone layer in 1985. Chemicals called CFC's contributed to the thinning of the ozone layer. Scientists and politicians from all over the world are talking about what to do about this problem.

Puzzle Piece 6:
If the ozone layer gets too thin, it will not filter the damaging ultraviolet rays from the sun. Too many of these rays will reach the earth, and people may get more skin cancer from being out in the sun. The sun's ultraviolet rays can also burn your eyes. These cataracts are cloudy films that cover the eye and make it difficult to see clearly. Cataracts can be caused by too much sun, so it's important to wear sunglasses and when you're out in the sun.

Name _____

Second-Hand Smoke Etiquette Activity Sheet

Discuss the following statements in your group. Write your opinion and take notes in the space provided.

1. Smokers should always ask permission to smoke.

2. A smoker is in a room with four people and only one person objects to him/her smoking.

3. You are attending a meeting about planning an important social event. Several people in the room are smoking. You are a nonsmoker who is uncomfortable in a room filled with smoke and tell the smokers that you will have to leave the room. What consequences might there be for your decision?

4. Someone is asked not to smoke, and he/she proceeds to light up.

5. Someone is already smoking when someone else joins the group and courteously asks that he/she not smoke.

NOTE: Remember! Cigarette smoke consists of more than 4,700 compounds, including 43 carcinogens.

Smoke Alarm Student Reading

Nonsmokers and Smoke
More than 40,000 studies have demonstrated the harm done by smoking. But surveys indicate that many Americans still don't know the dangers of smoking tobacco. Nonsmokers who live with smokers are more likely to have lung problems. The smoke nonsmokers breath when they are around smokers is called secondhand smoke or environmental smoke. Even pets can breath secondhand smoke.

Effects of Tobacco Smoke
Tobacco smoke contains dirt particles that pollute the respiratory system. Hot smoke dries the lining of the airways, which makes them sore. Smoke causes eyes to become red and watery. Smoke also causes hair and clothes to smell. Tobacco smoke contains poisons. The poisons paralyze the cilia and prevent cilia from cleaning the airways. When cilia can't work, smoke leaves behind more dirt. This dirt causes the body to produce more mucus. Then airways get clogged with mucus. More mucus leads to more coughing. The mucus that builds up in the warm, moist lungs invites infections to grow. Smokers and people who live with smokers have more colds and other infections of the respiratory system. Before smoking became common, bronchitis and emphysema were rare diseases. Tobacco smoke contains carbon monoxide, which crowds oxygen out of the blood. Then smokers feel tired and out of breath. Irritation from the tobacco smoke can cause alveoli deep in the lungs to break. As more and more alveoli break, less transfer of oxygen takes place. Then smokers can't get enough oxygen in their blood. Tar in tobacco smoke coats the cilia, preventing them from sweeping the lungs clear. More coughing occurs because the cilia are paralyzed. The cough helps clean the respiratory system when the regular system is overworked. Tar causes alveoli to become black, stiff and brittle. Eventually, they break. Broken alveoli reduce lung capacity.

Tobacco and the Earth
Tobacco is also bad for our planet. Growing and producing tobacco harms the earth. The fertilizers and pesticides tobacco growers use can pollute soil and water. Tobacco companies cut down forests to get wood to burn to dry the fresh tobacco. This loss of trees can turn good land into deserts.

Did You Know?
- Most cases of cancer are caused by smoking.
- Most people with lung cancer die from the disease.
- Smoking is addictive.
- Even light smoking (fewer than 10 cigarettes a day) is dangerous.
- Smoking is hazardous to your health!

It's My Body

Name _____

Directions:

Read the following letter to "Dear Gabby" and write a response. What are your feelings about this letter? If you can do so, please support them by fact.

Dear Gabby:

I'm tired of people telling me not to smoke. It is my body, and I can do what I want to my body. I don't tell my friends to smoke cigarettes. And I don't think they should tell me not to smoke. What difference does it make if I smoke?

Signed:
It's My Body and I'll Smoke if I Want To

Dear It's My Body and I'll Smoke if I Want To:

Smoke-Free Zones

Name _____

Directions:
Talk with your family about smoke-free zones in your home. Complete the checklist to show which areas of your home are smoke free. You don't need to return this page to class because this information is just for you and your family.

____ Check here if your home and cars are all smoke free.

Check the rooms in your home that are smoke free:
____ living room
____ kitchen
____ dining room
____ bathroom
____ bedroom

other rooms (list)

Should Smoking Be Banned In Public Places?

Name _____

Procedure for Reading Smoke Check Badges

1. Look at the Smoke-Check badge assigned to your group. Match the color of the monitor strip on the badge to the color of one of the color squares below it. Record the number of the matching color square below.

   The number of the matching color square is _____ (0,I, II, or III)

2. Design a table below to record your data. Draw a rectangle around the number of the matching color squares (from step 1) and the number of cigarette equivalents in the column next to it.

Color Square	Cigarette Equivalents
0	0
I	1.5
II	3
III	6

3. Record the number of the matching color square and the number of the cigarette equivalents (from step 2) in the table your teacher has drawn on the board. Or you may choose to record this data on a data table on your computer.

Procedure for Discussing a Ban on Smoking in Public Places

1. For the purposes of this discussion, each member of your group will consider one of these two statements:

   - Smoking should be banned in public places.
   - Smoking should be allowed in public places.

   Circle the statement you will consider. The statements should be divided among the members of your group so that each one is considered thoroughly.

2. Think about the statement you chose to consider. Do you agree with the statement? To investigate the pros and cons of the statement, look at your lab sheets and any other materials your teacher suggests.

3. Talk to the other members of your group about the statement you considered. As a group, decide how you will present your conclusions to the class.

Procedures for Vote Tally

1. Read each ballot and make a tally mark under the appropriate heading on the chalkboard.

2. Count the total number of tally marks in the column labeled "For the Ban."
   Record the total below:

   _____ students in the class voted for a ban on smoking in public places.

3. Count the total number of tally marks in the column labeled "Against a Ban."
   Record the total below:

   _____students in the class voted against a ban on smoking in public places.

4. Add the number of students who voted for a ban (see step 2) to the number of students who voted against the ban (see step 3) to find the total number of students who voted.
   Record the total below:

   _____students for a ban plus _____students against a ban equals total number of students who voted

5. Divide the number of students who voted for a ban by the total number of students who voted. Then multiply by 100. The resulting number is the percentage of students who voted for a ban. Record your calculations and do the same calculations for the percentage who voted against the ban and record below.
   _____percent of students voted for the ban on smoking
   _____percent of students voted against the ban on smoking

Instructions for Smoke-Check Test

Name _____

Your teacher has asked for volunteers to conduct a test for exposure to environmental tobacco smoke. Before you volunteer, consider carefully whether you are willing to follow the procedure below. If you decide to volunteer, here's what you will need to do:

1. Wear a Smoke-Check badge for four days as you go about your normal routine.

2. Each morning when you get dressed, clip the Smoke-Check badge to the outside of your clothing.

3. When you go outdoors, clip the badge to the outside of your coat.

4. At night, put the Smoke-Check badge on a table near your bed.

5. After four days, put the badge in a clean plastic bag and close the bag with a twist tie. Save the bag until it's time for the rest of the class to analyze the results of the test.

Date for removing Smoke-Check badges: _____

Clean Air Puzzle Question Sheet

Name _____

Directions:
Put together the pieces of information the members of your group collected to answer the following questions.

1. What makes up the air?

2. How do we take air into our bodies?

3. What are some things in outside air that can be harmful to people and other living things?

4. How can we reduce outside air pollution?

5. What are some things in indoor air that can be harmful to people and other living things?

6. How can we reduce indoor air pollution?

7. What can happen to people who breath polluted air?

8. How does air pollution affect our planet?

9. What is happening to the earth's ozone layer?

10. What are some health risks caused by changes in the ozone layer?

Health and Passive Smoke

Name _____

The dangers of second-hand smoke or environmental tobacco smoke parallel those of direct smoke. There is evidence that shows that the people nearby who inhale the toxic fumes generated by the smoker, particularly from the burning end of the cigarette, could get lung cancer and sustain heart damage.

Tobacco smoke consists of:

A. Cigarette Components
- organic matter
- nicotine alkaloids
- additives

AND

B. the products created when the intense heat (1600 - 1800F) breaks down those components to:
- CO_2
- CO
- tar

The amount, depth, and duration of inhalation influences the degree of absorption.

Major differences exist in the components of mainstream and sidestream smoke, largely determined by the degree of combustion: - Mainstream smoke is inhaled into the lungs from smoking the cigarette, depositing large particles in the larger airway.
- Sidestream smoke may come from someone else's tobacco or one's own, from the burning end of the cigarette between puffs, or while it is lying in the ashtray.
- Sidestream smoke is a mixture of irritating gases and carcinogenic tar particles that reach deeper into the lungs because they are smaller.
- Sidestream smoke is dirtier and chemically different from mainstream smoke

Passive smoking ranks behind direct smoking and alcohol as the third leading preventable cause of death:
Dr. Stranton Glantz, University of California at San Francisco - at a World Conference on lung health - Based on what your have read here and what you already have learned about environmental tobacco smoke, complete the position scale below:

Select a position about what you have read by marking the scale below:

1	2	3	4	5
Strongly Agree	Agree	Undecided	Disgree	Strongly Disagree

Imagine That! Creative Writing Sheet

Name _____

Imagine that there was an "alien" visiting our planet and he sees people with white "sticks" between their fingers. They are sucking on them, and blowing smoke out of their mouths. He says he would like to try it. He asks if there is any information you would want him to know before he tries it. Write your advice for him below.

Create an ad for a "new" product on the market that --
a. is proven to be hazardous to your health,
b. is responsible for at least 350,000 deaths a year in America
c. has not had to be approved by the Food and Drug Administration
d. is addictive
e. is used by children

Time Magazine Article Position Statement

Name _____

Excerpts from: ***Time Magazine***

STRONGER DATA LINK SMOKING TO ASTHMA IN YOUNG

BOSTON, June 14 (Reuters)--Tests of nearly 200 children with asthma have uncovered strong new direct evidence that exposure to other people's cigarette smoke causes or worsens the condition in children.

Although doctors have suspected a connection between asthma and secondhand smoke for years, the link has been based on studies in which people were asked to estimate how much youngsters had been exposed to cigarette smoke from others. But such estimates may have been inaccurate.

The new study, published in the current issue of The New England Journal of Medicine, was far more direct. The team of Maine doctors who conducted the study measured the children's exposure looking for telltale chemicals in their urine. When doctors counted the number of asthma attacks each child had suffered during the preceding year, they discovered that the children exposed to the most secondhand smoke has 70 percent more attacks than those with little or no exposure. When the researchers analyzed the data using parental estimates of smoke exposure, children exposed to the highest levels of secondhand smoke seemed to have 80 percent more asthma attacks.

The evidence that the smoke from someone else's cigarette causes asthma-related illness "is sufficiently strong" and the amount of illness is sufficiently severe that "systematic efforts to reduce inhalation are warranted for children with asthma," the doctors concluded.

As estimated two million to five million children suffer from the lung problem. The team, led by Dr. Barbara Chilmonczyk of the Foundation for Blood Research in Scarborough, Maine, also found that the parents accurately estimated how much secondhand tobacco smoke their children had been exposed to, a discovery that gives additional credence to past epidemiological studies.

The latest findings come after the Environmental Protection Agency, using the results of 30 studies, concluded that secondhand smoke can cause cancer in nonsmokers. That ruling has helped prompt new restrictions on smoking in public places.

Based on what you have read here and what you have learned about environmental tobacco smoke in this unit, write a 1-2 page Position Statement. Be sure to list as many facts as you can to support your opinion on the issues relating to banning smoking in public places.

Chlorine: The Miracle Cure Debate Endocrine Disruption and Chlorine By-products

(Grades 7-12)

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http://www.scilinks.org/criteria.htm

Table of Contents

Overview

Carcinogens are agents that can cause cancer. In industry there are many potential dangers of being exposed to carcinogens, but beware! There may be more reason to be concerned. According to such organizations as "La Leche League" (the organization most supportive of breastfeeding), The Consumer Product Safety Commisssion, Scientists from the U.S. Food and Drug Administration, Dr. Gina Solomon (senior scientist with the National Resources Defense Council in San Francisco) and others, what should we consider? What do I need to know? Why be concerned? The dangers of carcinogen agents reach beyond the enclosed walls of industry into our environment, and sometimes, more frighteningly, into our homes and our...BODIES.

In this lesson students will take a close look at the element "Chlorine" as one of several important single elements or building blocks of matter which can be combined to produce a variety of different compounds. They will investigate its use in making products that play important roles in home, school and industry. They will explore the possible dangers and risk factors involving chlorine, the carcinogen question and our health.

Back to Table of Contents

Technology Resources

Internet Sites:

The Environmental Causes of Cancer Survey
http://www.chemtox.com/cancerchildren/survey.htm
SURVEY regarding environmental factors, which shows evidence of increasing child cancers in the U.S. and abroad. As stated in the previously listed ***New York Times*** article, child cancer now affects one in every 600 children and continues to grow approximately 1% per year. This steady yearly increase provides strong evidence for environmental/chemical factors as the primary cause to the problem. These chemical exposures can occur in the home, school, job, as well as from food sources and use of common home products. Unfortunately, because of the large number of chemical exposure sources in today's society, defining the significance of any one chemical is often difficult. Therefore, doctors designed the SURVEY to help identify which chemicals may be a higher risk for contributing to cancer as well as to look for increased risks occurring from interactions between chemicals that would otherwise be overlooked.

Chlorine Chemistry Council---Chlorine Disinfects: Chlorine Can Bring Chemistry to Life
http://c3.org/classroom/bbc.html
Chlorine Can Bring Chemistry to Life introduces students to chemistry without tackling the whole periodic table at once. Recognizing basic elements as building blocks is essential to the study of science. And looking closer at one element in particular -- chlorine -- can help ignite students' interest in chemistry. Download materials that outline a two-day study of building block chemistry using basic concepts and easy-to-find materials. Additional free materials that can extend your lessons on chemicals in everyday life can be ordered by clicking here or by writing to ***Schools, Chlorine Chemistry Council***, 1901 L Street, NW, Suite 300, Washington, DC 20036.

ATSDR-ATSDR's Home Page
http://atsdr1.atsdr.cdc.gov:8080/atsdrhome.html
The mission of the Agency for Toxic Substances and Disease Registry (ATSDR), as an agency of the U.S. Department of Health and Human Services, is to prevent exposure and adverse human health effects. The agency also prevents diminished quality of life associated with exposure to hazardous substances from waste sites, unplanned releases, and other sources of pollution present in the environment. ATSDR is directed by congressional mandate to perform specific functions concerning the effect on public health of hazardous substances in the environment. These functions include public health assessments of waste sites, health consultations concerning specific hazardous substances, health surveillance and registries, response to emergency releases of hazardous substances, applied research in support of public health assessments, information development and dissemination, and education and training concerning hazardous substances.

MSNBC Health/Your Environment
http://www.msnbc.com/news/223977.asp#BODY

ECME: Environmental Estrogens (The Endocrine System)
http://www.tmc.tulane.edu/ECME/eehome/basics/endosys/
The endocrine system is a complex network of chemical signals and messages that control many immediate and life-long bodily responses and functions. Growing taller, developing male or female characteristics and reacting to fear are all partially directed by endocrine hormones. All animals with backbones - from fish to mammals - have an endocrine system that works hand-in-hand with the nervous system to:

- maintain the body's internal steady state (nutrition, metabolism, excretion, water and salt balance);
- react to stimuli from outside the body;
- regulate growth, development and reproduction; and
- produce, use and store energy.

Endocrine Disrupters
http://www3.hmc.edu/~clewis/endocrine/intro.htm
Endocrine Disrupter is a term given to any artificial substance which assumes the same function as a hormone in the body, or inhibits the normal functioning of natural hormones. Many of these pollutants are chemicals and derivatives of chemicals used in pesticides, plastics, detergents, lacquers and other everyday materials. Most commonly, the hormone functions disrupted by these artificial agents are the steroid hormones, many of which determine sexual characteristics and behaviors. This Internet Sites describes the endocrine system, endocrine disrupters, its health effects, and what we can do.

Endocrine Disrupters (Why Files)
http://whyfiles.news.wisc.edu/045env_hormone/index.html
In July, an EPA committee met in Chicago. Their problem: are synthetic chemicals causing hormonal chaos?
[Posted August 7, 1997]
The Why Files gives a detailed overview of:

- What are endocrine disrupters?
- Wildlife woes: Pesticides don't discriminate
- Human woes: DES, DDT, PCB's, dioxin 'n more
- How does the endocrine system work?
- Hormone basics
- Hormone confusion: How disrupters do their work
- History: DDT and eagles' eggs
- What's being done?
- The EPA's action plan
- Prospects for success

Endocrine Disruption: A Short Explanation of What is Known
Melissa Kaps, Good Neighbor Project Intern
http://www.enviroweb.org/gnp/endocrine.htm
The endocrine system consists of three components, which are glands, hormones, and target cells. These three elements work together to relay messages throughout the body that regulate functions and responses. Some of the functions and responses that are the responsibility of the endocrine system are controlling the body's growth, developing male or female characteristics, and making the body respond to fear stimuli. Also, in conjunction with the nervous system, the endocrine system maintains the body's inner state, reacts to outside stimuli, and assists in development and reproduction. The endocrine system, with the help of the endocrine hormones, plays a large and important role within the body of any animal that has a backbone. Therefore, any disruption in this system would have devastating effects. Endocrine disrupters do interfere with this important system in the same ways as endocrine hormones. They are found everywhere in the environment in the forms of many pesticides, heavy metals, plastics, detergents, and other synthetic substances.

Other Internet Resources
You can use the handout titled, **"Chlorine: The Miracle Cure Debate Additional Internet Resources"** to check other Internet Sites related to this lesson.

Software Resources

- **Mosby's Medical Encyclopedia - The complete Home Medical Reference) Windows CD-ROM**, at Softkey International, One Athenaeum Street, Cambridge, Ma 02142
- **Microsoft Encarta Encyclopedia,'98 Deluxe CD-ROM**; Microsoft Corporation, at Microsoft Encarta World Wide Web site http://www.encarta.msn.com/
- National Geographic Interactive, CD-ROM; Data-ware Technologies, distributed by Mindscape at 88 Rowland Way, Novato, Ca 94945, Tel: (415) 895-2000 or visit the web site http://www.mindscape.com.
- **Coral, Chemlab,** by Coral Corporation and Educoncept Ltd. At I. Hoffmann + Associates Inc. (H +a) 34 Ross Street, Toronto, Ontario, Canada M5T 1Z9 or Tel: 416-977-6732 Fax 416-977-0766
- **Periodic Table Bundle version 3.1**, >by HyperProg Software, at HyperProg Computing, P.O. Box 446, East Brunswick, NJ 08816

Multimedia Software Resources

- A.D.A.M. The Inside Story '97 edition, CD-ROM, A.D.A.M. Software, Inc. at 1600 Riveredge Parkway, Suite 800, Atlanta, Georgia 30328 U.S.A. or visit the web site, http://www.adam.com
- Microsoft PowerPoint '98 and Mircosoft Excel, Macintosh Edition at the Microsoft Office World Wide Web Site using the URL, http://www.microsoft.com/office
- The Green Files, by Coral Corporation and Educoncept Ltd. At I. Hoffmann + Associates Inc. (H +a) 34 Ross Street, Toronto, Ontario, Canada M5T 1Z9 or Tel: 416-977-6732 Fax 416-977-0766

Video Resources:

- *Building Blocks of Our World: Chlorine* Chlorine Chemistry Council, 2501 M Street, N.W., Washington, D.C. 20037 (202) 887-5418
- *The Elements,* Discovery Channel School at http://www.discoveryschool.com Or call toll free 1-800-892-3484

Digital Images & *Quicktime* Video Resources: Kodak DC40 and software, *PhotoEnhancer for the KODAK Digital Science DC 40 Camera* at Picture Works Technology, Inc. 125A Town and Country Drive, Danville, Ca 94526-9720 and ***Apple Quicktime software*** at the web site http://www.apple.com

Back to Table of Contents

Teacher Background Information

Most people know that table salt, a natural mineral essential for the proper functioning of our nervous and muscular systems, is sodium chloride. But many would be surprised to know that hundreds, probably thousands, of organic chlorine chemicals are produced by an array of biological and natural chemical processes in our environment. Many of these chemicals are identical to highly publicized manmade organochlorines: chlorophenols, chlorinated hydrocarbons, PCBs, CFCs and dioxins. But many others are entirely new molecular entities, many of which possess extraordinary and important biological properties similar to those of penicillin, morphine and the new anti-cancer drug taxol. As a fundamental chemical element, chlorine is not only abundant in the Earth's crust (ranking 18th in the list of elements) but it is also ubiquitous in our soil, rivers, lakes, trees, plants and, of course, oceans. Like other common elements carbon, hydrogen, oxygen, nitrogen, sulfur, phosphorous that are present in all living things, it would appear that chlorine and the other halogens (bromine, iodine and, to a lesser extent, fluorine) are present as well. Although only 30 natural organochlorines had been discovered by 1968. As of April 1994, this number has grown to over 1,000. And more are being discovered every month.

The Environmental Protection Agency (EPA) has been mapping out a vast program to check whether synthetic chemicals like, certain organochlorines, can disrupt hormones in humans and animals. These "hormone disrupters" can cause cancer, birth defects and immune problems. Even incredibly tiny concentrations can interfere with reproduction. The hormone disruptors are more evidence that chemicals can be dangerous even if they don't cause cancer. In humans, as in animals, hormones have many communications jobs, affecting mood and memory, reproduction and development, virtually any biological process you can name. While the nervous system sends electrical signals along nerves, hormones drift to their destination through the blood to cells that have the correct receptor molecules on their outsides. Once locked onto a receptor, a hormone may instruct a cell to divide or make a certain protein. Or it may tell the cell to stop dividing or making proteins. There's growing evidence that artificial chemicals in the environment can disrupt hormones by sending erroneous signals or blocking legitimate signals. Since the hormones are part of the endocrine system, the hormone disrupters are also called endocrine disrupters. And since the concern originated with estrogen, the "female" hormone, they are sometimes called estrogen mimics. Although the human harm from endocrine disrupters is not as clear as the animal harm, there's reason to worry. In terms of biochemistry, we're not that different from other mammals, where endocrine disruptors effects are clear, particularly in the reproductive apparatus. But there was one giant "experiment" with endocrine disrupters on humans. Between the 1940s and 1970s, doctors prescribed an artificial estrogen named diethylstilbestrol, or DES, to prevent miscarriages in millions of pregnant women. Only long after the fact did Doctors find that DES had caused a rare form of cervical cancer in some of their daughters. Other evidence is more ambiguous. Several studies -- but not all -- have found a worldwide lowering of sperm counts, and blamed it on the rising concentrations of estrogen mimics in the environment. Some scientists say estrogen mimics could also explain the growing incidence of breast cancer and perhaps prostate cancer as well. Endocrine disrupters have structures a lot like real hormones. They include:

- breakdown products of several pesticides that are now banned, such as DDT,
- PCBs, a persistent group of chemicals, are still found in electrical equipment that pollutes lake and stream sediments in many industrial regions. Polychlorinated biphenyls (PCBs) contain 209 individual chlorinated chemicals (known as congeners). PCBs are either oily liquids or solids and are colorless to light yellow in color. They have no known smell or taste. There are no known natural sources of PCBs. Some commercial PCB mixtures are known in the United States by their industrial trade name, Aroclor. PCBs don't burn easily and are good insulating material. They have been used widely as coolants and lubricants in transformers, capacitors, and other electrical equipment. The manufacture of PCBs stopped in the United States in 1977 because of evidence that they build up in the environment and cause harmful effects. Other products containing PCBs are old fluorescent lighting fixtures, electrical appliances containing PCB capacitors, old microscope oil, and hydraulic fluids
- dioxins, a group of toxic chemical byproducts from paper production and incineration
- chemicals found in the epoxy lining of "tin" cans
- plastics used for storing food
- dental sealants
- Vinclozolin, a fungicide used on fruit.

Although some of these chemicals, like the PCBs, are off the market, they break down very slowly. Tests of people living as far from factories as the Arctic have found PCBs at levels that could be dangerous.

Back to Table of Contents

Learning Objectives

Students will be able to:

- **Observe** and **record** different chemical and physical properties of selected chlorine compounds.
- **Investigate** and **identify** the use of chlorine compounds in making products that play important roles in our home, school, and workplace or industry.
- **Investigate** the possible increase of risk factors of certain types of cancer, endocrine disruption, and other health problems by chlorine by-products and other chemicals in the environment.
- **Demonstrate** how chlorine also protects public health by removing microscopic life from a water culture.
- **Debate** the Pro's and Con's of the use of chlorine and other chemicals.

Back to Table of Contents

MSPAP/Core Learning Goals

(MSPAP vocabulary is highlighted within the learning objectives above.)

- **Goal 1: Skills and Processes**: The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information.
  Expectations 1 2, 3, 4, 5, 6 & 7
- **Goal 3: Concepts of Biology**: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) and major biological concepts to explain the uniqueness and interdependence of living organisms, their interactions with the environment, and the continuation of life on earth.
  Expectations 5 & 6
- **Goal 4: Concepts of Chemistry**: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) to explain composition and interactions of matter in the world in which we live.
  Expectations 2, 4, 5 & 6

Back to Table of Contents

Vocabulary

Carcinogens- A substance with the ability to cause cancer.
Chlorine- The seventeenth atomic element on the Periodic Table, described as one of the most active elements rarely found free or uncombined.
Dioxin- A known carcinogen, and product of incineration and paper production.
Phthalates- Chemical additive used to make plastics soft and pliable.
Hormone disrupting toxicity-
DDT- Substances better known as organochlorine pesticides
Vinyl chloride- A colorless, flammable gas used to make "PVC".
DCB (dichlorobenzene)- Chemicals used to control moths, mildew, and as a deodorizer for restrooms and waste containers.
PCB's- (Polychlorinated biphenols) a group of manufactured organic chemicals known as congeners, found in electrical equipment.
PVC- (polyvinyl chloride) A colorless, flammable gas used in the production of plastic products.
Bleach- A disinfectant agent that's a 5.25% solution of sodium hypochlorite and water.
Cancer- A malignant growth of tissue, usually ulcerating and tending to spread causing ill health and wasting away.
Estrogen- The female hormone that influences the development and control of female sex organs.
Testosterone- The male hormone
Tumors- An abnormal mass of tissue growing without obvious cause from cells of pre-existing tissue.
Endocrine Disrupters- Any compounds mimicking actions of, or altering levels of neurotransmitters, hormones, and growth factors in the developing brain.

Back to Table of Contents

Equipment and Materials

Per class:

- PowerPoint presentation
- Overhead transparencies of activity sheet diagrams
- Class Computers and TV/Monitor with connection device
- Web-page resource booklets or computer with internet connection activity sheets for students
- A number of chlorine products from home, school, or industry for display
- Chemical and chemistry posters
- Periodic Table of Elements

Per investigative teams of 4-5 students:

- Web-page resource booklets created by printing Web-pages of Internet Sites to be used, or a computer with internet connection. (Web-Sites can also be videotaped or saved to Disk using a special software program like ***WebWacker*** or ***Netscape History***)

Materials for laboratory activities:

- 2 (8-ounce) clear plastic cups
- water
- food coloring
- bleach
- droppers
- Magnifying glass
- Microscopes
- Aluminum foil
- pH paper
- test tubes
- test tube rack
- beakers
- tap water
- chlorine compounds

Per student:

- Activity sheets/booklet for each student
- Environmental Survey Form
- Group Analysis of Environmental Survey
- Chemical Magic
- The Elements
- Web Quest and Software Exploration: Elements for Life's Sake Part I (An Electronic Worksheet)
- Web Quest and Software Exploration: Elements for Life's Sake Part II (An Electronic Worksheet)
- Web Quest and Software Exploration: Elements for Life's Sake Part III (An Electronic Worksheet)
- Chlorine In Our Lives: Notes
- Chlorine In Our Lives

Activities

Day 1

Pre-Viewing Activities

ACTIVITY 1: Learning Activity: (Drill)
As an introductory, warm-up activity, have students answer *the* "Environmental Survey". This is a set of questions modified from the original ***"Environmental Causes Of Cancer Survey"*** http://www.chem-tox.com/cancerchildren/survey.htm. Explain that the survey will be used to help scientists determine the kinds of chemicals most people use and come in contact with in their everyday life. After completing the survey bring the students attention to certain parts of the survey that details certain products that may be used in and around the house, school or other places they frequent. During the discussion, use ***Microsoft PowerPoint*** to lead students into thinking about how the survey implies an increased risk for a child developing cancer when exposed to several chemical exposures simultaneously or in close time periods. Introduce the Internet Site of the original ***"Environmental Causes Of Cancer Survey"*** http://www.chem-tox.com/cancerchildren/survey.htm. using the ***PowerPoint*** presentation.

- The class will then use the student worksheet, "Group Analysis of Environmental Survey". They will do an analysis of their completed surveys in their investigative teams. The students will fill in a chart and using the data they collect, create a graph. Some students will enter their data in ***Microsoft Excel (Office)*** and use ***Microsoft Excel (Office)*** to generate a graph. Students will post their graphs and the class will compare and contrast them.

Note: According to this survey, "if the body is exposed to many chemical factors simultaneously, or in close time periods, then the body's defenses and genes involved in cancer growth can be overwhelmed. This is especially true in a young child whose defenses and genetics are far more susceptible to harm than an adult. For example, In just one year, a child that's exposed to a combination of chemicals (lawn or home pesticides, home remodeling chemicals, household disinfectants, room painting, etc.) would be at a higher risk for developing cancer." Many of these chemicals we simply take for granted and we never consider the risks! Tell students that they will complete a number of activities to learn about some of these chemicals, and there effects on our body and health.

ACTIVITY #2:What will students do? (Opening Activity)
"Chemical Magic", taken from the free teaching materials, "***Chlorine and Building Block Chemistry***", available by writing to: Schools, Chlorine Chemistry Council, 2501 M Street, N.W. Washington, DC 20037.

"CHEMICAL MAGIC"
Introduce this activity using the student activity sheet, "Chemical Magic"; Before class, set up for this short laboratory, hands-on investigation to build awareness about the elements, particularly the element Chlorine. Have the students work in small cooperative learning groups as investigative teams to complete this activity. Distribute the activity sheet "Chemical Magic" and have students read through the introduction.

"In this activity you will perform some chemical magic. Be sure to follow the procedures carefully. Remember the safety rules for working with chemicals. Do not bring the chemicals into contact with your eyes, skin, nose, and mouth. Wash your hands after the activity. Wear safety goggles. Dispose of the chemicals according to the teacher instructions."

Review the procedures and distribute materials for the team investigation. Make sure the teams work cooperatively following the procedures in the handout to complete their investigation, make their observations, and answer the analysis and conclusion questions.

During the discussion of the analysis and conclusion questions with the class show students the bottle of bleach (sodium hypochloride) and tell them that their conclusion was right about Solution A; it contains bleach, which is made mostly of the element Chlorine. Use a short video clip/segment from the Discovery Channel-Assignment Discovery Series called "***The Elements***" which traces the evolution of chemistry from the Greeks to present day. Students will answer questions like, " What is an element? Where are elements found? How many elements are there?" .The video will lead students to a Web Quest and Software Exploration activity "Elements-For Lifes Sake" using the World Wide Web and software programs. They will learn more about the elements we come in constant contact with, particularly chlorine.

Focus For Viewing:
The focus for viewing is a specific responsibility or task(s) students are responsible for during or after watching the video, to focus and engage students' viewing attention. While viewing a short clip of the Discovery Channel Video, "***The Elements***" students will be given instructions to record their answers and notes on their activity sheet. Students will get a brief historical account of the evolution of chemistry from the Greeks to present day, as they are introduced to the elements.

Viewing Activities:

Begin Tape:
Start at the very beginning and have students listen carefully to "***The Element Song***" by Tom Lehrer. Students will answer questions 1, 2, 3 and 4 on their student activity sheet. **PAUSE** the video when you see the names of the first 3 elements you want them to list in response to the 4th question. Push the pause button on the remote to **RESUME** the tape again and have them list the fourth element. After they see and write the last one (FIRE) **PAUSE** the tape again and ask "Why do you think the Ancient Greek Philosophers believed these to be the only elements? Discuss the students answer to this question and **RESUME** the tape again where you see the word FIRE. Have students answer the next question, according to Ancient Greek Philosophers, how were all things believed to have been created? **PAUSE** the tape after the Narrator says, "You only have to burn wood to see the proof". Discuss their answers to the question. Now ask, according to their beliefs, do you think the Ancient Greek Philosophers were right when they said You only have to burn wood to see proof? After discussing the question **REWIND** the tape back to the word "FIRE" and then push the play button to **RESUME.** Next, **PAUSE** the tape when you see the definition of "ELEMENT" appear. Ask students again, were the Ancient Greeks right when they said you only have to burn wood to see proof? The answer should be NO. In answer to the next question on their activity sheet, have them write the definition they see. **RESUME** the tape, and have them answer the last question. **END THE TAPE** when the Technician shows a magnified view of an element sample from soil. Discuss the last question then go to the Internet Activity.

Next, introduce "Web Quest and Software Exploration Elements-For Life Sakes" activity, using the World Wide Web and software programs. Students will learn more about the elements we come in constant contact with, particularly chlorine. Use the student activity sheet "Web Quest and Software Exploration Elements-For Life Sakes" and ***Microsoft Encarta 98 Encyclopedia CD-ROM*** and go through a search to find the chemical elements. Encarta will also do an Internet search, and take us to the World Wide Web to explore various web sites like ***WebElements:*** http://www.shef.ac.uk/chemistry/web-elements/nofr-key/cl.html to introduce chlorine as an important building block element. Chlorine is only one of a handful of single elements that combine to form most of the matter on the earth. Students can use the periodic table on this site to point out the building block elements: Oxygen (O), Silcon (Si), Aluminum (Al), Iron (Fe), Calcium (Ca), Sodium (Na), Potassium (K), Magnesium (Mg), Hydrogen (H), Phosphorus (P), Chlorine (Cl), Carbon (C).

Review with students that these elements are sometimes called "building blocks" because they make up 99% of the earth's crust, atmosphere, and ocean by weight. Students will explore and learn more about these elements by doing the Web Quest and Software Exploration activity called "Elements-For Life Sakes" in investigative teams of two or three.

Day Two

Pre-Viewing Activities
Use the bottle of bleach and ask students if they can think of any other things that we use in our daily lives that contain chlorine? Have students recall the Web Quest and Software Exploration activity called "Elements-For Life Sakes", using the World Wide Web and software programs. Briefly discuss some things they learned about the element chlorine. Next have students watch the introduction of the video "***Building Blocks of Our Lives-Chlorine***."

Focus For Viewing
While viewing the video, "***Building Blocks of Our Lives-Chlorine***" students will be given instructions to record their answers and notes on their activity sheet. Students will list things we might not have without chlorine, and using student sheet #1 "Chlorine In Our Lives", ask the students to circle those items or products that they have used or seen at school.

Viewing Activities

ACTIVITY #3 (Engagement Of Students) ***"Chlorine In Our Lives***" taken from the free teaching materials booklet, "***Chlorine and Building Block Chemistry***" available by writing to: Schools, Chlorine Chemistry Council, 2501 M Street, N.W. Washington, DC 20037, and video tape "***Building Blocks of Our Lives-Chlorine.***"

"CHLORINE IN OUR LIVES" BEGIN TAPE:
1. Start at the very beginning and list examples of things they see that we use in our everyday lives that contain chlorine. **PAUSE** the video after the statement " You just try living in a house without chlorine" and ask students what do they think it would be like. Discuss their thoughts about it. After the short discussion, push the pause button on the remote to **RESUME** the tape again and have them list things we might not have without chlorine. **PAUSE** the tape after you see the "chlorine license plate" on the back of the car just as it pulls away. Discuss the students' answer to the question.

2. Next distribute student sheet #1 "Chlorine In Our Lives" and ask the students to circle those items or products that they have used or seen at school.

3. Discuss their responses and explain that chlorine likes to combine with other elements and compounds, and that scientists have found ways for chlorine to help build or improve things. Take for example a soccer ball, (I'll hold up the ball) what is it made of? We will discuss the question and then begin the tape again:

BEGIN TAPE: Start at the point where the same question is asked and explained on the tape. Have students write the chemical formula for VINYL and name the elements that it consists of. What percent of the ball is chlorine? **STOP** the tape here and discuss.

4. Then bring students attention back to the ***Environmental Causes Of Cancer Survey*** http://www.chem-tox.com/cancerchildren/survey.htm and the Microsoft PowerPoint presentation in the introductory activity. Introduce another Website, ***ATSDR/EPA*** http://atsdr1.atsdr.cdc.gov:8080/cx.html (Agency For Toxic Substances and Disease Registry) and hand out their list of the top 20 hazardous substances. Ask students to look over the list to see if any of the chemicals on the list look familiar? They should find Vinyl Chloride on the list. Use anatomical chart and/or models of the human body to introduce students to their investigations of chlorine's (and other chemical's) possible roll in increasing the risk factors of certain types of cancer and other health problems and diseases. Tell students to write names of chemicals and health problems on a sheet of paper throughout their activities. They can then tape or pin the words to the anatomical figures during the lesson to show how our bodies are being affected. They will work like a team of scientists at various stations, to complete a number of activities to learn more about Chlorine compounds and other chemicals. They will explore how our exposure to these and other chemicals can effect our body and our health. (NOTE: This will lead to and introduce activity #4)

Day 2 & 3

Post Viewing Activities

Activity #4 (Exploration) Tell students that they will investigate chlorine's (and other chemicals) possible role in increasing the risk factors of certain types of cancer and other health problems and diseases. They will work like a team of scientists at various stations, to complete a number of activities to learn more about Chlorine compounds and other chemicals. They will explore how our exposure to these and other chemicals can effect our bodies and our health. After completing all tasks, students will ***write a proposal statement about the use of chlorine, and its possible risk factors to our health that will be video taped for a simulated news broadcast***. A rubric will be provided for this activity. Students will work in investigative teams of four or five to go through each station to gather facts about the topics listed below. Instruct students to record their responses on the activity check-off sheet (rubric) "Chlorine Investigators Report".

Station #1

a.) *A.D.A.M. The Inside Story* and Endocrine disruption and hormone disrupting Toxicity:
Here, students will use ***A.D.A.M. The Inside Story CD-ROM*** to explore the endocrine system and learn about its parts and functions. Students will also use printouts of various Internet Webpages to complete a student worksheet describing the neural (brain), Endocrine System (hormones), and behavioral effects of environmental endocrine disrupting chemicals. They will complete a diagram of the structural parts and try their hand at working out various puzzles and take the Quizmiezer's quiz. They can also explore the anatomy and access 3D anatomical models.

Station #2 b.) ***MSNBC "Newsbriefing-Health and My Environment":***
http://www.msnbc.com/news/YOURENVIRONMENTH_Front.asp
Here, students will read and discuss Articles from ***msnbc.com on "Health and Your Environment***" to research and discuss such topics as the effects of global warming, whether organic foods are healthier, etc. Students will read and discuss these articles and others taken from a search of ***"National Geographic Interactive CD-ROM***," by Data-ware Technologies. They will gather information to use in creating a story board for making a ***PowerPoint*** presentation that could be used at an EPA meeting to relate and argue their concerns about the carcinogin effects of certain chemicals.

Station #3
c.) **Carcinogens, Cancer and Me:**
Here, students will use the Internet, ***Mosby's Medical Encyclopedia - The complete Home Medical Reference) CD-ROM***, Softkey International, and ***Microsoft Encarta Encyclopedia, '98 Deluxe CD-ROM***; Microsoft Corporation to do some research to learn basic facts about cancer. Students can, also, take notes and view video-clips, or see animations on "Cancer" and complete a graphic organizer that details basic information they learned about the topic. Students will use information taken from a visit to ***Metlife Internet site*** to view a Cancer Risk survey. Boys can view the one on Prostate Cancer and girls can view the Breast Cancer Risk Survey. They can compare and contrast the surveys and use the ***Metlife Height*** and Weight Tables/Men and Women
http://www.metlife.com/Lifeadvice/Tools/Heightnweight/index.html to compare and contrast their weight to the data tables on the Internet Site.

Station #4
d.)Exploring Chlorine Compounds and Eliminating Microorganisms from Water
Here students will do one of two hands-on laboratory investigations to observe and compare the physical and chemical properties of different chlorine compounds, or students will investigate how the adding of chlorine to drinking water has been used to eliminate waterborne diseases such as cholera in North America, by destroying disease-causing microorganisms. Students will be able to safely demonstrate how chlorine is being used to protect public health by removing microscopic life from a water culture.

Day 4 & 5

ACTIVITY #5 (Explanation)

- SIMULATED NEWS BROADCAST
- CRITICAL THINKING QUESTIONS DEBATE

- Divide the class into three groups.:
- Investigative Team one: will represent ordinary consumers
- Investigative Team two: will represent the chlorine industry
- Investigative Team three: will represent environmentalists Based on their role, investigative teams would then discuss and answer questions related to the problem. They will meet in expert groups to discuss how they would debate the pros and cons of the use of chlorine.

  Have each group choose a spokesperson and have the debate. Videotape the debate and use the ***Digital Camera*** to capture images of the debate. Create your own ***Quicktime video***, and have student investigative teams plan on using the debate as part of a presentation in the distance learning lab. Guidelines for he debate should be provided. Other classes can look at the debate tapes, evaluate, and critique them.

Extensions

Field Trip(s)

- Contact authorities and plan a visit to a water-treatment plant for a close-up view of how water is made safe to drink.
- Plan a visit to the Maryland Science Center to view the Visible Man and Visible Woman exhibit and explore interesting exhibits on the human body.

Health
Invite a local public health official to come in to talk with the class about the treatment of waterborne diseases and the use of chemicals, like chlorine, for disinfectant.

Language Arts
After students have completed all of the activities they can write out the pros and cons of chlorine usage according to their notes from investigative teams. These could be put on the class web page.

Home Assignment
Handout: Student Sheet #1- "Chlorine In Our Lives"

Back to Table of Contents

Assessment/Evaluation

Have student's display and explain their products from the various activities and use some peer evaluation techniques. Videotape the debate and have students view the tape about a week later to critique the debate.

Back to Table of Contents

1999 EnviroHealth Link Master Teacher Team:
Evelyn Walls & Janet Henke

Chlorine: The Miracle Cure Debate
Additional Internet Resources

Here is a list of additional Internet Sites you can visit to do more research on the effects of chemicals in the environment and our health. Just click on the URL to visit the site.

Other Internet Resources:

Pesticides May Challenge Human Immunity
Science News, March 9 1996
http://soundprint.org/~science/pesticide2.html

Water On Tap: A Consumer's Guide to the Nation.....
How Safe Is My Drinking Water?
http://www.epa.gov/OGWDW/wot/introtap.html http://www.epa.gov/OGWDW/wot/howsafe.html

Properties of Chlorine Dioxide
http://www.clo2.com/factsheet/properties.html

Highlighting the use of Chlorine Dioxide for water treatment and disinfection.
http://www.clo2.com/index.html

Uses of Chlorine Dioxide
http://www.clo2.com/factsheet/uses.html

Women’s ills: Are toxins to blame?
New research suggests that is indeed the case
http://www.msnbc.com/news/246794.asp

RACHEL'S ENVIRONMENT & HEALTH WEEKLY #536
---March 6, 1997---HEADLINES: IMMUNE SYSTEM TOXINS
http://www.monitor.net/rachel/r536.html

RACHEL'S ENVIRONMENT & HEALTH WEEKLY #571
---November 6, 1997---HEADLINES:THE TRUTH ABOUT BREAST CANCER--PART 1
http://www.monitor.net/rachel/r571.html

This brief questionnaire can be used as an aid in estimating your risk for breast cancer
http://archive.msnbc.com/modules/breast/quiz.asp

Prostate cancer check-up
Find out your risk
http://www.msnbc.com/modules/quizzes/prostate_cancer.asp

Height and Weight Tables/Men and Women
http://www.metlife.com/Lifeadvice/Tools/Heightnweight/index.html

Height & Weight Table For Men
http://www.metlife.com/Lifeadvice/Tools/Heightnweight/Docs/men.html

Height & Weight Table For Women
http://www.metlife.com/Lifeadvice/Tools/Heightnweight/Docs/women.html

From 'What is cancer?' to 'Can I prevent it?'
http://www.msnbc.com/news/165986.asp#BODY

Stopping prostate cancer in its tracks
Gene switch find could lead to new drugs to prevent, treat the disease
http://www.msnbc.com/news/245706.asp

A Prospective Study of Spontaneous Abortion: Relation to Amount and Source of Drinking Water Consumed in Early Pregnancy
http://www.clo2.com/reading/drinking/Epidpap1.html

Agency for Toxic Substances and Disease Registry
Office of the Associate Administrator for Science
http://atsdr1.atsdr.cdc.gov:8080/cx.html

Fifty facts from The World Health Report 1998
http://www.who.int/whr/1998/factse.htm

Name _____ Date _____

Environmental Survey Form

Directions: Read each of the survey questions and circle yes or no. If the question does not pertain to you, or if there is no possible answer you can give, do not circle anything.

Yes	No	1. Did you ever spend time at your mother or father's place of employment? (After school, holidays etc.)
Yes	No	2. Is your home close to currently active agriculture farming areas (such as citrus groves, corn, cotton, etc)?
Yes	No	3. If answer is yes to above question, Do you know the type of agriculture?
Yes	No	4. If no agriculture areas are currently close to your home, was there ever any agriculture conducted in the past around your home?
Yes	No	5. Did you ever visit friends or relatives who lived close to agriculture growing areas?
Yes	No	6. Did either parent follow the mosquito trucks back in the 60's & 70's which emitted a pesticide fog plume?
Yes	No	7. Do you live near a golf course?
Yes	No	8. Was space type of HEATER used inside the home more than gas, oil burning, and small kerosene heaters?
Yes	No	9. Were roach or ant pesticides ever applied indoors by family members or professional pest control?
Yes	No	10. Were lawn pesticides ever applied?
Yes	No	11. Were shrubbery pesticides ever applied by a family member?
Yes	No	12. Were shrubbery pesticides ever applied by a company?
Yes	No	13. Were termite treatments ever applied while living in the home?
Yes	No	14. Does your mother consume diet drinks containing Aspartame (nutra-sweet)?

Yes	No	15. Does your father consume diet drinks?
Yes	No	16. Were flea bombs (aerosol or smoke vapor) ever used in the home?
Yes	No	17. Were liquid or powder flea treatments ever applied to the interior of the home – this is where the pesticide is usually sprayed over the entire carpet and/or couches?
Yes	No	18. Was any type of laundry detergent used?
Yes	No	19. Was any fabric softener used?
Yes	No	20. Was bleach used as a cleaning or disinfecting agent in the home?
Yes	No	21.Was pine cleaner used in the home?
Yes	No	22.Were any fragrance products (such as plug-ins – or aerosols) ever intentionally used to add fragrance to the household air?
Yes	No	23. Was the home that your family lived in built within the last 15 years?
Yes	No	24. Is your home wood or concrete block construction?
Yes	No	25. Is the type of flooring more carpet, a tile or hard wood, etc?
Yes	No	26.Was new carpet ever installed during the time of living in this home?
Yes	No	27.Were any rooms painted during the time of living in this home, particularly using latex or oil paint?
Yes	No	28.Was or is there a type of pet in the home?
Yes	No	29. Is the pet often treated for fleas with chemical flea treatments?
Yes	No	30. Does your mother use perfume?
Yes	No	31. Does your father use colognes?
Yes	No	32. Is some type of deodorant used by you and your mother?
Yes	No	33. Is some type of deodorant used by you and your father?
Yes	No	34. Is some type of shampoo used by your mother and other family members?

Yes	No	35. Is some type of hair creme-rinse being used by your mother and other family members?
Yes	No	35. Is some type of hair creme-rinse being used by your mother and other family members?
Yes	No	36. Is your mother or other family members applying finger nail polish in a salon or at home?
Yes	No	37. Are you or any other family members having hair permanents done?
Yes	No	38. Does your mother color her hair?
Yes	No	39. Does your mother use a face "foundation" base-make up?
Yes	No	40. Has anyone in your family applied hair spray to their hair?
Yes	No	41. Has your father ever used any type of hair coloring, creme, tonic or hair spray?
Yes	No	42. Do you live close to or near a microwave tower? These are metal towers about 100 feet high, which are used to transmit phone or cell phone communications.
Yes	No	43.Do you live close to High Power Lines?
Yes	No	44. Are any factories in the vicinity of your home?
Yes	No	45. Did you use a pacifier as a child?
Yes	No	46. Have you ever taken any x-rays?
Yes	No	47. Did your mother receive anesthesia during the pregnancy (dental, etc.) (not counting during child delivery)?
Yes	No	48. Do you know what type of anesthesia procedure was used when your mother gave birth?
Yes	No	49. Can you circle one? Local, spinal block, general anesthesia?
Yes	No	50.Was any remodeling done in your home such as painting, drywall, wall paper or new carpet?
Yes	No	51. Did anyone get sick after the remodeling?
Yes	No	52. If yes was the sickness within a month or two after remodeling?

Yes	No	53. Does your mother use skin cream moisturizers often?
Yes	No	54. Do you use moisturizing skin creams often?
Yes	No	55. Does your mother use suntan or sunblock lotion?
Yes	No	56. Do you use suntan or sunblock lotion?
Yes	No	57. Do you swim in a chlorinated pool?
Yes	No	58. Is your home is near a trash incinerator?
Yes	No	59. Was a flavor enhancer (*ACCENT*) ever used on foods you eat?
Yes	No	60. Are you aware of any foods eaten regularly which contained monosodium glutamate (MSG)? These often include flavored potato chips, Cheeto type snacks, frozen pizza, soups, etc.
Yes	No	61. Has anyone used an alcohol beverage, like cooking wine, or a cough medicine that is 10% or more alcohol? (Vicks NyQuil}
Yes	No	62. Does any family member drink coffee?
Yes	No	63. Does any family member smoke?
Yes	No	64. Does any family member come in contact with second hand smoke or regularly smoke?
Yes	No	65. Did you receive your childhood vaccinations?
Yes	No	66. Did you experience any adverse reactions to vaccinations?
Yes	No	67. Do you have regular fluoride treatments?
Yes	No	68. Since under 4, have you used fluoride toothpastes to brush your teeth?
Yes	No	69. Have you experienced exposures to any other chemicals that have not mentioned in this survey?
Yes	No	70. Is the primary water you drink TAP? (Not DISTILLED, Not bottled SPRING)

Group Analysis of Environmental Survey

Thank you for completing the Environmental Survey. The data from your survey will be used to help determine the kinds of chemicals most people use and come in contact with in their everyday lives. Do an analysis of your completed survey with your group. Fill in the chart below. Answer the following questions on the back of the sheet. Use complete sentences.

1. From the survey, which products did you and your family members use?
2. How did your answers compare to those of other members in your group?
3. How do you think scientists and doctors could use this survey in their research?
4. Use the data in your chart to make a graph.

Members of the Group. Write names in this Column.	**# Yes Answers**	**# No Answers**	**# Not Apply**
AVERAGE			

Name _____ Class _____ Date _____

Chemical Magic

In this activity you will perform some chemical magic. Follow the procedures carefully. Remember the safety rules for working with chemicals. Do not bring the chemicals into contact with your eyes, skin, nose, and mouth. Wash your hands after the activity. Wear the safety goggles. Dispose of the chemicals according to the teacher's instructions.

MATERIALS: (Per group of 4-5 students)

- Two clear plastic 8 ounce cups
- One container of warm water
- Sample A (Inside a small container with a lid)
- One dropper
- One small sample container of red food coloring
- Paper towels
- Safety eyewear

PROBLEM: What scientific methods can we use to explain what happens when the sample items are mixed or is it magic?

HYPOTHESIS: (Directions: Write a statement of your predictions to describe what you think the best scientific methods are to explain what happens when the sample items are mixed; or do you suggest it is magic? Explain.)

EXPERIMENT PROCEDURES:

1. Fill the two plastic cups with equal amounts of water (approximately half full)
2. Add one drop of red food coloring to one cup. Swirl until its one even color throughout.
3. Add 2 droppers full of Sample A to the second cup. Draw a picture to show your observations. Label your drawing and write an explanation. Use the space below.

4. Pour the food coloring solution into the Sample A solution and let it sit, observe for 30-60 seconds. Draw a picture and write an explanation to describe your observations. Use the space below.

ANALYSIS AND CONCLUSION:

1. What inference can you make based upon your observation?

2. Would you consider what happened magic? Explain why or why not?

3. What scientific methods were you able to use to determine if the results were or were not magic?

4. Identify Sample A and use prior knowledge as well as information you gained from observations from the experiment to justify and support your answer?

5. Write a conclusion statement to your investigation.

Name _____ Date _____

The Elements

While watching the video ***"THE ELEMENTS"*** and write a short answer the following questions. Don't worry, the video will be paused from time to time to give you extra time and to go over answers.

Listen carefully to "***The Element Song***" by Tom Lehrer:

1. When did Tom Lehrer write ***The Element Song***?

2. How many elements did he name in his song?

3. How many elements could he name today?

4. Once upon a time it was thought that there were only four elements List them:
    a.
    b.
    c.
    d.

5. Why do you think the Ancient Greek Philosophers believed these to be the only elements?

6. According to Ancient Greek Philosophers, how were all things believed to have been created?

7. According to their beliefs, do you think the Ancient Greek Philosophers were right when they said You only have to burn wood to see proof?

8. Were the ancient Greeks right when they said you only have to burn wood to see proof?

9. What is the definition for the word Element?

10. Why can't we classify earth, air, fire, and water as elements?

Name _____ Date _____

Web Quest and Software Exploration Elements-For Life's Sake (An Internet Search With "*Encarta*")

PART I

Did you know that Chlorine is only one of a handful of single elements that combine to form most of the matter on the earth. We can get a brief overview of this important element using ***Microsoft Encarta 98 Encyclopedia CD-ROM***. Let's do a search using ***Encarta*** to find the chemical elements.

1. Who proposed the Periodic Table of Elements?

2. What happens when I click on the symbol "Cl", for chlorine?

Chlorine is one of the building block elements, Oxygen (O), Silicon (Si), Aluminum (Al), Iron (Fe), Calcium (Ca), Sodium (Na), Potassium (K), Magnesium (Mg), Hydrogen (H), Phosphorus (P), Chlorine (Cl), Carbon (C). These elements are sometimes called "building blocks" because they make up 99% of the earth's crust, atmosphere, and ocean by weight. To learn more about Chlorine you are going on a Web Quest. ***Encarta*** can help get you started on this adventure. Follow the link from this article by clicking on the word "*halogens*". Halogens, in chemistry, are a group of five closely related chemically active elements. The name *halogen*, or salt former, refers to the property of each of the halogens to form with sodium a salt similar to common salt.

3. What are the names of the five halogens?

PART II

Now click on the word **"Chlorine"** to browse through an article to learn some interesting facts about this important element, its history and production. Then click on the symbol for "More information about This Subject" in the upper left corner of the ***Encarta*** window and click on the "Web Searches" icon in the menu. Do a Whole Web Search by clicking on the selection in the menu list that pops up. This will extend your search to the entire World Wide Web and continue your exploration. Visit at least three of the URL's that pop up as a result of your search and list five facts you learn about Chlorine. Write the URL to give the location of the fact.

Name _____ Date _____

Web Quest and Software Exploration Elements-For Life's Sake Part II (An Internet Scavenger Hunt)

PART II. "Scavenger Hunt"

You will visit these Internet sites to find the items below. Only do the ones assigned to your investigative team. Each investigative team will share what they found when all teams have finished their search. Write your answers on your Internet Activity Log Sheet in your notebook.

Investigative Team #1
Visit the in Chlorine Perspective Web Site by pointing your browser to
http://www.akzonobel.com/bc/intro.htm and answer these questions.

1. How many jobs is chlorine related to in Europe?

2. What percent of medicines are made using chlorine chemistry?

3. What percent of crop protection chemicals used by farmers are based on chlorine chemistry?

4. What does 55% of European chemical production depends on?

5. What percent of Western Europe's drinking water is made safe with the help of chlorine.

6. Is this statement true, "Chlorine is everywhere".

7.What are the number of naturally occurring chlorine-based compounds.

8. Can Chlorine exist by itself in nature?

Investigative Team #2
Visit the Chlorine in Perspective Web Site by pointing your browser to
http://www.akzonobel.com/bc/intro.htm and answer these questions.

9. One of the most common elements in nature, chlorine is even more plentiful than which element?

10. What are three key natural sources of organochlorines?

11. Name a tiny animal that produces a chlorinated alkaloid, with pain- killing properties several hundred times more powerful than morphine

12. On land, how many natural chlorine-based compounds are known to be produced by terrestrial fungi and plants?

13. What releases some three million tons of methyl chloride into the atmosphere every year.

14. What factor do Environmentalists frequently attribute levels of dioxins found in the environment to?

15. Name three sources of dioxin in the environment.

Investigative Team #3
Visit the Internet Site Web Elements and answer the questions using the URL http://www.shef.ac.uk/chemistry/web-elements/nofr-hist/Cl.html.

16. Who discovered chlorine?

17. What is the Atomic number and Atomic weight of chlorine?

18. When and where was chlorine discovered?

19. What is the Origin of the name, chlorine?

20. Who proposed and confirmed chlorine to be an element in 1810? (He also named the element.)

21. Why are even the smallest water supplies now usually chlorinated?

22. Name the element that's used in the production of paper products, dye stuffs, textiles, petroleum products, medicines, antiseptics, insecticides, foodstuffs, solvents, paints, plastics, and many other consumer products.

Investigative Team #4
Visit the Internet Site Web Elements and answer the guestions using the URLhttp://www.shef.ac.uk/chemistry/web-elements/nofr-hist/Cl.html.

23. How is most chlorine used?

24. How many elements make up 99.5% of the human body?

25. Elemental chlorine is the (10th, 12th, 20th) most abundant element? (circle one) Now visit the Internet Site, http://www.efilmgroup.com/disvii_2.htmlAnswer these questions.

26. Why were1000 residents evacuated?

27. What helped to helped to minimize hazards?

28. What did Officials estimate the amount of chlorine gas leakage from the tank cars to be?

29. What other chemical did officials detect on the scene, appearing as a colorless, odorless crystal used on the head of matches?

Now visit the Internet Site, Chlorine Bleaching, Dioxin and Women's Health http://www.web.net/terrafemme/chlor.htm. Answer this question.

30. What makes chlorine such a dangerous environmental toxin?

Internet & Software Exploration
Elements-For Life's Sake Part III
(Fun and Games With Elements and Chemistry)

DIRECTIONS: Choose one or more of the activities below and expore, have some fun and learn at your own pace.

PART I *"THE PERIODIC TABLE CHALLENGE"*
http://www.chem.uky.edu/misc/periodicquiz.html
Visit this Internet site and go to a fun interactive activity on the Internet to have fun while learning more about elements. Have fun with this element game. You can take the Periodic Table Challenge.

PART II " A COMIC BOOK PERIODIC TABLE "
http://www.uky.edu/~holler/periodic/periodic.html
If you like cool periodic tables, you will love this site. Visit A Comic Book Periodic Table. It's an art gallery of comic-book cartoons hyper-linked to almost every chemical. Try to create your own. We can use the Scanner to scan them and put them on our class Webpage.

PART III "FUN LEARNING THE ELEMENTS "

- Check out an interactive software program, Periodic Table Bundle v3.1©1995-1997 Steven Rodger.This program contains 2 parts. One helps you learn the Periodic Table of Elements (elements 1-111) and the other tests you on how well you know them. Download this software program and save it to your own disk. HyperProg Software's Home Page (Periodic Table Bundle v3.1) http://members.aol.com/hyperprog/index.html
- Next visit "The Visual Elements Periodic Table," featuring full color photographs of the elements. Try to guess the element by using the picture. Try to create some of your own. We can use the Scanner to scan them and put them on our class Webpage. http://www.chemsoc.org/viselements/
- Learn the words to *The Elements Song* and create your own element rap. We can record it, create an audio or midi-file and put it on our class Webpage. http://paul.merton.ox.ac.uk/science/elements.html

PART IV "FUN WITH TWO CD-ROM 'S"

- Use the Corel ChemLab CD-ROM and explore the wonders of chemistry. With this software perform your own fascinating experiments or choose from a wide selection of preset experiments. In this virtual laboratory work with realistic scientific equipment that is easy to use. Acids, bases, buffers, gas properties, kinetics, oxidation-reduction reactions, and radioactivity are only a few of the scientific principles you can learn about. You will find a 3D molecule viewer, gas lab, interactive periodic table, and an online chemistry texbook. Explore and learn at your own pace.
- Use the Life Science Mysteries: The Green Files CD-ROM and try to solve two challenging missions: Oil Spill and The Gemco Disaster. Explore four 3D rendered areas, the storage room and diving area are two. Work in the office and laboratory. Visit the Learn Zone. This is an interactive textbook with six scientific learning modules that contain diagrams, animated exercises, a self-test and more.

Name _____ Date _____

Chlorine In Our Lives
Notes

While watching the video *Chlorine in Our Lives*, taken from the free teaching materials, *Chlorine and Building Block Chemistry*, write a short answer to the following questions and write down words or terms that would be helpful in an Internet search. Don't worry, the video will be paused from time to time to give you extra time and to go over answers.

1. After watching the introduction to the tape, and hearing the statement, You just try living in a house without chlorine, what do you think it would be like?

2. Write a list of things that you might not have with out the element chlorine. Use the back of this paper to continue your list.

3. What is a soccer ball made of?

4. Write the formula for "VINYL" and name the elements that it consists of.

5. What percent of the ball is chlorine?

Internet Word Search:

Are We Creating the Superbug?
Overuse of Antibacterial Soaps and Other Products
(Grades 6-12)

Table of Contents

Overview

The students will investigate the use of antibacterial products such as hand soaps and kitchen and bath cleaners. They will use this information along with an understanding of bacteria to explore how the increasing use of these products may prove harmful in the long run.

The more frequently a strain of bacteria is exposed to an antibacterial agent, the more likely it is that a resistant strain of that bacteria will be formed. When antibacterial use was primarily reserved to medical facilities, only certain bacteria like staphylococcus began to develop immunity to the antibiotics. We have yet to learn what the outcome will be with the general public using these antibacterial products on a regular basis.

Back to Table of Contents

Technology Resources

Internet Sites:

Study Suggests Antibacterial Soaps Can Backfire
http://www.seattletimes.com/news/health-science/html98/bact_080698.html
This site reports on a laboratory study led by Dr. Stuart B. Levy examining the effects of triclosan on bacteria.

Antibacterial Soaps May Create New Problems
http://www.safenotsorry.com/soap.htm
This site suggests when and how to wash your hands with normal soap and water.

Home, Bacteria-Ridden Home
http://www.sciam.com/explorations/072197bacteria/mirsky.html
This site also reports on the work of Stuart B. Levy of Tufts University.

Software Resources
The World Book Multimedia Encyclopedia
525 West Monroe Street, 20th Floor, Chicago, Illinois 60661, 1-800-975-3250

The New Grolier Multimedia Encyclopedia
http://www.grolier.com, 1-800-243-7256

U.X.L Science, An Impring of Gale, 835 Penobscot Bldg., Detroit, MI 48226-4094

Back to Table of Contents

Teacher Background Information

Many products that are now on the market are labeled antibacterial. More and more press coverage is given to bacterial infections like E.coli and salmonella. The general public seems swept up in the antibacterial product movement. Are there risks associated with the use of these products? How do these products work?

Dr. Stuart B. Levy, a medical researcher from Tufts University, led a study on the antibacterial agent TRICLOSAN. The research showed that triclosan acts on a specific bacterial target instead o being a nonspecific biocide. Additionally, the research showed that the development of resistance to triclosan came from mutation to two bacterial genes. Levy does not suggest a ban on the use of triclosan but dopes recommend cautious use in the home of the products containing this chemical.

Beyond the very serious issue of possible bacterial resistance from widespread use of antibacterial products, there is another area of concern for science and health teachers. Some individuals may believe that antibacterial products protect them from all kinds of diseases. Many illnesses that are transmitted through families are viral not bacterial. The use of antibacterial agents offers no protection from viruses. Instead it may create a false sense of protection. Education in science and health classes needs to clearly distinguish between the two categories of pathogens and suggest ways to avoid or treat both.

Back to Table of Contents

Back to Table of Contents

Learning Objectives

Students will be able to:

- **compare and contrast** various types of bacteria
- **formulate an opinion** about the relationship between antibacterial agents and bacteria
- **evaluate** how the overuse of antibacterial agents may lead to increase resistance to their effects.

Back to Table of Contents

MSPAP/Core Learning Goals

(MSPAP vocabulary is highlighted within the learning objectives above.)

- **Goal 1: Skills and Processes:** The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the instruments of science to collect, organize, interpret, calculate, and communicate information.
  Expectations 1, 2, 5 & 7
- **Goal 2: Concepts of Biology:** The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1)and major biological concepts that explain the uniqueness and interdependence of living organisms, their interactions with the environment, and the continuation of life on earth.
  Expectations 2, 5 & 6

Back to Table of Contents

Vocabulary

Bacterium(a) - prokaryotic cell from the Kingdom Monera having no clearly defined nucleus
Antibiotic - a substance produced by a microorganism that inhibits or kills other microorganisms
Antibacterial - a substance that is intended to inactivate or kill bacteria
Triclosan - the active ingredient in some of the antibacterial products being marketed

Back to Table of Contents

Equipment and Materials

Per class:

- Web-page resource sheets or computer with Internet connection

Per team of 4 students:

- Samples of products containing antibacterial agents such as *Lysol*, *Dial* antibacterial soap, alcohol, and other antibacterial soaps and household products

Per Student:

- Copies of:
  - Worksheet #1, Bacteria
  - Worksheet #2, Let's Read About It
  - Worksheet #3, Internet WebQuest
- Activity Sheet

Back to Table of Contents

Procedures

ACTIVITY 1:
Students will do background research to learn or review information about bacteria. This background is necessary for a better understanding of the issues surrounding the use of antibacterial products. Students are to use the software versions of encyclopedia to gain information needed to complete the worksheet, Bacteria. Allow 15 - 20 minutes of research time. Discuss with students the answers to the worksheet before proceeding. In the discussion be sure to differentiate between bacteria and viruses.

ACTIVITY 2:
Have students generate a list of diseases commonly spread through home contact among family members. Record all student responses on the chalkboard. Note which of these are bacterial and which are viral. Remind students that the products they will be investigating are antibacterial. Keep the list posted in view of the students so that it can be referred to throughout the rest of the lesson.

ACTIVITY 3:
Divide the class into teams of 4. Have students complete a K-W-L regarding antibacterial products. Ask for volunteers to share this information before proceeding. with the next part of the activity. Distribute samples of products that are labeled antibacterial. Instruct students to read the labels and complete the worksheet "Let's Read About It". Allow ten minutes for groups to finish the worksheet. You may want groups to study more than one product.

Discuss the results of each group's investigation.

ACTIVITY 4:
Have students research antibacterial soaps and cleaners using the WebQuest Activity Sheet. If students do not have access to the Internet, the teacher can provide photocopies of the articles for students to read. Lead the students in a discussion of their findings. Record key ideas on the chalkboard.

Back to Table of Contents

Extensions

Language Arts

Students can write a letter to the Consumer Product Safety Commission,, describing their feelings about the issues surrounding the use/overuse of antibacterial products.

Science

If the teacher has the necessary background and if the school is equipped with proper safety equipment, students could design and conduct experiments testing the efficacy of the products in killing certain bacteria. Materials can be ordered from biological supply companies like Carolina Biological, 1-800-334-5551 or FAX 1-800-222-7112.

Back to Table of Contents

Assessment/Evaluation

Ask students to write a position paper related to the widespread use of antibacterial products. In the paper they must take a stand for or against this use. They should cite references from the their research to support their view.

Back to Table of Contents

1999 EnviroHealth Link Master Teacher Team: Janet Henke & Evelyn Walls

Worksheet #1
Bacteria

Use a resource such as *The World Book Multimedia Encyclopedia, The New Grolier Multimedia Encyclopedia, or U.X.L. Science* to answer the following questions about bacteria. Answer in complete sentences and cite references from the text where it is appropriate.

1. Describe what a bacterium looks like. Include a labeled diagram of a typical bacterium.

2. Complete the following chart:

Type of Bacteria	Description	Where Found	Illness Related to It	
1.				
2.				
3.				
Other				

3. Are all bacteria harmful? If not, give examples of helpful bacteria.

4. How can bacterial growth be controlled?

5. How are bacteria different than viruses

Worksheet #2
Let's Read About It

Obtain samples of antibacterial agents from your teacher. Read the label and the other printed material on the container. Answer the questions below.

1. The name of the product is _____.
2. It is manufactured by _____.

3. Use the information on the label to list the ingredients in the product.

4. The active ingredient that is supposed to kill the bacteria is _____.
5. What is the purpose of the other ingredients?

6. Copy the directions for use that are printed on the container.

7. Copy any warnings that are given on the label.

8. From what you already know about bacteria, are there any problems associated with the use of this product? If yes, describe the problems.

9. Does the label indicate if the product is effective against viruses?

10. Will this product be effective in killing viruses? Why or Why not?

Worksheet #3
Internet WebQuest Activity Sheet

Problem: Can the use of antibacterial soaps and cleaning products lead to resistant strains of bacteria?

In groups of 2 - 4 students, access your web browser and type in the following URL's:

http://www.sciam.com/explorations/07219/bacteria/mirsky.html
http://www.s-tcom?daily/06-97/06-10/97/b01ho046.htm

Locate the answers to the following questions. Cite your source as you answer the questions in complete sentences.

1. Name the compounds found in antibacterial products that kill the bacteria.

2. What is the risk of using antibacterial products?

3. 3. How do the antibacterial agents work to kill the bacteria?

4. List at least two reasons why antibacterial products should not be used everyday.

5. Describe the ecological relationships that exist among bacteria and between humans and bacteria.

6. What should people do to defend themselves against bacteria?

7. Describe the procedure for effectively washing your hands.

8. What additional risks have been associated with the chemical diethanolamine (DEA), a foaming agent found in some antibacterial products?

Thank You For Not Smoking Second
(Grades 6-8)

Table of Contents

Overview

Thanks to many strong educational programs, young people today are aware of the dangers of using tobacco products. However, smoking continues to be an issue. Young people may choose not to smoke but still be adversely affected by second hand, passive, or side stream smoke. This lesson will review the respiratory system and look at the air quality issues surrounding second hand smoke.

Back to Table of Contents

Technology Resources

Internet Sites:

The Environmental Causes of Cancer Survey
http://www.epa.gov/iaq/pubs/etsbro.html
This site defines and describes secondhand smoke. It describes particular risks to children from second hand smoke exposure and gives suggestions to reduce exposure

Environmental Tobacco Smoke (EMS)
http://www.cancer.org/tobacco/air.html
This site describes the effects of Environmental Tobacco Smoke (ETS).

Second Hand Smoke and Your Family
http://www.lungusa.org
This is another site that describes second hand smoke and sidestream smoke. It also describes the link between second hand smoke, cancer, and heart disease.

American Lung Association Fact Sheet
Second Hand Smoke and Children
http://www.lungusa.org
In addition to describing second hand smoke, this site also links effects of exposure to asthma. This site includes numbers of cases per year and links parental smoking to SIDS (Sudden Infant Death Syndrome).

Tobacco - facts about ... Second Hand Smoke
http://www.alaw.org
This site describes second hand and side stream smoke. It also describes the link between second hand smoke and cancer and heart disease.

Software Resources

- Bodyworks, The Learning Company, Inc. One Anthenaeum Street, Cambridge, MA 1-800-227-5609, http://www.learningco.com

  How Your Body Works, Mindscape, Inc. and Addison-Wesley Publishing Company, Inc. (415) 897-9900

Back to Table of Contents

Teacher Background Information

Public awareness has increased in recent years related to the harmful effects of smoking. Recent court decisions require the use of identification to purchase cigarettes. Fines paid to states by the tobacco companies are helping to fund tobacco use prevention and smoking cessation programs. Despite all of the information and negative publicity, adults and young people continue to smoke.

Less attention has been focused educationally on the effects of second hand smoke. For a young child or an older child who has decided not to smoke there are risks of respiratory problems just because they are around environmental tobacco smoke. In 1993, the Environmental Protection Agency (EPA) released a report estimating the risks associated with exposure to ETS. Since that time, numerous independent studies have confirmed the information in that EPA report.

Children are especially at risk from the second hand smoke because of the immaturity of their respiratory systems. Their situation may be compounded because they have less control of their environment than an adult. An adult who has chosen not to smoke can avoid places and situations where smoking will be taking place. A child raised by a smoker or riding in a motor vehicle with a smoker may not be able to avoid the exposure. Children and their adult caretakers need more education regarding the dangers of second hand smoke. Families need to learn how to lessen the effects on children if there is a smoker in the family. The non-smoking members of society need to continue their campaign to provide some free environments for all.

Back to Table of Contents

Learning Objectives

Students will be able to:

- **List** the parts of the respiratory system and **enumerate** on the function of each.
- **Relate** the structure of the respiratory system to the effects of tobacco smoke.
- **Cite** from the text describing the effects of second hand tobacco smoke.
- **Make a generalization about** the harmful effects of second hand tobacco smoke on children.

Back to Table of Contents

MSPAP/Core Learning Goals

(MSPAP vocabulary is highlighted within the learning objectives above.)

- **Goal 1: Skills & Processes, Science**: The student will use the instruments of science to collect, organize, interpret, calculate, and communicate information.
  Expectations 1,2,5 & 7
- **Goal 3: Concepts of Biology**
  The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) and major biological concepts that explain the uniqueness and interdependence of living organisms, their interactions with the environment, and the continuation of life on earth.
  Expectations 2, 5 & 6

Back to Table of Contents

Vocabulary

Carcinogen - A substance with the ability to cause cancer
Benzene - One of the known carcinogens found in tobacco smoke
Carbon monoxide - Colorless, odorless gas produced as a by product of tobacco smoke
second hand smoke - Mixture of the smoke given off by the burning end of a tobacco product and smoke exhaled from the lungs of the smoker
ETS - Environmental tobacco smoke; a name given to second hand smoke
Sidestream smoke - Another term used to name the smoke given off by the burning end of a tobacco product.

Back to Table of Contents

Equipment and Materials

Per class:

- Overhead transparencies of the respiratory system
- Overhead transparencies of the Activity Sheet
- Class computer and projection
- Web-page resource sheets or computer with Internet connection

Per student:

- "What Do You Know About Breathing?" Activity Sheet
- "There's Something in the Air" Activity Sheet
- Colored pencils
- Drinking straw or coffee stirrer

Back to Table of Contents

Procedures

Introductory Activity

As an introduction, have students complete the activity sheet, "What Do You Know About Breathing", to measure what they already know about the respiratory system and tobacco. Use the transparency of the respiratory system as the students score their own responses.

Student responses will help the teacher decide how much emphasis is necessary in the next activity. Instead of the pre-test, students could complete a K-W-L about the respiratory system and tobacco. The L portion can be completed as part of the assessment of learning at the end of the class.

Activity 1
Using educational computer software like ***Bodyworks*** or ***How Your Body Works,*** review the function of the respiratory system. If a computer linked projection system is available, project the images on the screen to allow students to better see the structure of the system as the functions are being discussed. Allow students to label a diagram of the system that they will be able to refer to as the lesson progresses. Using the colored pencils, have students shade the parts of the respiratory system affected by tobacco smoke.

Activity 2
Show the transparency "Components of Tobacco Smoke". Discuss with students that these chemicals are present in the air around the smoker and therefore in the second hand smoke from the burning cigarette and from the exhaled air of the smoker.

Activity 3
Distribute the drinking straws or coffee stirrers, one per student. Be sure you have not touched the end of the straw that will be placed in the students' mouths. Wrapped straws would be a good choice. Instruct students that they are going to place the straw in their mouths, close their nose by pinching the nostrils together, and breath exclusively through the straw for one minute. Add the warning that if they feel light-headed (dizzy), they should stop. If they already have respiratory problems they may want to watch the activity rather than participate in it.

After the one minute, discuss with students how they felt while they were breathing through the straw. Comments should describe the rather frightening sensation of not being able to get enough air. Tell students that what they experienced is similar to what breathing feels like if a person has a respiratory disease like asthma or emphysema.

Activity 4
Using at least one of the web sites, students will investigate the effects of these chemicals on the respiratory system. They should complete the handout "There's Something in the Air".

Activity 5 Students should work in pairs to develop an action plan related to the regulation of smoking in public places. As part of their action plan, they will write a position paper for or against the development and maintenance of public health regulations on smoking as it relates to second hand smoke.

Back to Table of Contents

Extensions

Language Arts
Have students write a letter to the local newspaper (or a FAX to a radio talk show host) describing the harmful effects of second hand smoke especially to children.

Mathematics

Have students conduct a survey in a place like a shopping mall or crowded public place where smoking is allowed. They could collect data related to the numbers of smokers they observe and the number of those smokers that were with children. A table of their data along with a written summary of their conclusions would complete their project.

Another survey could involve the collection of data from a mini mart or other store selling tobacco products. The students could count the number of packs or cartons or cigarettes sold in a given amount of time. They could then graph the data and write a conclusion about the patterns of smoking within their neighborhood.

Back to Table of Contents

Assessment/Evaluation

Have students construct a tri-fold pamphlet explaining why second hand smoke is harmful to children. The pamphlets could be submitted to the PTA and distributed at all parent meetings.

Have students make and display posters explaining how to avoid exposure to second hand smoke in their homes and in public places.

Back to Table of Contents

1999 EnviroHealth Link Master Teacher Team:
Janet Henke & Evelyn Walls

Worksheet #1
What do you Know About Breathing?

See how many of these questions you can answer correctly. Circle the ***T*** if you think the answer is true and circle the ***F*** if you think the answer is false.

T or F 1. Breathing rate decreases when you exercise.

T or F 2. When the diaphragm contracts, the lungs take in air.

T or F 3. The epiglottis keeps food from going down your windpipe.

T or F 4. Smokers are only damaging their own bodies.

T or F 5. The gas that you exhale is oxygen.

T or F 6. You can drink and breathe at the same time.

T or F 7. The effects of smoking are permanent.

T or F 8. Nicotine causes increased heart rate and blood pressure.

T or F 9. Bronchitis is an inflammation of the windpipe.

T or F 10. Emphysema damages the alveoli.

Worksheet #2
There's Something in the Air
Internet WebQuest Activity Sheet

Problem: How do the chemicals in tobacco smoke affect the bystander?

In groups of 2-4 access your web browser and type in the following URL's:

http://www.cancer.org
http://www.lungusa.org
http://www.nci.nih.gov
http://www.epa.gov
http://www.alaw.org

Locate the answers to the following questions. Be sure to cite the text to support each answer that you give.

1. Name at least five (5) components of tobacco smoke that have been proven to be harmful to humans.

2. Choose one to two of the substances listed in #1 and give specific information about the effects of that component. Try to find out what part of the respiratory system is most affected by it.

3. How is secondhand smoke hazardous?

4. What groups of people are most susceptible to the effects of secondhand smoke and why?

5. What is the link between a pregnant woman who smokes and her unborn baby? What about an infant living in a household where there is tobacco smoke?

6. What can be done in a home to lessen the effects of secondhand smoke?

7. Even if you choose never to use tobacco in any form, how can the smoking of others affect you?

Biological and Chemical Weapons...Around Here? Investigating the Threat of New Age Warfare to our Environment

(Grades 8-12)

Table of Contents

Overview

This lesson introduces students to a realistic view of biological and chemical weapons and their potential impact on our environment. There has been much discussion recently, from the release of Sarin Nerve Gas in Tokyo in 1995 to the Gulf War Syndrome, about the ramifications of this new type of terrorism. The questions always filter down to the root concern of such a disaster. What would we do if it happened in our backyard? This lesson affords students the opportunity to learn the facts about several different biological and chemical weapons and also to become aware of the potential human health risks present in their own environment.

Back to Table of Contents

Technology Resources

Internet Sites:

Chemical Demilitarization
http://www.hnd.usace.army.mil/chemde/stckdisp.htm

Tyler's World Chemical Warfare Page
http://sjha.sjusd.k12.ca.us/SJHA/pages/StdntProj/StuPgs96/Tyler%27sPages/chemwarfare/chemicalwarfare.html

CASCAD - NBC Protection
http://www.trillium.net/norenvironmental/sitemap.htm

Chemical Weapons Working Group
http://www.cwwg.org/cwwg.html

Countering the Anthrax Threat
http://www.anthrax.osd.mil/

A Look at History - The Plague
http://www.aeaintl.com/plague.htm

Zoonotic Diseases Facts About Plague
http://www.tdh.texas.gov/zoonosis/DISEASE/pamphlet/FACTSPLA.HTM

Plague
http://anatomy.adam.com/mhc/top/000596.htm

Facts About Plague from the Centers for Disease Control and Prevention
http://www.cdc.gov/od/oc/media/fact/plague.htm

National Necrotizing Fasciitis Foundation
http://www.nnff.org/

National Institute of Allergy and Infectious Diseases
http://www.niaid.nih.gov/factsheets/streped.htm

Software Resources

BodyScope
MECC Educational Software
http://www.mecc.com/

Multimedia Software Resources

HyperStudio
Roger Wagner Publishing, Inc.
http://www.hyperstudio.com

PowerPoint
Microsoft Office
http://www.microsoft.com/office/powerpoint/pptpricing.htm

Video Resources:

BodyScope
NOVA-Gulf War Syndrome "Battle Alert in the Gulf"
http://www.pbs.org

Digital Camera:

Take pictures of the students conducting research as well as during their presentations.

Back to Table of Contents

Teacher Background Information

Recently, there has been a growing concern about a new type of terrorism: terrorism that relies on inexpensive biological and chemical weapons. Nerve gas and mustard agents have been in the news from the events in the Tokyo subway in 1995 to the more recent Gulf War Syndrome. Because some of these weapons are so inexpensive to produce and so deadly, public awareness is growing.

These agents are sometimes called the "poor man's atomic bomb." It seems a bit extreme, but when you consider that a five pound bag of sugar represents the amount of Anthrax that could potentially kill everyone in our nation's capitol, the comparison is more than adequate. There are several factors and conditions that each biological or chemical weapon require in order for it to be most effective. For example, anthrax inhalation is deadly when taken into the lungs, hence the aerosol spray that creates small particles to travel deep into the lungs. On the other hand, the mustard agent or nerve gas that is most notable for its use in the Gulf War, is stored safely around the country including locally. We should be more concerned about the potential risks associated with the means of neutralizing and releasing it "safely" into our environment.

With the AIDS epidemic almost becoming accepted by the public, it appears that it is only the diseases with shock appeal that stir up the community. Such ailments include the flesh-eating bacteria streptococcus. There are many misconceptions associated with the potential hazards of such a virus. Streptococcus, or necrotizing fasciitis, is a flesh-eating bacteria that is a completely different strain of strep that causes the more common strep throat. Having strep throat is in no way going to develop into a flesh-eating illness.

One must be cautious when conducting research concerning this topic with students or on your own. The Internet has a tremendous amount of information, but not all of it is accurate. The suggested Internet sites have been carefully screened to assure that they contain accurate information. When you are conducting research on a topic with as much shock appeal, one should use text references to support the Internet resources.

Back to Table of Contents

Learning Objectives

Students will be able to:

- **Utilize** Internet resources effectively
- **Interpret** data to draw logical conclusions about the potential health risks of potential biological and chemical weapons in our area
- **Investigate** a given scenario involving a potential disaster
- **Identify** key facts by **referring back to the text**
- **Demonstrate** their understanding **citing** facts from their research
- **Create** a news report about their **investigation**

Back to Table of Contents

MSPAP/Core Learning Goals

(MSPAP vocabulary is highlighted within the learning objectives above.)

Goal 1: Skills and Processes: The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information.
Expectations 1, 2, 4, 5 & 7

- **Goal 3: Concepts of Biology:** The student will demonstrate the ability to use skills and processes and major biological concepts to explain the uniqueness and interdependence of living organisms, their interactions with the environment, and the continuation of life on Earth.
  Expectations 5 & 6
- **Goal 4: Concepts of Chemistry:** The student will demonstrate the ability to use scientific skills and processes to explain composition and interactions of matter in the world we live.
  Expectations 5 & 6

Back to Table of Contents

Vocabulary

Anthrax *Bacillus anthracis* - Inhaled spores germinate and release toxins, causing swelling in chest cavity; possible blood and brain infection.
Mustard Agent HD - Purified sulfur mustard has 5% sulfur impurity, a mild odor, but great blistering power. This type is stored at the Aberdeen Proving Ground.
Pneumonic Plague *Yersinia Pestis* - A natural flea-borne form causes bubonic plague.
Necrotizing Fasciitis *Streptococcus pyogenes* - A serious but rare streptococcal infection of the skin and subcutaneous tissues. (group A streptococcus)

Equipment and Materials

Per class:

- Computer with modem and Internet access
- Overhead projector
- VCR and monitor (optional)
- Apple presentation system (optional)

Per investigative team of 4:

- Information packets produced from the web sites above (for 8 groups, or access to Internet lab)
- "The Reporter's Lead Cards"
  - Topic One
  - Topic Two
  - Topic Three
  - Topic Four

Per student:

- "The Reporter's Reference"

Back to Table of Contents

Procedures

ACTIVITY 1:
Use a KWL or other brainstorming strategy to develop an idea of the students' prior knowledge of bio-chemical agents. Record the students' thoughts on large chart paper or a transparency to refer back to at the end of the student reports.

Show the first three minutes of the ***NOVA*** video as an additional motivator for the lesson. This segment shows the public reaction to a package that was said to contain Anthrax. It was a false alarm, but left many questioning the outcome if this or another similar situation were to occur as a reality.

ACTIVITY 2:
There are four different "Reporter's Lead Cards" designed to prompt unique investigations that require extensive research to gain a complete and accurate investigation. Distribute The "Reporter's Lead Cards" in a manner best suited for your students. I prefer a random selection.

Once each group has their "Reporter's Lead Card", distribute the handout titled "The Reporter's Reference." This handout contains questions and statements that students should use as a starting point for their report.

Answers and leads to possible information can and should be found in multiple sources always bearing in mind the source of the information.

ACTIVITY 3:
Guided Research Activity
Research stations can be developed in either a computer lab setting by bookmarking appropriate sites or in a classroom or library by creating Internet packets that contain the necessary information. Each student should concentrate on specific questions from the prompt and "The Reporter's Reference." If only a few computers are available to students, consider web-whacking or video taping the Internet. Allow a specific time for research during class. You may want to encourage students to use their own personal computers for further research under adult supervision.

ACTIVITY 4: After sufficient data has been researched and gathered by each group, each member of the group should begin to write a rough draft of the three-minute report. Each student should refer back to "The Reporter's Reference" to ensure a thorough report. Use a scoring tool for the report and go over the grading criteria before they begin.

Rough drafts should be reviewed by a peer and then discussed in each group. After all of the rough drafts have been read and discussed, the final three-minute report should be written. Each student should be assigned a role in the group. A writer, typist, editor, and reporter are fair and equitable responsibilities. Allow students to complete their final presentation in ***Power Point*** or ***HyperStudio***.

ACTIVITY 5: The oral presentation should be creative, with emphasis on the accuracy of the report. The ability to identify the source of the facts presented should be crucial element of this collaborative effort. Consider video taping or taking digital photos of students during their report.

Back to Table of Contents

Extensions

Field Trip
Columbus Center
COMB is an internationally recognized research laboratory devoted to the application of molecular biology and molecular genetics to marine organisms. COMB is committed to the advancement of research, education, and economic development. A variety of field trips are provided by The Columbus Center during the course of the school year related to biotechnology.
http://www.umbi.umd.edu/~comb/

Art
Have students create designs from photos of bacteria and toxins. They could create posters that would be set up if an area is to be quarantined. Students could use ***HyperStudio*** or ***HyperCard*** to create presentations that include pictures from web sites.

Language Arts/Social Studies
Have students conduct research to discuss the pros and cons on the use of bio-chemical warfare agents during wartime. Use various resources to investigate the historical impacts of bio-chemical agents and their outbreaks not necessarily influenced by man. Students could write letters or send e-mail to legislators inquiring about local action plans for such an occurrence. Legislators e-mail addresses can be found at the Maryland ***General Assembly Home Page*** http://mlis.state.md .us/. Students could write officials of Aberdeen Proving Ground about their disposal process. Have the students create a crisis plan if there was an outbreak.

Math
Have students use sequences and series or exponential growth/decay to describe the spread of these toxins throughout an environment.

Technology
Create ***Hypercard*** and/or multimedia presentations of other agents. All research could be posted on a school or classroom website following all county guidelines.

Back to Table of Contents

Assessment/Evaluation

Learning Logs

Students should be evaluated on several criteria. The evaluation should include an emphasis on the student's participation in the group activities as well as their role in the oral report. Individual accountability should be factored into this mini-unit. Create a scoring tool for the final product. Have students evaluate and critique each other's reports using a specific checklist or other scoring tool.

Back to Table of Contents

1999 Enviroheath Master Teacher Team:
Jeremy Carlino & Bill Barnes

Name _____
Group members _____
_____

The Reporter's Reference
Student Checklist for News Report

The presentation should take about three minutes to read and should include the following information. All of your answers should be text based.

- ☐ Identify who is currently infected and who is possibly infected?
- ☐ Identify what is causing the problem?
- ☐ Identify key facts about item of concern.
- ☐ Identify myths about the item of concern.
- ☐ Where is this situation occurring?
- ☐ From the data, think about when this contamination started.
- ☐ Identify possible reasons for how they became contaminated?
- ☐ Will it spread? How?
- ☐ Identify who is at risk of contamination?
- ☐ How is the public reacting?
- ☐ How should the public react?
- ☐ Is this filmed on location?
- ☐ What is the plan to contain the outbreak or spill?

The Report's Lead Card Topic One

Suppose you work for a local news station. The station has just received an anonymous tip that a terrorist group has just released Inhalation Anthrax at the main entrance of BWI Airport. Bacillus Anthracis, otherwise known as Anthrax, has been released at BWI Airport in the form of an aerosol spray.
You have notified the proper authorities and you must now cover the story. Write a news report about the situation at BWI Airport.

Before you begin to write, you may want to consider the known facts about Anthrax in this form. Think about who is at risk of contamination. You may want to think about how the public is reacting. Think about how the media should handle this emergency.

Now write a news story about the situation at BWI Airport.

Refer to "The Reporter's Reference" for a thorough report. After you have a thorough list of questions, use the bookmarked websites, Internet resource guide, or magazine article to write your report. All of your answers must be supported by some form of text that you are able to cite.

The Report's Lead Card Topic Two

Suppose you are a reporter for the Baltimore Sun. You have been assigned to cover the story about a child that has been contaminated after crossing into a secured area of the Aberdeen Proving Ground facility. Residing less than 100 yards from the site, he entered during a game of hide-and seek with friends. The boy was found within minutes of contamination. Write a news article telling the rest of the story.

Before you begin to write, you may want to consider the known facts about the agent that caused the contamination. Think about how much of this chemical and how long this chemical has been stored in this area. Think about the long term effects for others in this area. You may want to think about what is being done to eliminate this agent from this site.

Now write a news article telling the rest of the story.

Refer to "The Reporter's Reference" for a thorough report. After you have a thorough list of questions, use the bookmarked web sites, Internet resource guide, or magazine article to write your report. All of your answers must be supported by some form of text that you are able to cite.

The Report's Lead Card Topic Three

Suppose the editor for the City Paper printed an article that suggested that if city officials did not look into the city's rat problem around the Inner Harbor, a possible epidemic of Pneumonic Plague could break out. As a news reporter for ***The Baltimore Sun***, your editor has assigned you to write a fact-based article in in response to this recently printed editorial. Write a report to clarify the facts for the concerned citizens of Baltimore.

Before you begin to write, you may want to consider the history of this disease. You may want to think about how Pneumonic Plague occurs. Think about what actions can be taken to lower the risk of such an outbreak. Think about the likelihood of this actually occurring in our city.

Now write a fact-based article in response to the comments about Baltimore's rat problem.

Refer to "The Reporter's Reference" for a thorough report. After you have a thorough list of questions, use the bookmarked web sites, Internet resource guide, or magazine article to write your report. All of your answers must be supported by some form of text that you are able to cite.

The Report's Lead Card Topic Four

Suppose you work for a local news station. The station is working on a late-breaking story about Necrotizing Fasciitis, otherwise known as Flesh Eating Bacteria. A small child with the chicken pox seems to have contracted this bacterial infection. How this infection occurred is still a mystery. Many people that reside in the same area where this child lives have many questions about their own safety. Write a news report that will inform the public about the facts of this type of infection.

Before you begin to write, you may want to consider the known facts about Necrotizing Fasciitis. Consider the implications of becoming infected and who is at risk of infection. Think about the symptoms of this infection. You may want to think about how the public is reacting.

Now write a news report that will inform the public about the facts of this type of infection.

Refer to "The Reporter's Reference" for a thorough report. After you have a thorough list of questions, use the bookmarked web sites, Internet resource guide, or magazine article to write your report. All of your answers must be supported by some form of text that you are able to cite.

Cancer City, USA 10019
Investigating Cancer Clusters
(Grades 8-12)

Recognized for excellence by

Selected by Science Educators SCILINKS From NSTA

http://www.scilinks.org/criteria.htm

Table of Contents

Overview

In this lesson, the students will investigate a phenomenon known as the cancer cluster. As our population increases so does the incident rate of cancer, and it is projected to continue to rise to become the leading cause of death in the United States. With movies such as ***A Civil Action***, the public is becoming increasingly aware of the potential threat of cancer clusters. A cancer cluster is defined as the occurrence of a greater than expected number of cases of cancer within a group of people, a geographic area, or a period of time.

This lesson requires students to determine potential cancer clusters given real data and to support their findings using mathematical calculations. Is it a real cancer cluster or simply a result of chance?

Back to Table of Contents

Technology Resources

Internet Sites:

Program Manager for Chemical Demilitarization
http://www.pmcd.apgea.army.mil/graphical/

Maryland Department of Health & Mental Hygiene
http://mdpublichealth.org/
This site provides some basic statistics about cancer in Maryland.

National Cancer Institute
http://rex.nci.nih.gov/
This site provides facts about cancer clusters, causes, and research information.

The American Cancer Society
http://www.cancer.org

The CDC's Division of Cancer Prevention and Control
http://www.cdc.gov/cancer

The CDC's National Center for Health Statistics
http://www.cdc.gov/nchswww

The SEER Program
http://www-seer.ims.nci.nih.gov

Software Resources

BodyScope
MECC Educational Software
http://www.mecc.com/

Multimedia Software Resources

HyperStudio
Roger Wagner Publishing, Inc.
http://www.hyperstudio.com

PowerPoint
Microsoft Office
http://www.microsoft.com/office/powerpoint/

Graphing Calculator:
TI-83 Graphing Calculators

TI Calculators & Educational Solutions
http://www.ti.com/calc/docs/calchome.html

Teacher Background Information

Cancer is a common disease that, on average, strikes one out of every three people. It is the second leading cause of death in the United States. It is not unusual for several cases to occur within the same family or neighborhood. It is for this reason that suspected cancer clusters are viewed differently by the public than they are viewed by epidemiologists, the scientists who study suspected disease clusters.

A cancer cluster occurs when the number of cancer cases within a geographic area, a particular group of people, or a certain period of time is greater than expected. State/local health departments are responsible for conducting cancer cluster studies and are the agencies to which a suspected cluster should be reported. It is not uncommon for the initial evaluation of a suspected cluster to reveal that the number of cancer cases is not substantially different from the expected pattern in number, type, or age of the cases. More comprehensive evaluations are generally conducted when the state/local health department determines that the pattern of cancer cases is unusual or when the aggregation of cases is associated with a possible source of exposure (e.g., a hazardous waste site or contaminated groundwater).

It may be somewhat difficult to find data that is easy for students to use in its raw form. However, there are several articles, graphs, and charts, that contain data points that can interpolated and used to create a table that students can work with. Students should utilize the graphing calculator to interpret the real world data and make decisions about suspected cancer clusters.

Back to Table of Contents

Learning Objectives

Students will be able to:

- Utilize Internet resources effectively
- Utilize the graphing calculator as a problem solving tool
- **Analyze** data from a chart to draw logical and meaningful conclusions
- **Create** a graphical representation of the correlation of cancer to a given area
- **Interpret** data to draw logical conclusions about how the incidence of cancer is related to our environment

Back to Table of Contents

MSPAP/Core Learning Goals

(MSPAP vocabulary is highlighted within the learning objectives above.)

Goal 1: Skills and Processes: The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect,organize, interpret, calculate, and communicate information.
Expectations 1, 4, 5, 6, &7

- **Goal 3: Concepts of Biology:** The student will demonstrate the ability to use skills and processes and major biologicalconcepts to explain the uniqueness and interdependence of living organisms, their interactions with the environment, and the continuation of life on Earth.
  Expectations 5 & 6

Back to Table of Contents

Vocabulary

Cancer - is a term for diseases in which abnormal cells divide without control. Cancer cells can invade nearby tissues and can spread through the bloodstream and lymphatic system to other parts of the body.
Cancer Cluster - is the occurrence of a greater than expected number of cases of cancer within a group of people, a geographic area, or a period of time.
Epidemiologists - are the scientists who study the frequency and distribution of diseases in populations.
Incidence - The number of new cases diagnosed each year of a specific disease.

Back to Table of Contents

Equipment and Materials

Per class:

- Computer with modem and Internet access
- Overhead projector
- VCR and monitor (optional)
- Apple presentation system (optional)

Per student:

- "The Facts about Cancer" Activity Sheet
- "Cancer Cluster Investigation" Activity Sheet
- TI - 83 graphing calculator

Back to Table of Contents

Procedures

ACTIVITY 1:
Teachers should bookmark the suggested web sites on each student's computer. If a lab is not available, consider creating xeroxed Internet packets, "webwhacking" each site, or videotaping the sites. Have the students determine, using the Internet resources provided by the teacher, if the statements on "The Facts about Cancer" Activity Sheet are true or false .

ACTIVITY 2:
"Cancer Cluster Investigation" is a table that contains enough data to determine the mortality rate of breast cancer for women in each given state. The data was taken from several sources and has been worked into a usable form for the students. The table is based on actual data from the suggested web sites.

The students should determine the mortality rate for breast cancer for each state and record the rates in the chart. They should use the data to answer the questions below the chart.

ACTIVITY 3:
Students should write a letter to the Health Department of any particular state that they believe should be studied as a suspected cancer cluster or part of a regional cluster, based strictly on the incidence and mortality rates of breast cancer from the table. The letter should include a graphical representation of their findings as support.

Back to Table of Contents

Extensions

Field Trip/Student Service Learning
Teachers are encouraged to get students involved in providing services for cancer patients and their families. There are national and local organizations that always need help. Teachers should call to verify the eligibility of students for such community service. Call 1-800-4-CANCER for information on providing community services for patients and their families.

Art
Students could create and design pieces of art to be donated to a local hospice or cancer recovery center.

Language Arts/Social Studies
Students could write their letters to the State Health Department in the form of a writing prompt. Students could also write letters or send e-mail to legislators inquiring about local cancer rates by geographic location. Legislators e-mail addresses can be found at the Maryland ***General Assembly Home Page,*** http://mlis.state.md.us/.

Math
Students could use probability to create a simulation of the incidence of a specific cancer. The TI-83 calculator can be used to generate the data.

Technology:
Students could create a multimedia presentation for the Health Department using ***HyperStudio*** or ***PowerPoint***. Take pictures of students visiting the cancer patients and their families with the digital camera. Post student service learning projects on a school web site.

Assessment/Evaluation

Students should be evaluated on the successful completion of "The Facts about Cancer" Internet search and the "Cancer Cluster Investigation." Students that successfully complete this activity should come to the conclusion that states in the Northeastern United States have a higher mortality rate for breast cancer in women. This should be evident from the answers to the questions and should be clearly conveyed in writing to the Health Department of each appropriate state.

Furthermore, consider how students chose to represent the data as part of the evaluation. Create a scoring tool for the final product that you wish them to produce and share the scoring tool with them before they begin the assignment. Students should conduct a peer review of each other's letters using specific guidelines. Do ***not*** send these letters to the proper authorities unless the data is accurate and reliable.

Back to Table of Contents

1999 EnviroHealth Link Master Teacher Team: Jeremy Carlino & Bill Barnes

Name_____

The Facts about Cancer
Student Internet Search

Student Internet Search

Directions: Use the selected Web sites to determine if the following statements are **TRUE** or **FALSE**. Use the information from the web sites to support your choice.

Everyone that sunbathes will develop skin cancer.

What you eat can determine your risk of developing a certain type of cancer.

Cancer can be caused by an injury, if it is serious enough.

Cancer is more likely to occur in older people.

Where you live can determine your risk of developing a certain type of cancer.

Cancer is caused only by things in our environment.

Breast cancer can occur in men.

Farmers are more likely to die of cancer than other Americans.

Cancer is the second leading cause of death in America.

Cancer is a new disease that first began in the early 70's.

Cancer spreads by coughing.

Where you work can determine your risk of developing a certain type of cancer.

Name_____

Cancer Cluster Investigation

The following table shows the incidence and mortality rates of breast cancer in women for each state. Use the given data to calculate each rate per 100,000 people.

State	Estimated Deaths	Number of People	Breast Cancer Mortality Rate
California	**54,600**	**200,000**	
Colorado	**11,800**	**50,000**	
Maryland	**40,200**	**100,000**	
Massachusetts	**18,050**	**50,000**	
New Jersey	**38,700**	**100,000**	
New York	**83,800**	**200,000**	
Texas	**26,400**	**100,000**	
Utah	**2,130**	**10,000**	

Questions

1. What is the average mortality rate of all of the given states?

2. The national average of breast cancer mortality in the United States in 26.4% per 100,000 women. Which of the states in the chart are above the national average?

3. List the geographic similarities of the states with the higher averages.

4. Explain what mortality rate you would expect Connecticut to have based on this data.

5. Use a graphing calculator to create a meaningful graphical representation of this data. Create a sketch of the graph and describe what it represents.

Organic Mechanic, Part I
he Effects of Pesticides on Human Health
Grades 7-12)

Table of Contents

Overview

Organic farming seems to be more popular then ever. You can find items labeled in most major grocery stores and farmers markets with the word organic in their title. Stories about alar and other pesticides causing harm to human health come out in news- papers from time to time. We all have seen the "Chesapeake Drain" signs and have read about chemical runoff that ends up in our Bay or in the water supply. Other stories about chemical sensitivity have not only been in the news, but have also made their way into fictional TV shows and movies. But what are the health risks of farmers using pesticides and what risks are involved in growing foods that have chemical coverings sprayed on them? What benefits have we enjoyed from the use of pesticides and are those benefits outweighing the costs?

Part one of this lesson tries to introduce students to the basics of pest control information: What is the need for pest control, what crops are eaten in Maryland, what are current chemical and natural methods for pest control? All of these are addressed in part one of this unit. In part two students apply their knowledge in designing a garden and in exploring the other factors in play when we make daily dietary decisions. Students will compare the costs of organic food verses traditionally grown food by visiting stores and taking surveys. The overriding theme in Organic Mechanic is what effect does farming with chemicals vs. organic farming have on human health.

Activity Overviews

1. There's a coat on my food?!?
This activity allows students a chance to see that different substances may be covering the food they eat. Students work alone or in small teams for removal of different substances from an apple.

2. An Internet Apple A Day
This activity shows students more about the apple they used in activity one. Students use the Internet to see just how many pesticides they would encounter if they ate an apple a day.

3. What's the PEST in pesticides?
Here, students use the Internet, a background reading sheet and the ***Ultimate Human Body*** CD ROM to investigate pesticides, nutrition and their connection to human health. Students can be broken up into small groups to complete this activity or they can work independently.

4. Veg Head Vocabulary
Here students get the background vocabulary they will encounter during this lesson. All vocabulary words have been defined for you in the teacher background information.

5. EPA? What do they say? Finally students are asked read what the Environmental Protection Agency has to say on the subject of pesticides and children's health.

Back to Table of Contents

Technology Resources

Internet Sites:
Environmental Protection Agency
http://www.epa.gov.pesticides/food/
This site has a ton of information presented in an easily navigated format.

Ask Jeeves For Kids
http://www.ajkids.com
This is an Internet search engine designed to return links for young adults. You are able to type in questions and ***Ask Jeeves*** will return answers from its own database as well as "hits" from other search engines.

The Ortho Home Page
http://www.ortho.com
Ortho, the people who make all of the chemicals for your lawn care, have a very nice site with a lot of information.

The Monsanto Home Page
http://www.monsanto.com
This company makes many of the products that are used both by gardeners and commercial farmers. Along with chemical pesticides, they produce genetically engineered seeds. A huge site.

The Foodnews Web Site
http://www.foodnews.org
This site has some of the activities used in this lesson. The site allows students to see just how many pesticides they are being exposed to during their normal eating day. Along with student centered activities there is some really good information located here.

Infoseek
http://www.infoseek.com
One of the major Internet search engines.

Software Resources

BodyScope
MECC Educational Software
http://www.mecc.com/

Multimedia Software Resources

The Ultimate Human Body
By Dorling Kindersley Education
This software is a wonderful resource for exploring the human body. There are many of pictures, video and audio files on a range of topics. Available from DK Multimedia, 95 Madison Ave., New York City, NY 10016; (800) 356-6575; http://www.dk.com

Back to Table of Contents

Teacher Background Information

The use of chemical pesticides has been with us for long time. It wasn't until World War One and Two that they became widespread. In the mid-1940s DDT was developed. It wasn't until years later that this chemical was linked to major environmental problems.

Currently there are hundreds of different pesticides being used on food we eat every day. In the United States the department of Agriculture and the Environmental Protection Agency are responsible for making sure the pesticides are used by American farmers are safe. But just how this is determined and the health impact chemical pesticides have on people is of great controversy. Some people say that the levels we ingest are minimal and of no health risk. Others say that the problems of cancer, excess estrogen production (in women), headaches and a whole host of other medical problems can be traced to the pesticides and other chemicals we are fed. Look in any major grocery store and you can see that "Organic " food is more popular then ever. The high price, low availability and different "aesthetic" quality of organic food make it less attractive to many shoppers.

How much should we worry about what we eat? What is practical to try and do with our own diets? How do we get students to eat healthy things and get them to think about pesticides. This lesson tries to give students an introduction to both sides of the pesticide/organic issue.

Back to Table of Contents

Learning Objectives

Students will be able to:

- **List pros and cons** of using pesticides in farming and gardening.
- Conduct **research** using the Internet, computer software and printed material.
- **Analyze** research and information on pesticide use vs. organic pest management.
- **Define** related vocabulary.

Back to Table of Contents

MSPAP/Core Learning Goals

(MSPAP vocabulary is highlighted within the learning objectives above.)

- G**oal 1:** The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate and communicate information.
  Expectations 2, 3, 4, 5, 6, 7
- **Goal 3:** The student will demonstrate the ability to use scientific skills and processes and major biological concepts to explain the uniqueness and interdependence of living organisms, their interactions with the environment and the continuation of life on earth.
  Expectations 6

Back to Table of Contents

Vocabulary

Algicides: Controls algae in lakes, canals, swimming pools, water tanks, and other sites.
Antimicrobial: Kills microorganisms (such as bacteria and viruses).
Bio Accumulation: The accumulation of toxins ingested over a long period of time.
Beneficials: Insects that help farmers control "pests." An example of a beneficial might be the ladybug, a natural enemy of the aphid. Introducing beneficials can help reduce the amount of chemical pesticides needed.
Defoliants: Cause leaves or other foliage to drop from a plant, usually to facilitate harvest.
Fungicides: Kills fungi (including blights, mildews, molds, and rusts).
Fumigants: Produces gas or vapors intended to destroy pests in buildings or soil.
Herbicides: Kills weeds and other plants that grow where they are not wanted.
Insecticides: Kills insects and other Arthropods.
Miticides: (also called acaricides) Kill mites that feed on plants and animals.
Organic: A term that means that farming has been done without the use of chemical pesticides or chemical fertilizers.
Companion Planting: The practice of planting vegetables near each other that can assist each other to grow well and ward off pests.
Chemical Pesticide: A term describing a wide range of commercially available sprays that kill insects, fungi and other organic material in and around crops.

Back to Table of Contents

Equipment and Materials

- An Apple a Day Activity Sheet
- Student Background Information Sheet
- Student Background Reading Guide
- Veg Head Vocabulary Crossword
- Note cards
- Exploration of the Systems of the Human Body Activity Sheet
- Pesticide Internet Research Activity Sheet

Back to Table of Contents

Procedures

ACTIVITY 1:
There's a coat on my food?!?
This lesson is designed to introduce students to the fact that the foods we eat can be covered in things we might not want. Begin this lesson by asking students what are some healthy things to eat. List those on the board (or overhead). If students don't include fruits and vegetables, lead them there and have them give specific examples. Hold an apple (make sure that it is clean and wax coated - most non-organic apples have a thin layer of wax on them) and ask students if they think the apple is healthy. Have students offer things that an apple or similar item offers them. Ask students if they think apples might actually be bad for them and record ideas for how an apple might actually be unhealthy. With the edge of a sharp knife, gently scrape the wax covering from an area of the apple and show students that the apple has some hidden things that they might be ingesting along with the vitamins and minerals. Distribute the apples to the teams of students (no larger than 3 people in a team) and have them record the things they see on their apples. Distribute the paper towels and the small tubs of water to the tables. Ask students to start by just using the water to rise off the apple to see which of the "pesticides" they can remove. Have them record their findings. When students have completed this task, add a few (three or four) drops of soap to the water. Ask students to use the soapy water to see if they are able to remove more of the items that cover their apples. Finally, have students use the paper towels to rub the apples to see if they can get all of the pesticides off. Again, have students record their findings. Orally review with students what they found. Tell the students that they are about to embark on a unit called the Organic Mechanic. Tell them that they will be investigating what things are used to control pests and how those things affect the human body. If students want, allow them to eat the apples.

ACTIVITY 2:
An Internet Apple A Day
Have students sign on to http://www.foodnews.org and complete the Apple A Day activity. As a follow up to the first activity, this shows students just how many pesticides they will be getting into their bodies if they did eat an apple a day. This activity will familiarize the students with some of the names of the pesticides. For each trial, the students make on this interactive web activity, they will be presented with the following:
a) A list of the different pesticides they were exposed to
b) A way to click and find out more about the specific pesticides they were exposed to
c) A way to click and see what health effects the pesticides might have on humans
d) A graph showing how many days they were exposed to pesticides.

Distribute the Apple A Day Worksheet.

After students have completed this activity, bring them back together to share their findings. Each student will have different results. You should have students compare their results. You may also want to have students make a class list of pesticides and their health effects.

ACTIVITY 3: *What's the pest in pesticide?* This activity is designed to have students use the Internet, ***The Ultimate Human Body*** CD ROM software and the provided background information sheet to further their understanding of what current information exists on pesticides and their effect on human health.

For each activity students are being asked to complete an activity worksheet. These sheets will help students keep track of the information they collect. These sheets can also be used as assessments.

Choosing how to group students for this activity is up to you. If you have the resources (computers with CD ROM's and Internet connections), you might want to jigsaw students. To accomplish this, have students choose a partner. One member of each team will work on the Internet search while the other member of the team will complete the ADAM and Human Connection (background reading) worksheet. You can then bring the teams back together to share what they learned. If you would like to have every student complete both activities and you have the resources, make enough copies for each student.

Distribute the Internet worksheet *What's The Pest In Pesticide?* and ask students to complete it. Depending on how you choose to group your students, you may also distribute the *Pesticide Background* worksheet along with copies of the *Students Background Information* sheet. As students complete this worksheet, have them move to the computers and complete the Ultimate Human Body worksheet entitled *Exploration of the Systems of the Human Body*.

When students are done, bring them back together and ask them to discuss the information in their teams. If you had every student complete each activity, lead a class discussion. At the end of the discussion ask students to write a summary of the information they found. You might want students to use note cards (this information can be used as reference material to assist the final activity) as a method for summaries.

ACTIVITY 4:
Veg Head Vocabulary This activity is designed to help students review vocabulary. You have been provided with the vocabulary and this is a good time to review the basic terms with students. Some of the terms are common ones that students should have already come in contact with, while other terms will need to be explained further. When you think students are ready, distribute the crossword puzzle and have students complete this on their own. When students are done, review the terms and definitions as a whole class. Another possible use for this activity sheet is to assign it as a home assignment.

ACTIVITY 5:
EPA? What do they say?
Now that students have done some background research and sharing of information about pesticides and their effects on the human body, students need to understand why this issue is especially important to children. The Environmental Protection Agency has a wonderful Web site http://www.epa.gov/pesticides/food/ which has a number of pages students can use. The goal of this activity is to have students begin to gather information *they* think is important. You can complete this activity in one of three ways:

1. You may have students go on the Web and read the information on-line.
2. You may use Web-TV to present the information.
3. If you do not have web access for your class, you can download a PDF file and print it, or you can call 1-800-490-9198 and order free print copies of the brochure.

Whatever method you choose to present the information, distribute note cards to students. A template for the note cards has been provided. Tell students that they will have some time (I usually limit it to about 20 - 25 minutes) to explore and research on this site. Have students read the information presented and record what they think are the important points. Tell students that the note cards are going to be used at the completion of the second lesson. To use this as a graded assignment, give the students a minimum number of note cards they will need to complete. Also, you may want to break students into small teams. The Web site is broken down into the following categories: How the government regulates pesticides; What the pesticide residue limits are on food: Why children are especially sensitive to pesticides; What "integrated pest management" means; What "organically grown" means; Types of pesticides on foods; Health problems pesticides may pose; Healthy, sensible food practices. Each area of this site is relatively short, so student groups could be assigned more than one topic per person.

Back to Table of Contents

Extensions

Science
Have students complete a scientific investigation comparing plants grown with and without pesticides

Have a chemist from EPA or Department of Agriculture come in to speak with students about testing procedures

Have students create a time line showing the development of pesticides in the United States.

Math
Have students calculate the number of tons of pesticides used each year by different countries.

Social Studies
Have students create color coded maps showing countries that use different pesticides.

Have students write to the embassies of countries still using DDT and other pesticides that have been banned in the United States.

English
Have students write biographies of the people who worked and are currently working on pesticide issues.

Computer Science
Have students design Web pages showing and explaining their findings and thoughts on this issue. Have students create their own web searches that focus on one or more areas covered.

Economics
Have students investigate the costs of newer pesticides as they compare with those of older, sometimes banned pesticides. The older pesticides are still in use in many countries. Have students write a report on why this is and what the United States government might do (or is doing) to eliminate the use of banned pesticides. Remind them that we import fruits and vegetables from other countries.

Field Experience/Class Guest
Have students visit one of the many organic farms located in Maryland and Pennsylvania. One such farm can be located at http://www.ecofarms.com. Also, there is a farm in Southern Pennsylvania named Spoutwood Farms.

Have a farmer visit to discuss with the students the difficulties of being a farmer.

Back to Table of Contents

Assessment/Evaluation

There are many activities that have built-in assessments. All worksheets, and "searches" can be graded as class work. The crossword puzzle can be given as a home assignment.

At the end of lesson 2 students are asked to use their knowledge of pesticides and their related health risks as well as other information gathered to create a ***PowerPoint*** presentation. This presentation, along with an oral report can be graded.

Back to Table of Contents

1999 EnviroHealth Link Master Teacher Team: Doug Fireside & Felicity Ross

Name _____ Class _____ Date _____

An Apple a Day

We are going to be visiting a Web site where you will have a chance to learn about pesticides on apples. Start your Web browser and go to the site: http://www.foodnews.org Click on the *Apple A Day* link and then click on *How 'Bout Them Apples?*

1. How many pesticides were you exposed to? _____
2. Looking at the first chart of information when you scroll down, how many days were you exposed to the different numbers of pesticides. Record that information on the data chart:

Number of pesticides	Number of days out of the year	Percent of the year

a) On how many days were you exposed to 5 pesticides?

b) 8 pesticides?

c) Describe in your own words the information presented on the bar graph:

d)How many days did your apple have 1 pesticide?

e) How many did it have 10?

3. Now scroll down to the chart marked **You Are XX Number of Pesticides** and record the possible health effects of eating apples.

   _____
   _____
   _____

4. Choose one of those health problems and click on the small colored button next to it to learn more about the problem. Record a summary of your findings here:
   The health problem I choose to learn more about is:
   _____.
   Here are some details:
   _____
   _____
   _____
   _____

5. Now look at the chart *Your Detailed Results***.** Choose one of the pesticides and write a short description of it here:_____

Name _____ **Class** _____ **Date** _____

Pesticide Internet Research

Goal: This activity is designed to give you some background information on pesticides and the concerns that some people have about their use.

1. Let's begin by using Ask Jeeves to investigate what information we can locate about what pesticides are. Go to http://www.aj.com and type in the following: What are pesticides? and click ASK. When you get a response back, *Ask Jeeves* will have searched its own database along with other databases from other search engines. In its own response there are a list of garden pests on a drop down menu. List all of the possible pests that gardeners face:

   _____
   _____
   _____

2. Which search tool seems to give you the best response to your question?

   _____

3. Click on the choice from *Infoseek* Called *Hotline: What are pesticides*. According to this report, what is the current definition of a pesticide?

   _____
   _____
   _____

4. Describe in your own words how that definition is different from the dictionary definition?

   _____
   _____
   _____
   _____

5. Click in the address bar (or location bar) of your Web browser and type in http://www.foodnews.org. Press the return key and click the button marked *KIDS CORNER.* Scroll down. On the left side, click the links to answer the following:

   a. How can people reduce the number of pesticides they are exposed to?

      _____
      _____
      _____
      _____

   b. According to this site, what is wrong with the current regulation of pesticides by the EPA?

      _____
      _____
      _____

Well, if all of these chemicals are so bad, how many of them are you being exposed to? We can use this site to check. Click on the *Food News Home* button (or click the back button on your browser until you get to the *All You Can Eat* page). Let's go shopping to see how healthy you can be. Click on the EWG Supermarket link. Describe what this page can do:

_____

_____

_____

Now, let's select two foods from the breads, grains and pastas category: Click on the small boxes next to bagel and rice. But we can't live on just those foods! Now scroll down to the dairy category and choose butter, cream cheese and milk. So far, so good! Finally, scroll down to the meat and eggs category and select chicken, ground beef and a fried egg. That sounds like a balanced diet. Scroll down to the end of this page and click *Go to Checkout Line* so we can see how we did.

Record which food showed up the most on Your Detailed Results:

_____

How many pesticides were we exposed to? _____

Were there any foods we chose that didn't have any pesticides? _____ If so, which ones? _____

Can you think of a reason why those foods didn't have any pesticides?

_____

_____

_____

Click the back button and go shopping for yourself. Create a chart showing the foods and pesticides you purchased: _____

Student Background Information

We have all heard the saying, "You are what you eat." Well, for most of us, when we think of eating fresh fruits and vegetables, we think we are becoming healtheir because of what we're eating. while it is true that we need 6 to 10 servings of fresh fruits and veggies every day, what farmers use to protect those healthy things from pests is also going into our bodies. What we eat can have an effect on us both in the short and long term. Just what pestidcides do when ingested is not clear, but here are some common thoughts.

In a study published in the magazine *Science* in June of 1996, Tulane University researcher s took a look at how combining different pesticides can affect the human body. They found that even when looking at pesticides that were shown to be safe when tested on their own, combined with other pesticides (as might happen when you eat food treated by different farmers), the female body begins to produce more of the hormone estrogen. In some cases, there was a 500 to 1000 fold increase in estrogen production. An increased production of this naturally occurring hormone has been linked to increased risk of breast cancer.

Every day, you are exposed to thousands of germs. Yet a healthy body is able mount a defense against all but the most aggressive ones, thanks to your body's immune system. This natural defense system is on high alert 24 hours a day, 365 days a year, protecting you from your lab partner's sneeze (the common cold) to infection from that paper cut you got in Englihs class. But what happens when that defense system becomes weak? You are more susceptible to getting sick. Some research shows that exposure to pesticides can suppress your immune system. Pesticides and other environmental toxins are stored in your fat cells. Unless you are already eating organically grown food, you are probably being exposed to a fairly regular dose of pesticides.

Pesticide ingestion and exposure has also been linked to headaches, sinus infections, earaches and studies are looking at the connection to chronic fatigue.

With all of these health problems, you might wonder why farmers and gardeners use these pesticides at all. Well, most pesticides, when used properly, are very effective. Crop damage can be costly if pests like mites, beetles, and different types of fungi are not controlled. Along with those problems, farmers and gardeners must be on guard against weeds. Weeds rob the crop of light, moisture, and nutrients, resulting in lower yields that can be devastating for the farmer. weeds make harvesting difficult and contaminate the harvested crop with weed seeds, which means poor quality soy products. That's why almost all of the the world's soybean fields today are treated with herbicides. Imagine being able to purchase a few chemicals approved by the United States Department of Agriculture and Environmental Protection Agency as being safe to use for both human health and the environment. These chemicals can protect your crops. Coupled with chemical fertilizers, the yield can increase, allowing more people to be fed at a lower cost. Farmers have so many things to be concerned with during the growing season -- good weather, enough rain, late frost that can destroy certain crops, flooding -- being able to rely on chemical pesticides seems like a safe bet in a very unsafe but vital business. For smaller farms, growing foods without pesticides, fungicides, and other chemicals makes sense, but American farmers, and farmers around the world are relied upon to provide food for billions of people. Can we really trust that important job to anything besides trusted chemicals?

Name: _____ **Class:** _____ **Date:** _____

Student Background Reading Guide for Organic Mechanics

Directions: Read the *Student Background Information* sheet completely before responding to the following questions. Use what you already know along with the information on the *Student Background Information* sheet to record your responses:

1. What are some of the health risks associated with eating food treated with pesticides?

   _____
   _____
   _____
   _____

2. If individual pesticides are tested by the Federal Government and shown to be safe, why are people worried about pesticide use?

   _____
   _____
   _____

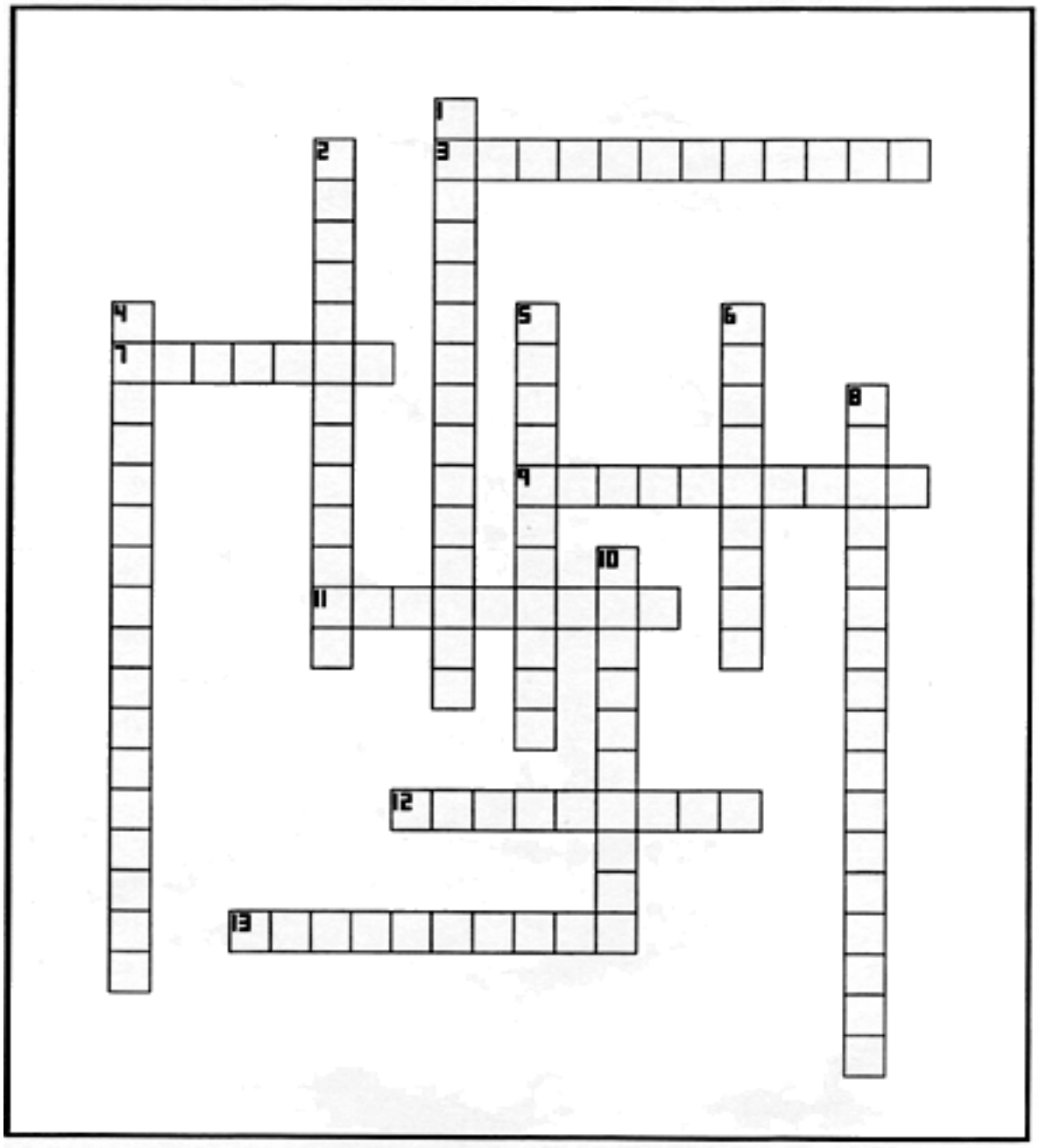
3. Give two reasons from the reading that supports why farmers are willing to use pesticides:

   _____
   _____
   _____

4. Based on what you read and already know about pesticides, if you were growing a vegetable garden, would you choose to use pesticides? Explain your answer:

   _____
   _____
   _____
   _____
   _____

Veg Head Vocabulary



Across

3. Kills insects and other Arthropods.
7. A term that means that farming has been done without the use of chemical pesticides or chemical fertilizers.
9. Kills fungi (including blights, mildews, molds, and rusts).
11. Controls algae in lakes, canals, swimming pools, water tanks, and other sites.
12. Produces gas or vapors intended to destroy pests in buildings or soil.
13. Kills weeds and other plants that grow where they are not wanted.

Down

1. The accumulation of toxins ingested over a long period of time.
2. Kills microorganisms (such as bacteria and viruses).
4. The practice of planting vegetables near each other so that they can assist each other to grow well and ward off pests.
5. Insects that help farmers control "pests."
6. Kills mites that feed on plants and animals.
8. A term describing a wide range of commercially available sprays that kill insects, fungi, and other organic material.
10. Cause leaves or other foliage to drop from a plant, usually to facilitate harvest.

Card #1 Source: _____

Fact I think is important: _____

_____

_____

Why I think it is important: _____

_____

_____

Where the information came from: _____

_____

_____

Card #1 Source: _____

Fact I think is important: _____

_____

_____

Why I think it is important: _____

_____

_____

Where the information came from: _____

_____

_____

Card #1 Source: _____

Fact I think is important: _____

_____

_____

Why I think it is important: _____

_____

_____

Where the information came from: _____

_____

_____

Card #1 Source: _____

Fact I think is important: _____

_____

_____

Why I think it is important: _____

_____

_____

Where the information came from: _____

_____

_____

Name: _____ **Date:** _____ **Class:** _____

Exploration of the Systems of the Human Body

Goal: By completing this activity you will gain a basic understanding of some of the systems of the human body. Different pesticides affect different systems in the body.

Directions: Start the CD ROM ***The Ultimate Human Body***. After the startup sequence, click on *The Body Machine* to investigate how food is broken down. Answer the following questions:

1. Along with the teeth which cut and grind food, what else happens to food when it is inside the mouth?
   _____

2. What part do **enzymes** play in this process?
   _____

3. **Click** on the salivary glands and describe the function of these organs:
   _____
   _____
   _____

4. Now click on the box in the upper left hand corner marked BODY SYSTEMS. When that menu comes up, choose the digestive system. Let's take a look at what happens when food enters the stomach. **Click** on the area where the stomach is located. What organs are in the upper abdomen?
   _____
   _____

5. Click on the stomach area and record what functions the stomach is responsible for:
   _____
   _____

6. Now let's see some of the systems affected by pesticides. One system that is affected is the nervous system. Click on the BODY SYSTEMS box and choose Nervous System. Click the box that says **FIND OUT MORE**. A pop-up menu will be on the screen. Choose **How the System Works**. Make a sketch of sensory receptors. Label the parts and click each part to find out how it works:

7. To see how nerve impulses work, click the small play button on the bottom of the screen.

8. Close the Pop-Up Menu by clicking on the small box next to where it says *FIND OUT MORE*. Click on *BODY SYSTEMS* and choose *Hormonal*. List the major organs in the Hormonal System. To see the organs in the lower portion of the system, click the small down arrow located on the left side of the screen.

   _____
   _____
   _____
   _____

9. What are the two hormonal glands in the brain? What is their function?

   _____
   _____
   _____

10. One other system that can be affected by the ingestion of pesticides is the immune system. Describe, from what you have already learned in science and health class, what the function of the immune system is:

    _____
    _____
    _____

11. The White Blood Cells are one of the main things that helps the human body fight off bacteria. To find information about Bacteria click on the AZ icon on the top of the page. Type in the word Bacteria and choose the first entry for bacteria. In the space provided, put into your own words what roll bacteria plays in the human body

    _____
    _____
    _____

12. Now click on the AZ and type in Bacteria again. This time choose the second entry listed for Bacteria to see and hear how antibodies work. Record that information here:

    _____
    _____
    _____

13. Pesticides also attack and can damage the reproductive system, affecting the production of hormones and can cause birth defects. Choose one of those to research using the ***Ultimate Human Body*** and record information below:

    _____
    _____
    _____
    _____

Organic Mechanic: Part II
Healthy Alternatives to Using Pesticides
(Grades 7-12)

Table of Contents

Overview

In **Organic Mechanic: Part I**, students investigated the link between human health and pesticides sprayed on produce. Students learned about a variety of pesticides, specifically why they are used and their effects on human health.

In **Organic Mechanic: Part II**, students will learn about healthy alternatives to using pesticides. For example, students will learn about companion planting, the use of biological controls, trapping and the use of barriers. Students will also learn about the economical ramifications of organic farming. Next, they will plan their own garden based on a garden scenario that their team is given. The unit will culminate with investigative teams making a presentation on the environmental, health, and economical pros and cons of pesticide use.

Back to Table of Contents

Technology Resources

Internet Sites:

SierraHome Gardening

http://www.sierra.com/sierrahome/gardening/

This Web site offers a plant encyclopedia, a gardening problem solver, a monthly gardening to-do list, and a gardener's message board.

Weekend Gardener

http://www.chestnut-sw.com/weekend.htm

This Web site provides information about growing flowers, vegetables and herbs. Information is provided about when and how to sow seeds, transplanting guidelines as well as the pests that affect them.

Garden.Com: Gardening for Today's World

http://www.ortho.com

This Web site features a monthly online gardening magazine, information about regional and community gardening, and free garden planning software.

Whole Foods

http://www.wholefoods.com/

Students can utilize this Web site to learn about one food chain's effort to make organic food more accessible. Students will learn about volume purchasing and the chain's efforts to keep a high level of food quality. Students may want to utilize this site when completing their final project.

Software Resources

PowerPoint

Microsoft Incorporated

This easy-to-use presentation software can be purchased at any any major software outlet.

Make It Grow

This garden design program can be accessed on http://www.shareware.com and can be used on Macintosh computers.

Additional Resources

Books

Vegetable Gardening For Dummies

by Charlie Nardozzi and the Editors of the National Gardening Association

A comprehensive easy-to-read gardening reference. The book includes charts and diagrams to plan a vegetable garden in almost any size space. Vegetable Gardening for Dummies also includes eco-friendly advice for ridding your garden of nasty pests.

Carrots Love Tomatoes: Secrets of Companion Planting for Successful Gardening

by Louise Riotte

This recently revised and updated planting companion provides information about how to use plants' natural partnerships to produce bigger and better harvests.

Teacher Background Information

Organic Mechanic: Part II, is the follow-up lesson to **Organic Mechanic: Part I**. In Part I, students investigated what is on the surface of an apple through the activity "An Apple a Day." Next, they researched the health effects of pesticides through an Internet search as well as through background reading, and the utilization of software. They also completed a crossword puzzle to reinforce vocabulary.

Back to Table of Contents

Learning Objectives

Students will be able to:

- **Identify** a variety of pests that affect produce.
- **Research** alternatives to pesticides in controlling pests.
- **Calculate** the area and perimeter of their plot of land in the garden project.
- **Utilize** scale in planning their garden.
- **Compare and contrast** the environmental, health and economical pros and cons of pesticide use.
- **Graph and compare** the costs of organic verses non-organic products.

Back to Table of Contents

MSPAP/Core Learning Goals

(MSPAP vocabulary is highlighted within the learning objectives above.)

- **Goal 1: Skills and Processes:** The student will demonstrate ways of thinking and acting inherit in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information.
  Expectations 1, 5 & 7
- **Goal 3: Concepts of Biology:** The student will demonstrate the ability to use scientific skills and processes to explain the physical behavior of the environment, earth and the universe.
  Expectation 5

Back to Table of Contents

Vocabulary

barriers: are physical blocks that keep pests away from plants.
biological controls: involves pitting one living thing against another, for example, releasing beneficial insects into a garden.
companion planting: planting a companion plant provides benefits to other plants growing nearby.
companion plant: is thought to repel pests.
crop rotation: planting crops in different beds from season to season.
home remedies: common household items used to control insects in the garden.
trapping- literally capturing pests that are causing damage to your crop.

Back to Table of Contents

Equipment and Materials

Per class:

- "Comparison Shopping Class Results" data chart
- Alternatives to Pesticides Information Sheets:
  - Barriers
  - Trapping
  - Companion Planting
  - Crop Rotation
  - Home Remedies
  - Biological Controls

Per investigative team of 3-5 students:

- 1 set of vegetable cards
- "What's Bugging You?" worksheet

Per student:

- "To Be or Not To Be Pesticide Free" worksheet
- Class Comparison: To Be or Not to Be
- Business Letter Writing Prompt
- Companion Plants Chart

Back to Table of Contents

Procedure

1. Students will begin their investigation for alternatives to pesticides by first taking a look at the pests themselves. Students will be divided into pairs. Each pair of students will receive a set of vegetable cards and the "What's Bugging You?" student worksheet. Students will use the Internet, ***Make It Grow*** garden planning software and books to research the pests that affect their assigned vegetable. They will draw a picture of the pest and describe how the pest is destructive.

2. Now that your students know which types of pests they are up against, it is their job to come up with a proposed solution. Six "Alternatives to Pesticides" stations will be set up around the room. Each station will have a different information sheet on the following six topics: Barriers, Biological Controls, Companion Planting, Crop Rotation, Home Remedies, and Trapping. Students will be given 5 minutes at each station to gather information. Each student in the pair should visit three stations and then share the information that they gathered with their partner. The students will want to take general notes for their final project and notes specific to the pest(s) they are working on. Together in pairs, students will write a proposal for how they will control the pests that may infest their crop.

3. The students have learned that pesticides are harmful to human health; yet, most produce bought is treated with pesticides. In the next activity, entitled "To be or not to be Pesticide Free," students will research the cost, appearance and availability of organic and non-organic produce. Students will next utilize the measures of central tendency by looking at the data collected by the whole class. The "Comparison Shopping Class Results" chart has been included for your convenience. This chart can be copied on the board or copied onto a transparency. From this information, students will find the mean, median, mode and range of the data. Using this data, students will create box and whisker plots of the organic and non-organic bill totals. Lastly, individually, students will utilize the class information to make a recommendation about whether or not they would buy organic food by writing a letter to the manager of the Giant Food Store. Their letters will chronicle their findings and make recommendations about which type of food to buy.

   Business Letter Writing Prompt Scoring Rubric
   3 points:

   - Student comments on the ease or difficulty of locating the produce.
   - Student comments on the appearance of the items.
   - Student compares and contrasts the prices of organic vs. non-organic produce.
   - Student makes recommendations on whether or not to buy organic and supports their recommendation with at least two details.

   2 points:

   - Student covers three of the four items listed above.

   1 point:

   - Student covers two of the four items listed above.

   0 points:

   - Student covers one or none of the four items listed above.

4. As a wrap up to the entire **Organic Mechanic: Parts I and II**, students in pairs or as individuals, will create presentations on the health and economical pros and cons of using pesticides. In the presentation, students will include examples of alternatives to pesticides. Students may use a variety of mediums for their final presentation. They should be encouraged to create a ***PowerPoint*** presentation, create a brochure, poster, or video.

Final Presentation Scoring Rubric

- *20 Points:* Visually Appealing
- *40 Points:* 3 or more pros of organic food (including at least one health pro)
- *40 Points:* 3 or more cons of organic food (including at least one economical con)

Back to Table of Contents

Extensions

Service Learning Project
Have students plan and plant an organic vegetable garden and donate the food to a local food bank.

Field Trip
Visit a local organic farm. Learn about what pesticide-free means are used to control pests on a large scale.

Speaker
Invite a local farmer into the classroom to discuss personal views on using pesticides verses utilizing alternative methods.

Social Studies
Students will research farming methods utilized in other countries. Students can also study the climate and soil conditions of other countries.

Language Arts
Have students write a persuasive letter to a local grocery store, urging them to carry more organic food items.

Mathematics
Have students calculate the costs of growing a garden from start to finish. Costs should include seeds, garden tools and any other items vital to sustaining a garden.

Art and Mathematics
Have students build a scale model of a garden.

Back to Table of Contents

Assessment/Evaluation

Organic Mechanic: Parts I and II offer several assessments throughout the activities. The "Pesticide Web Search" from **Organic Mechanic: Part I** provides a good assessment for how effectively the students utilize the Internet. The writing assessment is an excellent tool. A rubric for the letter has been included. The garden planning that takes place in the **Organic Mechanic: Part II**, is an excellent mathematics assessment that specifically measures the students' ability to use scale, area and perimeter. The final project, which is a presentation of the environmental, health and economical pros and cons of using pesticides, can be used to assess the acquisition of knowledge throughout the lessons.

Back to Table of Contents

1999 EnviroHealth Link Master Teacher Team:Felicity Ross and Doug Fireside

Vegetable Cards

Asparagus	**Carrots**	**Onions**
Snap Beans	**Cauliflower**	**Spinach**
Beets	**Collards**	**Peppers**
Broccoli	**Sweet Corn**	**Potatoes**
Brussel Sprouts	**Lettuce**	**Pumpkins**
Cabbage	**Okra**	**Tomatoes**

Name: _____

What's Bugging You?

You are just a beginner farmer and would like to do some research about some of the pests that you may encounter. You have just been given a **vegetable card** which tells you which vegetable you will be researching.

Write the name of your vegetable here: _____

Now, log on to http://www.chestnut-sw.com/weekend.htm the ***Weekend Gardener*** Web site.

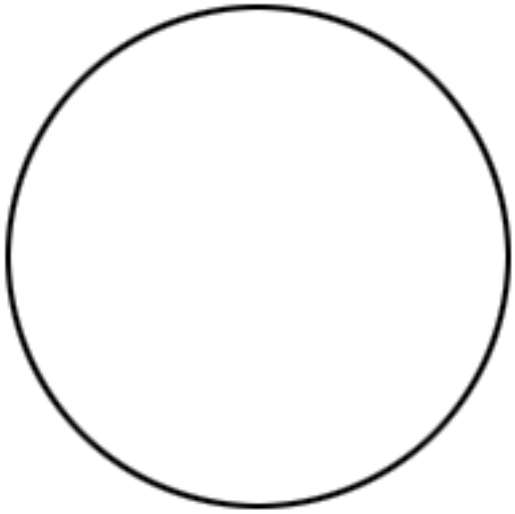
Next, click on **vegetable seeds**.

Click on your assigned vegetable. List the pests that can affect your vegetable in the box below.

Next, you will utilize a variety of resources to research one of the pests that afflicts your vegetable. Utilize one or more of the following options:

- ***Make It Grow 2.4*** - software. Look under the Pest file to find pictures of pest and descriptions.
- Go online to http://www.sierra.com/sierrahome/gardening/ . Click on **Ortho Problem Solver**. Submit your pest where it says pests and diseases.
- Use library books or information sheets provided by your teacher.

Draw a portrait of your pest:



Write a detailed description of your pest. Be sure to include how it negatively affects your vegetable.

Alternative to Pesticide Station: Barriers

Barriers keep pests form reaching your vegetables. For example, place a small copper strip around the outside or raised beds or containers to keep snails from reaching your plants; snails won't cross the copper stripping. If you are having problems with cutworms, push a small cardboard collar (a paper cup with the bottom pushed out works well) into the ground around seedlings to keep bugs from reaching the stems. A *floating row cover* is plastic or lightweight fabric covering that can protect your plants from insects.

Alternative to Pesticide Station: Trapping

Trapping pests before they reach your vegetables is another way to reduce pest problems. Trapping works best with night feeders - such as slugs and earwigs - that seek shelter during the day and that are attracted to dark, moist environments. You can trap snails and slugs under a slightly raised board at night, and then dispose of the board in the morning. Earwigs will collect in rolled-up newspapers.

Alternative to Pesticide Station:
Companion Planting

Companion planting involves utilizing plants that assist each other in growth, plants that repel insects and even plants that repel other plants.

Please utilize the list of companion plants located at this station.

Companion Plants Chart

Cool Season Vegetables

Plant	***Companion Plant***
Beets	Lettuce, Onions, Cabbage
Broccoli	Beets, Potatoes, Onions, Celery
Cabbage	Onions, Potatoes, Celery, Mint
Carrots	Peas, Lettuce, Chives, Radishes, Leeks, Onions
Cauliflower	Potatoes, Onions, Celery
Chard	Lettuce, Onions, Cabbage
Chinese Cabbage	Bush Beans, Marigolds, Onions, Sage
Kale	Late Cabbage, Potatoes, Sage, Marigolds, Onions, Nasturtiums
Kohlrabi	Beets, Cucumbers, Onions, Sage
Leeks	Carrots, Celery, Onions
Lettuce	Radishes, Strawberries, Cucumbers
Onions	Summer Savory, Camomile
Oriental Greens	Strawberries
Parsley	Tomatoes
Peas	Carrots, Turnips, Radishes, Cucumbers, Aromatic Herbs
Radishes	Redroot Pigweed, Nasturtiums, Mustards
Spinach	Strawberries
Turnips	Peas, Hairiy Vetch

Warm Season Vegetables

Plant	***Companion Plant***
Bush Beans	Cucumbers, Strawberries, Plant with Corn
Corn	Potatoes, Peas, Beans, Cucumbers, Pumpkins
Cucumber	Bush Beans, Pole Beans, Nasturtiums, Corn, Leeks, Onions, Peas, Radishes, Sunflowers
Eggplant	Redroot Pigweed, Green Beans
Melons	Morning Glory
Okra	Bell Peppers, Eggplant
Potatoes (early or late)	Bush Beans, Cabbage, Corn, Eggplant, Marigolds, Nasturtiums
Squash	Icicle Radishes, Nasturtiums
Sweet Pepper	Basil, Okra
Tomatillo	Basil
Tomatoes	Asparagus, Carrots, Celery, Chives, Garlic, Onions, Parsley

Alternative to Pesticide Station: Crop Rotation

If you plant the same vegetables in the same spot year after year, you are going to cause a number of problems, including these:

- Insects and diseases that spend part of their life cycle in the soil will build up there and be harder to control.
- Specific nutrients that the vegetables need will consistently be depleted and will be difficult to replace.

One way around these problems is to rotate your crops from season to season. In other words, plant them in different beds, as far away as possible from where they were planted before. Keep a journal of where your crops are planted from year to year and crop rotation should be easy and effective.

Alternative to Pesticide Station: Home Remedies

Many gardeners have had great success using common household products to control insects in their gardens. One home remedy is to add a clove or two of garlic and a few teaspoons cayenne to a quart of water, then blending it in a mixer. You then strain the solution to remove the chunks, and using a hand-held sprayer, spray your plants to control insects, such as aphids and whiteflies, and repel animals, such as rabbit and deer. Of course, after it rains, you have to reapply the mixture. Commercial products, such as Hot Pepper Wax and Garlic Barrier, which are based on the common foods, are also available. Either type of product is effective, simple, safe and fun to try.

Alternative to Pesticide Station: Biological Controls

Biological controls involve pitting one living thing against another. Releasing beneficial insects is one example of a biological control. Another use of bacteria, that while safe to humans, can make insects very ill and eventually dead. The most common and useful biological controls are forms of *Bacillus thuringiensis*, or Bt, which kill the larvae or moths and butterflies. Another Bt variety kills the larvae of moths and butterflies.

Please utilize the lists of good pests located at this station.

Biological Controls
Good Pests Chart

Good Pests	**How They Help**
Green Lacewigs	These beneficial insects are some of the most effective insects for garden use. Their voracious larvae feed on aphids, mites, thrips, and various insect eggs. Release them in your garden in late spring, after the danger of frost has passed.
Lady Beetles	Both the adults and the lizard-like larvae are especially good at feeding on small insects like aphids and mites. But releasing adults sometimes isn't very effective because they tend to migrate to another garden. You can try preconditioned ladybugs, which have been deprogrammed, so they're more likely to sick around in your garden.
Parasitic Nematodes	These microscopic worms parasitize many types of soil-dwelling and burrowing insects, including cutworms and grubs of Japanese beetles. Because grubs usually inhabit lawns, apply these worms there, too, as well as around the bases of your plants. Mix the nematodes with water, and spray them on the soil around the bases of your plants once it is spring.
Predatory Mites	These types of mites feed on spider mites and other small pests.
Trichogramma Wasps	These tiny wasps (which are harmless to humans) attack moth eggs and butterfly larvae (caterpillars).

To Be or Not Be Pesticide Free

Name: _____

You have learned that pesticides can be potentially very harmful to humans. Yet, most produce is grown with the use of pesticides and this is the food that most people buy everyday. Your job is to investigate why, if organic food is considered healthier, doesn't everybody buy it? This investigation will require you and your teammates to visit one or more grocery store. When choosing which grocery stores to visit, you will want to select a grocery store with a selection of organic produce.

Directions: You are going to visit one or more grocery store or a farmer's market to comparison shop. You are to investigate the cost of purchasing the items on the non-organic and the organic shopping lists. In addition to recording the cost of each item, you are to make observations about how each item looks, as well as how easy it is to find each item.

Non-Organic Grocery List

Non-Organic Shopping list	Cost	Appearance	Availability
Apples (1 pound)			
Tomatoes (1 pound)			
Strawberries (1 quart)			
Potatoes (1 pound)			
Total Cost			

Organic Grocery List

Organic Shopping List	Cost	Appearance	Availability
Apples (1 pound)			
Tomatoes (1 pound)			
Strawberries (1 quart)			
Potatoes (1 pound)			
Total cost			

Comparison Shopping Class Results

Student	Non-Organic Total	Organic Total
Total Cost		
Average Cost		

Name: _____

Class Comparison: To Be or Not To Be Pesticide Free

Given your class' data, find the mean, median, mode and range of each shopping list.

Non-Organic List (Bill Price):

Mean: _____ Median: _____

Mode: _____ Range: _____

Organic List (Bill Price):

Mean: _____ Median: _____

Mode: _____ Range: _____

Draw a box and whisker plot for each of the lists.

_____

_____

1. Compare the medians of each bill. Which median is higher?

_____

_____

2. Which of the bills has a larger range?

_____

Business Letter Writing Prompt

Now that you have studied the class data for the organic and non-organic shopping list, write a business letter to the manager of the Giant Food Store describing your findings. Be sure to include how easy or difficult it was to find each item. Be sure to comment on how the items looked. Also, be sure make comments about the price of the organic and non-organic food. Lastly, make a recommendation about which list you would buy. Be sure to support your recommendation from data collected and the class discussion.

Below is an example of the format you should follow. Write your letter on a separate piece of paper.

Your First and Last Name
Your address
City, State Zip
Month Day, Year (In Full)

Giant Food Manager's Name:
Address
City, State Zip

Dear _____:

Sincerely,

Pops Pops, Fizz Fizz, Oh What a Health Hazard It Is!
The Hazards of Persistent Organic Pollutants

(Grades 7-12)

Table of Contents

Overview

Persistent Organic Pollutants, or POPs, are toxic contaminants that are generally highly toxic in very small quantities. They often bioaccumulate and biomagnify in living organisms, including humans. Dioxin is the most toxic of the POPs and is never intentionally produced but is instead a byproduct of certain industrial processes involving chlorine, including drycleaning and the bleaching of paper. Dioxin has been associated with a wide range of human health problems including cancer, diabetes, infertility and learning disabilities.

The students will research what Persistent Organic Pollutants (POPs) are and the effects that they have on human health. The students will learn that Dioxin is the most toxic compound. They will learn how the pollutant moves from the environment into the food chain through a bioaccumulation simulation activity and will learn how it is passed up through the food chain through biomagnification.

Back to Table of Contents

Technology Resources

Internet Sites:

Dioxin Homepage

http://www.enviroweb.org/issues/dioxin/

This Web site explains what Dioxin is and where it comes from. It also explains how humans are exposed to Dioxin.

Green Peace USA

http://www.greenpeaceusa.org/

This Web site provides comprehensive information on a variety of environmental issues.

Archive of Postings to Dioxin-L

http://lists.essential.org/dioxin-l/

The Citizens Clearinghouse for Hazardous Waste is offering a listserv on the chemical dioxin. The purpose of the dioxin listserv is to distribute scientific information on dioxin, connect people who are working on dioxin, to alert people of events and activities that are scheduled around dioxin issues, and to provide a means for people to communicate on dioxin and get involved in CCHW's Stop Dioxin Exposure Campaign.

Environmental Defense Funds Chemical Scorecard

http://www.enn.com

Offers a good explanation of pollution scorecards on the net.

Ben and Jerry's: Vermont's Finest Ice Cream

http://www.benjerry.com/

This Web site provides information about what Ben and Jerry's ice cream company does in order to stay environmentally friendly.

Multimedia Resources

The Great Ocean Rescue
Tom Snyder Productions
80 Coolidge Hill Road
Watertown, MA 02172
(800) 342-0236
http://www.teachtsp.com This interactive classroom package includes a video-disc, printed material and software. This package is designed to engage students in learning about oceans and related topics in earth science.

Back to Table of Contents

Teacher Background Information

Persistent Organic Pollutants (POPs) are toxic contaminants that remain in the environment for a long time, often bioaccumulate and biomagnify in living organisms, and are generally highly toxic in very small quantities. POPs often travel long distances in the environment. They are distributed throughout the world and can be found in human and wildlife tissues at every latitude. Dioxin, a specific POP, is a shorthand term for a class of chemicals called polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans. These chemicals have never been intentionally produced on an industrial scale, but are generated as wastes and byproducts from combustion sources and certain chemical and industrial processes, including the production of bleached paper and in drycleaning. Dioxins are the most highly poisonous synthetic substance known. Dioxins are linked to cancer, endometriosis and other diseases; they can disrupt immune systems, reproductive systems and diminish intellectual capacity.

Bioaccumulation occurs because some contaminants do not readily pass through biological systems; rather they accumulate in the organism's fatty tissues. This makes the concentration of the contaminant inside the organism higher than outside the organism. As you move higher in the food chain, organisms on upper-levels bioaccumulate the collective contaminants from all their prey. This process is called biomagnification because the effect of bioaccumulation is magnified as you go up in the food chain. Organisms at the top have MANY times the contaminant concentration as those at the bottom.

Back to Table of Contents

Learning Objectives

Students will be able to:

- **List** a variety of health hazards that POPs, and specifically Dioxin, pose.
- **Simulate** bioaccumulation through a hands-on activity.
- **Calculate** the amount of exposure a gull would have to a harmful lipophilic pollutant in a food chain scenario.

Back to Table of Contents

MSPAP/Core Learning Goals

(MSPAP vocabulary is highlighted within the learning objectives above.)

Goal 1: Skills and Processes:
The students will demonstrate ways of thinking and acting inherit in the practice of science. The students will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information.
Expectations 2 & 5

- **Goal 3: Concepts of Biology:**
The students will demonstrate the ability to use scientific skills and processes to explain the physical behavior of the environment, earth and the universe.
Expectation 3
- **Goal 4: Concepts of Chemistry:**
The students will demonstrate the ability to use scientific skills and processes to explain composition and interactions of matter in the world in which we live.
Expectation 5

Vocabulary

Bioaccumulation - the increase in concentration of a pollutant from the environment to the first organism in a food chain.
Biomagnification - the increase in concentration of a pollutant from one link in a food chain to another
Dioxin - a shorthand term for a class of chemicals called polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans.
These chemicals have never been intentionally produced on an industrial scale, but are generated as wastes and byproducts from combustion sources and certain chemical and industrial processes. Dioxins are the most highly poisonous synthetic substances known. Dioxins are widespread in human milk and can cross the placenta; they are linked to cancer,
endometriosis and other diseases; and they can disrupt immune systems, reproductive systems and diminish intellectual capacity.
Lipophilic - literally means "fat-loving." A synthetic substance is lipophilic (attracted to fat) if it dissolves much more easily in lipids
than it does in water.
Persistent Organic Pollutants (POPs) - toxic contaminants that exhibit the following characteristics: they remain in the environment for a long time; they often bioaccumulate and biomagnify in living organisms, including humans; and they are generally highly toxic in very small quantities.

Back to Table of Contents

Equipment and Materials

Per class:

- overhead projector
- transparency of "Biomagnification" handout

Per investigative team of 3-5 students:

- Computer with modem and Internet access (or copied website resource booklet.)
- 1 shoe box labeled "Body of Water"
- 1 small baggy full of scrap paper circles from hole puncher - labeled "Water Soluble Toxin"
- 1 small rectangular magnet
- 1 small baggy full of metal shavings - labeled "Lipophilic Toxin"

Per student:
Xerox copies of following activity sheets:

- 1 copy of "What are POPs?" activity sheet
- 1 copy of "Bioaccumulation Simulation" activity sheet
- 1 copy of "Biomagnification" activity sheet

Back to Table of Contents

Procedure

Procedure

1. Pose the question to the group, "What are various forms of pollution?"

Possible responses: "Air pollution, solid waste pollution, water pollution."

Say, "Today we are going to discuss a class of pollutants known as POPs, and a specific pollutant called Dioxin. We will learn about what effects it has on human health and how it gets transferred through the food chain."

2. Students should be in groups of 3-5 students. Pass out the web search activity entitled "What are POPs?" and direct students to follow directions on the worksheet to research POPs.

3. As a class, the results of the web search will be discussed.

4. Pose the hypothetical question "Since Baltimore is not near a paper mill and we can choose to wear clothes that don't need to be drycleaned, why should we worry about dioxins?" Say, "That is what we are going to find out in the next activity." Pass out "Bioaccumlation Simulation" worksheet and the materials that go along with the activity.

On the chalkboard, write the following definition "Bioaccumulation is the increase in concentration of a pollutant from the environment to the first organism in a food chain."

Direct students to go through the activity procedure and complete the observations section.

5. Call on several student volunteers to share their observations. Pose the question, "Why do you think that the water soluble toxins did not stay with the zooplankton?"

Possible response: "The zooplankton were able to expel the toxins naturally."

Say, "What was the other toxin called?"

Possible Response: "Lipophilic"

Pose the question, "What do you think lipophilic means?" If students have trouble figuring out the meaning, break down the word into its parts, lipo and philic. Ask student what lipo means. Possible response "fat". Ask students what philic means. Possible responses "to love, the love of." If they have trouble figuring out what philic stands for give them some examples like "anglophilic means the love of England and bibliophilic means the love of books." Say, "Yes, the term lipophilic means the love of fats. Certain pollutants love fats and therefore get stored in the fat of the the animals that consume them which leads to bioaccumulation."

6. Say, "We have learned that bioaccumulation occurs when a pollutant passes from the environment to the first link in the food chain. Now, we will see what happens as the pollutant gets passed up the food chain."

Pass out the "Biomagnification" worksheet and place a transparency copy of it on the overhead. Write the following definition on the overhead for the students to copy on to their worksheet: "Biomagnification is the increase in concentration of a pollutant from one link in a food chain to another."

Discuss with the students what happens from one link to the next, that literally the amount of pollutant is being magnified as it goes up the food chain. Explain that each animal in the food link is ingesting accumulating pollutants from all of its prey; therefore, the higher up you are on the food chain, the higher the concentration of the pollutant.

Back to Table of Contents

Extensions

Science
Utilize ***The Great Ocean Rescue*** multimedia package by Tom Snyder Productions. Students will build a food web; watch the introductory movie entitled "The Food Web," in order to be provided with another illustration of how pollution can spread through the food web through the lesson "We are what we eat."

Environmental Studies
Log onto ***Ben and Jerry's*** Web site <http://www.benjerry.com/> to see how they are changing the packaging of their ice- cream to decrease the amount of dioxins being released into the environment.

Language Arts
Write a letter to the White House encouraging stronger regulations with regards to pollution and the environment. Students can e-mail the president at *president@whitehouse.gov* or mail a letter to 1600 Pennsylvania Avenue; Washington, DC 20500

Mathematics
Calculate the amount of toxin DDT that will be left after 100 years given that the half-life is 15 years.

Art and Technology
Design a poster or brochure alerting the public to the dangers of Persistent Organic Pollutants. This project could be a ***PowerPoint*** presentation or an electronic brochure.

Back to Table of Contents

Assessment/Evaluation

Evaluation and Assessment:

Any of the extensions would make meaningful assessment tools. Assessments are also built into the lesson through the "Dioxin Websearch," the "Bioaccumulation Simulation" and the "Biamagnification" worksheet.

Back to Table of Contents

1999 EnviroHealth Link Master Teacher Team:
Felicity Ross and Doug Fireside

Name_____ Class_____ Date_____

What are POP's?

No, I'm not talking about another way to say soda or a popular kids' cereal. Conduct the following Web search to learn about POPs and their effects.

Directions: Use your Internet browser to visit the following site: http://www.greenpeaceusa.org/toxics/ . Use the information on this page to answer the following questions.

1. What does the acronym POP stand for?

2. What are POPs?

3. How are POPs released into the environment?

4. What is the "most toxic compound known to science"?

5. What are two industrial sources that use chlorinated compounds?

Now, click on the link chlorine life cycle or type in the address http://www.greenpeaceusa.org/toxics/chlorinelifecycle.htm

1.

2.

3.

4.

5.

Name_____ Class_____ Date_____

Bioaccumulation Stimulation Activity Sheet

Bioaccumulation is

You are going to participate in an activity that simulates bioaccumulation between the environment and the first link of the food chain. The environment, in this case, is going to be a lake and the first link on the food chain will be zooplankton.

Materials needed per student group of 4-5

- 1 shoe box labeled "Body of Water"
- 1 small baggy full of scrap paper circles from hole puncher - labeled "Water Soluble Toxin"
- 1 small rectangular magnet
- 1 small baggy full of metal shavings - labeled "Lipophilic Toxin"

Procedure:

1. Obtain all materials above.
2. Dump the water-soluble toxin and the lipophilic toxin into the "Body of Water."
3. Take the magnet, which is representing zooplankton, and drag it across the bottom of the "lake" as if it were swimming for 30 seconds.
4. Take the zooplankton out of the water.
5. Write down your observations in the space provided below.

Observations:

Biomagnification

Biomagnification is _____

_____

So the gull has _____ x the amount of toxins than the water!

gull (4.8 x the amount of toxin of large fish)

large fish (1.7 x the amount of toxin of the small fish)

small fish (3.1 x amount of toxin of the zooplankton)

zooplankton (800 x the amount of toxin of the water

Smoking Without Choices to Secondhand Smoke and Children

(Grades 6-10)

Recognized for excellence by

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Table of Contents

Overview

You don't always see it or even smell it, but every time someone lights up a cigarette, cigar, or pipe, tobacco smoke containing more than 4,700 chemical compounds, including 200 known poisons, enter the air we inhale. Of these, at least 50 are known to cause cancer. This means that not only is the smoker inhaling harmful, irritating air, but sooner or later everyone around is forced to inhale the same cloud of smoke and become a passive smoker or involuntary smoker. Studies show that secondhand smoke (also called environmental tobacco smoke (ETS), which is a combination of exhaled smoke and the smoke from the burning end of a cigarette, cigar, or pipe) causes or exacerbates a wide range of adverse health effects, including cancer, respiratory infections, heart disease, and asthma.

Although smoking prevalence among the United States general population has declined over the past three decades, studies show that nonsmoking Americans continue without choice to be exposed to secondhand smoke or environmental tobacco smoke (ETS) which remains a major environmental and health issue. Secondhand smoke has an especially bad effect on infants and children whose parents smoke. Forty three percent of American children breathe in cigarette smoke from others' smoking at home and twenty four percent of children are exposed in the womb to their mothers' smoke. Parental smoking kills more young children than all other unintentional injuries combined.

Activities in this "hands-on" Internet-based lesson integrate health, biology, social studies, mathematics, art, reading, writing, and technology and can be adopted for use with students in middle and high school.

Activities are designed to develop and enhance students' MSPAP Outcomes and Core Learning Goals as they learn about the constituents of secondhand smoke and the dramatic health effects chemicals in secondhand smoke have on young children. As students explore the link between environmental tobacco smoke and lung development, they apply the steps of a scientific experiment, learn how to use point counting to collect and analyze data. Students are provided several types of extension and refining activities that provide opportunities for them to apply what they have learned about secondhand smoke.

Technology Resources

Internet Resources:

Teacher Sites:

Toxicology Problem Set
http://www.biology.arizona.edu/chh/problem_sets/toxicology/toxicology.html
Maintained by Southwest Environmental Health Service Center: The Biology Project. Provides excellent online interactive resource activities for biology and chemistry.

The Health Effects of Second-Hand Smoke: A Selection of Studies
http://www.cctc.ca/ncth/publicinfo/lists-B1.html
The National Clearinghouse on Tobacco and Health provides a bibliography of more than 75 current studies on the effects of secondhand smoke.

Secondhand Smoke Can Cause Lung Cancer in Nonsmokers
http://www.deq.state.la.us/oarp/rpd/2ndsmoke.htm
A good site for background information and list of free resource materials on secondhand smoke.

Student Sites:

Environmental Tobacco Smoke and Lung Development Activity
http://quetzal.blc.arizona.edu/chh/activities/tobacco_smoke/sign_in.html
The Southwest Environmental Health Science Center (The Biology Project) maintains this web site. Excellent site for biological and chemical class activities on environmental health science. Also contains links to lots of fun activities for kids involving games, brainteasers, and current hot topics on environmental health science.

Frequently Asked Questions - Second Hand Smoke
http://www.cctc.ca/ncth/publicinfo/faq-F2.html
The National Clearinghouse on Tobacco and Health maintains this site. Good site for acquiring background information, fact sheets, tables and charts, and bibliographies on secondhand smoke.

Second-Hand Smoke: What's In It?
http://www.cctc.ca/ncth/publicinfo/fact-A4.html
The National Clearinghouse also maintains this site. Site provides links to several publications and fact sheets about secondhand smoking.

Constituents of Tobacco Smoke
http://www.hcsc.gc.ca/hppb/tobaccoreduction/factsheets/inapuff.htm
Maintained by Health Canada's Health Promotion and Program Branch. Provides up-to-date resources on health services, programs, and issues.

How Smoking Affects Your Body
http://ourworld.compuserve.com/homepages/quitsmoking/kopykit/reports/body.htm
The Quit Smoking Company maintains this site. Provides background information and products available to quit smoking.

Children and Environmental Tobacco Smoke
http://www.cich.ca/htmle/ets.htm
The Canadian Institute of Child Health (CICH) maintains this site. Provides a wide range of background information on secondhand smoke and available software on ETS.

Videos:

Poisoning Our Children: The Perils of Secondhand Smoke
Produced by The American Academy of Otolaryngology Head and Neck Surgery Foundation. For a free secondhand smoke learning packet and video contact:

> The National Resource Center for Health and Safety in Child Care at:
> Phone: 1-800-598-KIDS
> or E-mail: Natl.child.res.ctr@UCHSC.edu

Back to Table of Contents

Teacher Background Information

Secondhand smoke, also called environmental tobacco smoke (ETS), is the smoke breathed out by smokers and the smoke from the burning end of a cigarette, cigar, or pipe. Exposure to secondhand smoke is called passive smoking or involuntary smoking. Secondhand smoke contains the same 200 poisons and chemicals found in the smoke that smokers inhale-such chemicals as formaldehyde, arsenic, cyanide, radioactive compounds, benzene, and carbon monoxide. In fact, the smoke that the smoker does not inhale may even contain higher amounts of these poisons. This is because the inhaled smoke is burned at a higher temperature that destroys some of the toxins, and its filter.

Secondhand or environmental tobacco smoke is classified by the Environmental Protection Agency (EPA) as a known cause of lung cancer in humans (Group A human carcinogen). The EPA estimates that secondhand smoke causes approximately 3,000 lung cancer deaths and 37,000-50,000 heart disease deaths in nonsmokers each year. Scientific studies show that continued exposure to secondhand smoke raises a non-smoker's risk of developing lung cancer by at least 50 percent and raises the risk of dying from heart disease by 30%.

Fetuses and young children are especially sensitive to secondhand smoke. The developing lungs of young children are affected by exposure to secondhand smoke. Infants and young children whose parents smoke are among the most seriously affected by exposure to secondhand smoke, being at increased risk of lower respiratory tract infections such as pneumonia and bronchitis. EPA estimates that passive smoking is responsible for between 150,000 and 300,000 lower respiratory tract infections in infants and children under 18 months of age annually, resulting in between 7,500 and 15,000 hospitalizations each year. Children exposed to secondhand smoke are more likely to have reduced lung function and symptoms of respiratory irritation like coughing, excess phlegm, and wheezing. Passive smoking can lead to buildup of fluid in the middle ear and "glue ear" which is the main cause of deafness in young children. Asthmatic children are especially at risk. It is estimated that between 200,000 and 1,000,000 asthmatic children have their condition made worse by exposure to secondhand smoke. Passive smoking may also cause thousands of non-asthmatic children to develop the condition each year. Studies on the effects of smoking on fetuses report an increase risk for still births, premature births, lower birth weight, increased fetal mortality, increased risk of sudden infant death syndrome (SIDS), long-term impairments in growth and intellectual development, and possible increase risk of getting cancer.

Back to Table of Contents

Learning Objectives

Students will be able to:

- **Write** a persuasive closing argument for a mock trial in which they **take a position** and make an attempt to **defend** their position with supporting facts.
- Use analyzed data from an on-line experiment to **evaluate** their hypothesis and **draw valid conclusions**.
- Collect and analyze data from an on-line computer experiment.
- **Determine the relationship** between exposure to environmental tobacco smoke and lung development.
- **Compare/contrast** an on-line experiment to a real-world experiment.
- **Calculate** the means for test groups using data obtained from an experiment.
- **Provide support** for conclusions using personal experience and information obtained from an on-line computer web site.
- **Write** an article that **reflects** knowledge gained on lung development and environmental tobacco smoke.
- **Justify** responses to critical thinking questions by **providing supporting data**.
- **Generate** a list of chemicals found in secondhand smoke and **describe** the effects of the chemicals on the body.
- **Identify** by **underlining** in chart substances found in environmental tobacco smoke that are known and possible human carcinogens.
- **Design** charts and graphic organizers to **display** data from a technical experiment and online computer references.
- **Rank in order** of most important to least important information learned from a technical report.
- **Describe** the adverse health effects of secondhand smoke on children.
- **Explain** why children are more vulnerable to secondhand smoke than adults.

Back to Table of Contents

MSPAP/Core Learning Goals

(MSPAP vocabulary is highlighted within the learning objectives above.)

- **Goal 1: Skills and Processes:** The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information.
  Expectations 1,2,3,4,5,6,7

- **Goal 2: Concepts of Biology:** The student will demonstrate the ability to use scientific skills and processes and major biological concepts to explain the uniqueness and interdependence of living organisms, their interactions with the environment, and the continuation of life on Earth.
  Expectation 2

- **Goal 4: Concept of Chemistry:** The student will demonstrate the ability to use scientific skills and processes to explain composition and interactions of matter in the world in which we live.
  Expectations 5

Back to Table of Contents

Vocabulary

Alveoli: cluster of tiny, thin-walled air sacs at the end of each bronchiole, where oxygen and carbon dioxide are exchanged.
Carcinogen: "known human carcinogens" are substances known to cause cancer in humans. "Possible human carcinogens" are substances suspected of causing cancer in humans.
Environmental tobacco smoke: (Also known as secondhand or passive smoking**)** smoke emitted from the burning end of a cigarette, pipe, cigar, and the smoke exhaled into the air from the lungs of smokers.
Exposure: researchers defined "exposure" to secondhand smoke as spending at least one hour a week near at least one smoker.
Impaired lung functioning: the inability of the lungs to exchange carbon dioxide for oxygen.
Mainstream smoke: smoke that is exhaled and then breathed out
Passive smoking:the breathing in of secondhand smoke.
Point counting: a technique for estimating three-dimensional structural data from two-dimensional data.
Secondhand smoke:smoke that goes directly into the air. A combination of mainstream and sidestream smoke.
Sepal tissue: tissue that forms new alveoli in the lungs.
Sidestream smoke: smoke coming from the burning end of a cigarette between puffs or while it is lying in an ashtray.

Equipment and Materials

Per class:

- VCR and Monitor
- Videotape:*Poisoning Our Children: The Perils of Secondhand Smoke*
- Transparencies of
    - Septal Tissue Point Counts on Lung Tissue (transparence can be made from the following source: ***Environmental Tobacco Smoke and Lung Development Activity*** (sample slide) located at the following web site: http://quetzal.blc.arizona.edu/chh/activities/tobacco_smoke/sign_in.html
    - Chart and diagram (similar to those located in ***Activity 3*** of Student Activity Sheet)
- Overhead Projector
- Chalkboard
- Automobile tailpipe
- Empty shoebox
- Battery
- Empty containers of:
    - Antifreeze
    - Ammonia
    - Butane cigarette lighter fluid
    - Paint stripper

Per investigative team of 2:

- Computer with modem or Internet access

Per student:

- Eye goggles
- Xerox copies of the following activity sheets and Internet web pages:
    - Activity 1-Student Handout:"The Perils of Secondhand Smoke"
    - Activity 2-Student Handout:"Environmental Tobacco Smoke and Lung Development-Lab Activity Sheet
    - Activity 3-Student Activity Sheet: "Inside Story of the Smoking Butt"
    - Activity 4- Student Activity Sheet:"Stretch Your Mind"
    - Web Diagram
    - Internet web page:Frequently Asked Questions-Second Hand Smoke
    - Internet web page:Second-Hand Smoke: What's In It?
    - Reflections Activity Sheet

Back to Table of Contents

Procedure

ACTIVITY 1: The Perils of Secondhand Smoke Video

Focus For Viewing The focus for viewing is a specific responsibility or task(s) students are responsible for during or after watching the video, to stimulate interest in the topic and provide background information on how children are affected by secondhand smoke or environmental tobacco smoke. To focus and engage students' viewing attention, point out to students the video they will be viewing will introduce them to secondhand smoke and how it affects the health of children. To give students a specific responsibility while viewing the video, tell students to see if they can find the answers to the questions on their activity sheet:"The Perils of Secondhand Smoke".

This 12-minute video provides a comprehensive look at the disturbing statistics on the harmful effects of secondhand smoke on children. Graphic animation is used to stimulate interest as students learn why they are extremely susceptible to secondhand smoke and how secondhand smoke damages developing organs. **Note:** Preview the video prior to classroom viewing.

1. Introduce this activity by having students write on a scrap piece of paper whether or not they smoke or have ever tried to smoke. Tell students not to write their names on the paper. Collect responses in a shoebox. Total the yes responses and write this data on the chalkboard.
2. Following the same procedure as indicated in step 1; have students indicate if they live in a house with anyone that smokes?
3. Use the data to calculate the percentage of students that responded with yes answers. Write this data on the chalkboard.
4. Have students comment on the significance of this number. (This represents the number of students in the class who are secondhand or passive smokers)
5. Discuss the meaning of secondhand or passive smoker. Discuss the meaning of secondhand smoke (environmental tobacco smoke ETS)
6. Have several volunteers share with the class what they already know about secondhand smoke.
7. Point out to class the purpose for viewing the video.
    - To learn about the importance of not being exposed to secondhand smoke
    - What is the name of the toxic substance you will use in this activity? What chemical does antiTo find out why young children are an increased risk to the harmful effects of secondhand smoke.
    - To learn how secondhand smoke damages the organs in the body.
8. Distribute student handouts for Activity1: "The Perils of Secondhand Smoke".
9. Have students read the entire handout before showing the video. Inform students they are to work with a partner to discuss and construct the answers for this activity.
10. BEGIN the video at the beginning of the tape.
11. PAUSE the video for a still picture in order to highlight a particular point, to allow students time to record information, analyze what they have seen, and/or predict an outcome.
12. END video at the end of the tape.

Post-Viewing Activity
Part 1

- Have teams discuss the answers to the summary items and record responses on the activity sheets.
- Conduct an oral discussion on student's recorded responses for Part 1

Follow-Through Activity
Part 2

- Set the stage for a mock trial in which the parents that appeared in the video are charged with child abuse for smoking around their daughter.
- Consider having students use the Internet to research the topic before starting the trial.
- Be creative in how you simulate the trial.
- Select students to role-play the following parts: Judge, state prosecutor, defending lawyer, jury members, witnesses (might include a doctor, staff member from school, home visitors, etc.), mother, father, daughter, and audience.
- Students playing the role of lawyers should read the closing arguments they wrote for Part 2 on their student activity sheet.
- You might have students write scripts for some of the other roles or some questions for the lawyers to present at the trial.
- As the arguments are presented, other students should record an error analysis of the presentations. Biased data that are misrepresented, the use of opinion instead of fact, etc. should be listed and shared with presenters at the conclusion of the trial.

ACTIVITY 2: "On-line Environmental Tabacco Smoke and Lung Development Experiment"
This on-line experiment is designed to give students an opportunity to collect and analyze scientific data from an experiment performed by scientists that illustrates the effects of environmental tobacco smoke on lung development of mice. Students learn the steps of a scientific experiment, how to use morphometry to collect three-dimensional data, and how to interpret their data.

This on-line experiment consists of five sections: Hypothesis, Methods, Data Collection, Results and Interpretation, and Conclusions. Students are required to enter their names and data into the computer. The web site will keep track of student's data and will not allow them to proceed to the next activity until the correct response is made.

Steps:

1. Depending on the prior knowledge of the students, a significant degree of discussion (instruction) may be necessary. To help students understand the concepts in this activity, you may want to focus on the following topics before starting this activity:
    - What does lung tissue look like under the microscope?
    - Point counting (A technique used to estimate components of three-dimensional structure from a two-dimensional slide). Use teacher-made transparency to explain this procedure.
    - How to measure sepal tissue volume
      Note: Consider making and using transparencies from the Introduction, Point counting sample slide, Data collection, Results/Interpretation, and Conclusion pages of this activity. Background information and transparencies will assist you with the discussion.
      Once students make the correct response for slide #1, the directions are very simple and easy to follow.
2. Students should work in teams of 2 (depending on the number of computers with modems available), however each student is responsible for recording his/her own data on their lab activity sheets.
3. Distribute xeroxed copy of Student Handout: "Environmental Tobacco Smoke and Lung Development Lab Activity Sheet" to each student.
4. Review procedures for completing the activity sheet.
5. Using the information from the Internet site indicated in step 6 below, instruct students to follow directions given at the web site and record the requested data in the appropriate spaces on their lab activity sheet.
6. To locate the experiment, have students visit the following Internet site:
    - Environmental Tobacco Smoke and Lung Development Activity
      http://quetzal.blc.arizona.edu/chh/activities/tobacco_smoke/sign_in.html
7. Use teacher judgement to determine whether or not you want your class to complete the title, purpose, and or hypothesis sections of this activity orally as a group before instructing teams to work on their own.
8. Remind students to use their mouse to click onto the next section in the activity.
9. After students complete the entire WebQuest and lab activity sheets, have a teacher-directed discussion on the information students recorded on their lab sheet.

Suggestions for additional discussion questions or home assignment

- What is septal tissue?
- What is the variable used in the experiment? Which group contained the variable?
- Why was it necessary to use a control group in this experiment?
- Why did the scientists use pregnant mice instead of mice as an experimental group?
- In your own words, what do the results of this experiment suggest about the effects of secondhand smoke on humans?
- If new septal tissue cannot form because of ETS damage, what will happen?

ACTIVITY 3: "The Inside Story of Secondhand Tabacco Smoke"

This activity will provide students the opportunity to explore some of the harmful substances found in secondhand smoke and learn how these chemicals affect the health of humans.

1. As a motivator, have the following *items indicated below on display for student viewing. Ask students the following questions: What do these items have in common? *Answer: Each contains or gives off a chemical substance found in cigarette smoke.* (**Note:** Try to use empty containers)
    - Antifreeze
    - Automobile tail pipe
    - Ammonia containe
    - Butane cigarette lighter fluid
    - Paint stripper
    - Battery

    *See the student handout, "Second-hand Smoke: What's In It?" for additional examples:
2. Ask students if the chemicals found in secondhand smoke are carcinogens? Discuss the meanings of known human carcinogens and possible human carcinogens.
3. Distribute copies of the student activity sheet called "Inside Story of the Smoking Butt".
4. Ask students what does the title of the activity suggest they will learn this activity.
5. Distribute to each student a xeroxed copy of the Internet web page called Frequently Asked Questions-Second Hand Smoke. Have students complete items Part A (items 1 and 2).
6. Distribute to each student a xeroxed copy of the Internet web page called Second-Hand Smoke: What's In It?
7. Have students read the information on the Internet web page and complete items 3 & 4 in Part A of the student activity sheet.
8. Students will use the Internet and work with a partner to complete Parts A & B of this activity.
9. Summarize lesson with an oral discussion on data students recorded on their activity sheets. Note: Use the chalkboard or overhead projector to display blank chart and diagram similar to those found on the Student Activity Sheet. Have student volunteers write their answers on the blank chart and diagram.

Activity 4: "Stretch Your Mind" This activity will give students an opportunity to reflect on their reading, use their prior knowledge, and communicate in writing their thoughts about children and environmental tobacco smoke. To help students put their ideas on paper, they must select one of several expressions to begin their writing task.

1. Distribute xerox copies of Student Activity Sheet: "Stretch Your Mind."
2. Have students read the introductory paragraph. Conduct an oral discussion on what vulnerable means.
3. Have students follow the directions on the activity sheet to complete tasks.
4. Summarize lesson by having several volunteers share with the class their writing tasks and list for task 2.

Extensions

Social Studies

- Research the Internet to find out if there has been any actual child abuse cases for secondhand or environmental tobacco smoke.

- Research in the library or the Internet to find out what legally constitutes a child abuse case. Based on what you find out, write a paragraph or two expressing why you think environmental tobacco smoking or secondhand smoking around children should or should not be classified as a form of child abuse.

Art

- Create comic strips that illustrates secondhand smoke and children
- Make a poster that illustrates the effects of secondhand smoke on children
- Create a collogue that illustrates the constituents of secondhand smoke

Community Health

- Elicit the help of parents, community association participants, teachers, or other adults to implement a Smoke-free environment for children campaign in your neighborhood. To obtain resources (computer diskettes ($4.77) and *Breathe Easy: A Community Resource to Reduce Exposure to Environmental Tobacco Smoke Packet*), contact Canadian Institute of Child Health (CICH) at (613) 224-4414, fax: (613) 224-4145 or e-mail: cich@igs.net
- Start a school-based tobacco education and media literacy program. Hooked on Hype: Tobacco Ad-diction teaches young people grades 6-10 through professional theater. Developed by the Growth and Prevention Theatre Company (G.A.P.), American Lung Association of Washington, Trial Lawyers for Public Justice Foundation and American Heart Association--Washington Affiliate, the program is implemented in schools by G.A.P. The program format consists of a 45-minute play, 45-minute discussion period and a Teacher's Guide for use in the classroom. For more information or to schedule a performance for your school, contact the G.A.P. Theatre Company, 305 Harrison St., Seattle, WA 98109.

Field Trips or Guest Speaker

Invite a speaker from your local health department, The American Lung Association (1-800-LUNG USA) or hospital speaker's bureau to speak to your class about environmental tobacco smoke.

Back to Table of Contents

Evaluation and Assessment

The assessment activity called "Reflections" can be used at the end of each activity in this lesson. It is a useful tool in assessing student's comprehension of the main concepts in the lesson, skills that need further development, planning further instructional and learning activities, determining areas requiring intervention, and student's self evaluation.

Back to Table of Contents

1999 EnviroHealth Link Master Teacher Team: Rosetta Jackson & Jennie Discepolo

The Perils of Secondhand Smoke

Part 1

Directions

1. Read over the items below so you will know what things to look for while viewing the video.
2. Your teacher will pause the video to allow time for discussion and note taking. Take notes on a clean sheet of paper.
3. Before recording your answers to the summary questions below, make sure you discuss the answers with your partner.
4. Use the information from this summary scorecard to lead you directly to more information about toxic chemicals.

SUMMARY QUESTIONS

1. While walking down the street, you pass a house that is on fire and releasing a huge cloud of smoke, which you smell. Use what you have learned and know to explain why this would or would not be considered as secondhand smoke.

2. Does secondhand smoke actually kill people? Give data to support your answer.

3. The statement was made that 70% of American children are passive smokers. Write a brief response to this statement. Make sure you provide supporting facts to justify your response.

4. Why would a child 6 months old whose parents smoke be more seriously affected by secondhand smoke than a person 18 years old?

5. All of the people listed below live in the same house with someone who smokes. Who is most likely to experience toxic effects from the secondhand smoke? Make sure you justify your answer.
    - The grandmother, who is very fit
    - The mother, who smokes
    - The father, who smokes
    - The teenage daughter, who has asthma
    - The son, who is in 4th grade

    Answer:

6. Explain why children exposed to secondhand smoke are likely to have ear infections? What are some health problems ear infections can cause?

7. Compile a list of health problems children exposed to secondhand smoke are likely to develop.

8. What do the items in the list below have in common?

Benzene	Carbon monoxide
Lead	Vinyl Chloride
Ammonia	Cadmium
Nicotine	Arsenic
Formaldehyde	Cyanide

    Answer:

9. Mrs. Taylor, who does not smoke or allow smoking in her car, just purchased a car that was previously owned by a smoker. Every time Mrs. Taylor's 3-year-old asthmatic son rides in the car, he starts wheezing and coughing. Mrs. Taylor is very puzzled about what is triggering her son's attacks. Use the space below and on the back of this page to write a brief note to Mrs. Taylor explaining what you think is causing her son's problem and what she should do.

The Trial

Part 2

Scenarios

Team member #1 Pretend you are a lawyer who was hired to represent the state, which has charged the parents in the video with child abuse for smoking around their daughter. The trial is just about to wrap up and you must prepare your closing argument to present to the jury.

Team member #2 Pretend you are the defending lawyer representing the parents who have been charged with child abuse for smoking around their daughter. The trail does not seem to be going in your favor. You do not believe secondhand smoke has any grounds for the charge of child abuse. Your last chance to clear the parents of the charge of child abuse is by presenting to the jury a very convincing closing argument.

Directions: Decide on which of the above scenarios you and your partner will respond to.
Use the space below to write your closing argument. Make sure your closing argument contains enough data to support your position and persuade the jury the parents **are** or **are not** guilty of child abuse.

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Environmental Tabacco Smoke and Lung Development

Lab Activity Sheet

Directions

1. Use your Internet browser to locate the on-line experiment at the following web site: http://quetzal.blc.arizona.edu/chh/activities/tobacco_smoke/sign_in.html
2. Read and follow all the directions given at the web site.
3. Record all the data you collect on this on-line experiment in the appropriate spaces provided.
4. To get started: Type your first name in the box located at the bottom of the Introduction web page, then use your mouse to click on the box.

I. **Title of Lab** _____

II. **Purpose:** To _____

III. **Hypothesis** _____

IV. **Methods/Procedures**

Experimental Group	Control Group
_____	_____
Brief description of experimental group	Brief description of control group
1.	
2.	
3.	
4.	
5.	

V. Results/Data

Step 1

Use the space below to **design a data table** to accurately **display** the data you collected for each slide. Make sure your data table is well **organized** and **contains an appropriate title** and **headings**.

Step 2
Calculate the mean for each group. Enter your answers on the lines below:

Mean_____(Experimental group) **Mean**_____(Control group)

Interpretation Now that you have collected your data, you need to determine what it means. You are given three possible interpretations of the data you collected. SELECT the interpretation you think is BEST and write it on the lines below:

_____
_____
_____
_____
_____

Conclusion Write your own conclusion for this experiment. Use the back of this lab sheet to write your conclusion.

Before you begin, **think about**:

- The problem that was investigated
- The hypothesis that was made
- The final results and the interpretation

Summary Questions

1. Explain how this on-line experiment differs from an experiment scientists would perform in a real-world experiment.

2. Look at your hypothesis again. Do your results support the hypothesis? Write a statement that shows your data is is not consistent with the hypothesis.

Application to Humans

3. Explain how environmental tobacco smoke (ETS) may cause changes in the lung structure.

4. What happens if new septal tissues cannot form because of secondhand smoke (ETS)?

5. If the lungs have less surface area, would the rate of gas exchange be affected? Explain why?

Reflection

6. **Write** four or more sentences that **reflect** what you learned from this on-line experiment.

Name _____ Class _____ Date _____

Student Activity Sheet

Inside Story of the Smoking Butt



Unfortunately, even if you don't smoke, you can still get sick from tobacco smoke. Only 15% of smoke from a cigarette is inhaled by the smoker. The other 85% goes directly into the air and is known as secondhand smoke, also called environmental tobacco smoke (ETS). If you breathe the smoke from another person's cigarette, the effects of the secondhand smoke are just as bad as if you were smoking. Because organic material in tobacco doesn't burn completely, cigarette smoke contains more than 4,700 chemical compounds that kill and harm thousands of adults and children each year. Startling statistics show that 50 to 67% of children under five years of age live in homes with at least one adult smoker. Children who are exposed to secondhand smoke all their lives are two to four times more likely to develop health problems than children of non-smokers.

The following activities will give you a chance to get an **inside look** at some of the harmful substances in secondhand smoke, what they are used for, and tour the body to see how it is affected by the chemicals in secondhand smoke.

PART A

Make sure you get a copy of the Internet web page called "Frequently Asked Questions-SECOND HAND SMOKE".

1. On your copy of the Internet web page, use your highlighter to show which chemicals are known to cause cancer and which chemicals are suspected of causing cancer in humans.

2. The list below shows a few of the daily uses of the chemicals found in secondhand smoke. Try predicting which chemicals listed on your Internet web page are used for each of the items listed in the box below. Write your answers on your Internet web page.

Preserves dead animals	Used to keep dogs away
Used in batteries	Used to clean toilets
Metal used to kill plants	Used in warfare

3. To find out how accurate your predictions were, your teacher will give you another Internet web page called "SECOND-HAND SMOKE - "What's In It?" Read over this Internet web page to determine how many correct responses you made. Record your answer on the line below:

   Number of correct responses:_____

4. What are some other chemical substances found in secondhand smoke that are not listed on the Chemical Substances Chart called "Frequently Asked Questions-Second Hand Smoke"? Write your answers on the Chemical Substance Chart.

Part B

Now that you had a chance to look at some of the harmful chemicals inside secondhand smoke, lets find out where these chemicals come from and how they affect your body.

1. Use your Internet browser to visit the following web site:

   Constituents of Tobacco Smoke
   http://www.hc-sc.gc.ca/hppb/tobaccoreduction/factsheets/inapuff.htm

2. Use the information from this web site to find out where the chemicals in smoke come from. Record your answers in the boxes below and write an appropriate title for the diagram.

Title: _____

- Secondhand smoke emits solid, liquid, and gas particles, which come from many different sources and affect the body in many different ways. Using the information from the web site, complete the chart below. Make sure you write an appropriate title for the chart.

Title: _____

Chemicals	Physical State	Sources(s)	Effects on the Body
Carbon monoxide			
Tar			
Amonia			
Hydrogen Cyanide			
Lead			

Part C

There's hardly a part of the human body that is not affected by the **chemicals** in secondhand smoke-which is sometimes called environmental tobacco smoke (ETS). The chemical substances in secondhand smoke cause cancer and many different kinds of health problems in humans. Take the chemical nicotine (a very strong poison in the tobacco plant), nicotine can kill a human in less than an hour if even a small amount is injected into the bloodstream. Let's take a tour of your body to get an inside look at how smoking affects it.

Materials Needed

- Ditto copy of Web Diagram

1. Working with a partner, use your browser to visit the following web site:

   How Smoking Affects Your Body
   http://ourworld.compuserve.com/homepages/quitsmoking/kopykit/reports/body.htm

2. As you read the information on the web page, think of a good way you can organize the information into your Web Diagram. Discuss your plans with your partner.

3. After you and your partner have agreed on the best way to organize the information from the Internet web page, complete your Web Diagram.

Name _____ Class _____ Date _____

Student Activity Sheet

Stretch Your Mind

Very often when adults smoke around children, they forget that children are more vulnerable to environmental tobacco smoke than adults and all the harmful ways smoke affect children. The following activities will help you learn more about children and environmental tobacco smoke and why children are more vulnerable to environmental tobacco smoke than adults.

- Use your Internet browser to visit the following web site:

  Children and Environmental Tobacco Smoke
  http://www.cich.ca/htmle/ets.htm

- After you finish reading the information on the web page, complete the following tasks:

Task One

1. Write two or more paragraphs **reflecting** on what you learned from reading the Internet web page. Make sure your writing task has an appropriate title. Before you start writing, think about:
   - Children exposed to environmental tobacco smoke
   - Why children are more vulnerable to ETS than adults?
   - The effects of ETS on children

   Select one of the expressions below to help you put your ides on paper

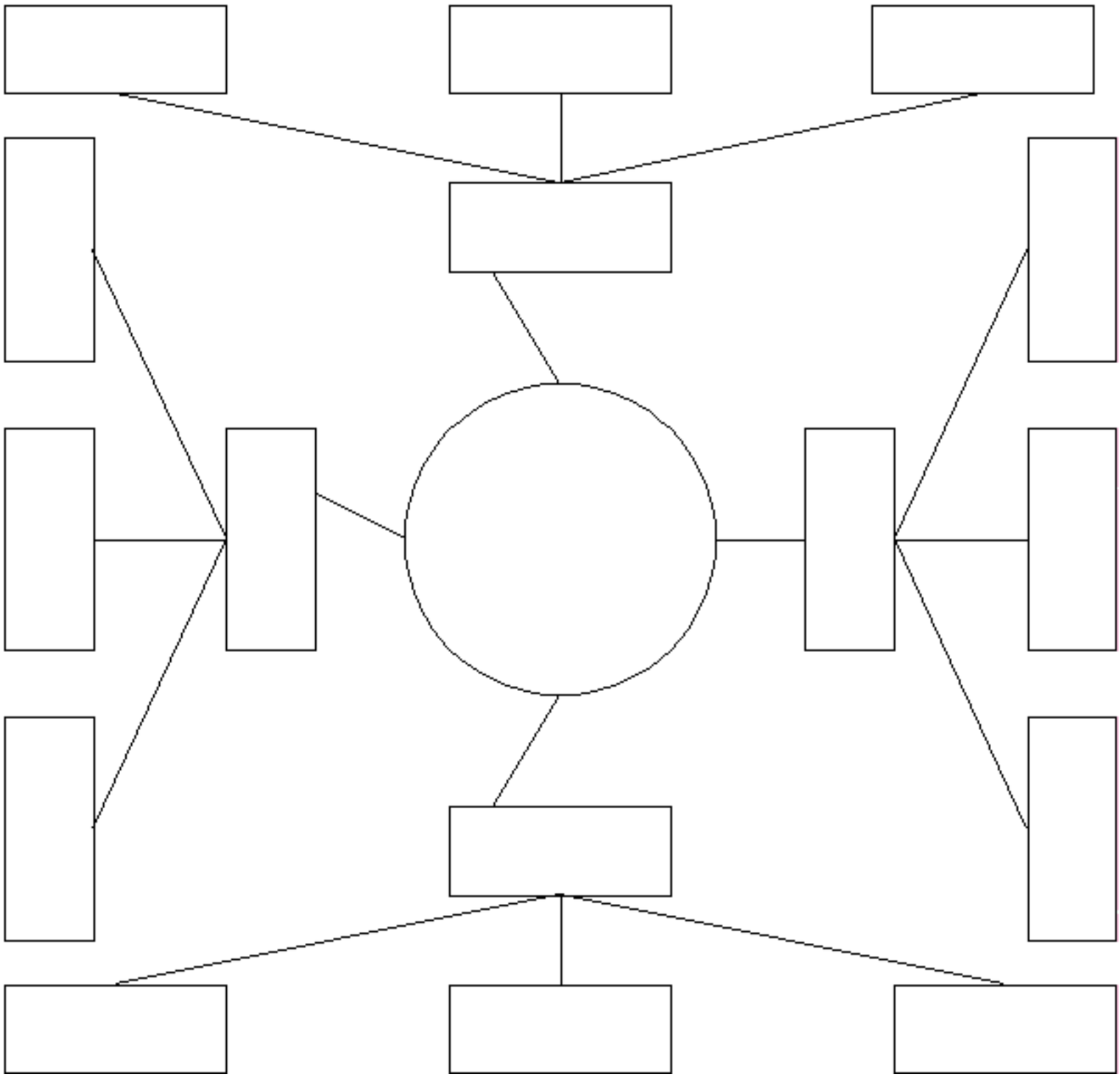
   - It seems important that...
   - One criticism I have is...
   - I'm concerned about...
   - I hate...
2. Use your notebook paper to complete your writing task.

Task 2

1. Choose the seven most important facts you learned from reading the Internet web page called "Children and Environmental Smoke."
2. Rank them from most interesting to least, giving reasons for your first and last choices.

Name _____ **Class** _____ **Date** _____

Web Diagram



Name _____ Class _____ Date _____

Reflections

Today's Topic: _____

1. From working on today's activities, I learned

_____
_____
_____
_____

2. I would like to learn more about

_____
_____
_____

3. Things I did well on this activity are:

_____
_____
_____
_____

4. Questions(s) I still have:

_____
_____
_____

5. Ways I can apply what I learned to the real world:

_____
_____
_____

6. If I were to give myself a grade on this activity, it would be a(n) _____ because:

_____
_____
_____

Those Silent, Hidden Environmental Dangers Building awareness of carcinogen effects through service learning

(Grades 6-12)

Table of Contents

Overview

In the early 1900's man became increasingly aware of the spread of infectious diseases. It was a serious and widespread outbreak, that wiped out hundreds of thousands of people across the global environment that opened the eyes of the world to the possible dangers of those silent, hidden enemies (viruses and bacteria). Just as these hidden enemies proved to be a serious threat to our health then, today we have to be aware of other possible serious, hidden threats to our health. Over time, man has had a serious impact on the global environment. As a result the water we use, the land we live off of, and the air we breathe has become contaminated with toxic chemicals that can have a negative effect on our health. One possible negative effect is Endocrine Disruption. In this lesson students will take a historical view of these issues, and compare and contrast the problems and obstacles that medical science has had to overcome to make the public aware of the possible dangers, as well as to discover the cures. Students will investigate how carcinogenic chemicals get into the environment, how people come in contact with them, and their overall health effects. Students will find ways to inform and educate their community about things people can do to avoid the possible dangers these chemicals can impose upon our health. Students will engage in Service Learning Projects. Through their Service Learning experience, students will connect with the environment in a positive way, and help do something to improve their surroundings and help their community.

Back to Table of Contents

Technology Resources

Internet Sites:

A Science Odyssey: Then+Now: Medicine and Health

http://www.pbs.org/wgbh/aso/thenandnow/medhealth.html

1900: Though the scientific community knows that germs cause disease, they don't completely understand how they're spread, and they certainly don't know how to destroy them.

Today: Life expectancy has risen dramatically, but poverty and the environment are still major factors affecting health worldwide. The average citizen knows a great deal about how to maintain health. Antibiotics have proven an indispensable tool in battling illness, but resistant strains of bacteria demand newer and stronger drugs. Organ transplants and high-tech medicine give thousands of people each year a second chance at life, but the medical system has become big business, and there is heated debate over access and cost of care. New disease organisms challenge the limits of scientific medicine.

ECME: Environmental Estrogens (The Endocrine System)

http://www.tmc.tulane.edu/ECME/eehome/

http://www.tmc.tulane.edu/ECME/eehome/basics/endosys/

This site gives information about environmental estrogens, a wide variety of natural compounds and synthetic chemicals that may mimic natural estrogen hormones. They have been linked to growth, reproductive and other health problems in wildlife and laboratory animals and may affect human health. It also describes the functions of the endocrine system, a complex network of chemical signals and messages that control many immediate and life-long bodily responses and functions. Growing taller, developing male or female characteristics and reacting to fear are all partially directed by endocrine hormones.

Chesapeake Bay Foundation

http://www.savethebay.cbf.org/index.html

At this site you can learn about the different CBF educational programs and field trip opportunities. Join the Student Bay Savers Program and learn all about ways to help improve the water quality of the Bay.

Endocrine Disrupters (Why Files)

http://whyfiles.news.wisc.edu/045env_hormone/index.html

In July, an EPA committee met in Chicago. Their problem: are synthetic chemicals causing hormonal chaos?
[Posted August 7, 1997]

- The Why Files gives a detailed overview of:
  - What are endocrine disrupters?
  - Wildlife woes: Pesticides don't discriminate
  - Human woes: DES, DDT, PCB's, dioxin 'n more
- How does the endocrine system work?
  - Hormone basics
  - Hormone confusion: How disrupters do their work
  - History: DDT and eagles' egg
- What's being done?
  - The EPA's action plan
  - Prospects for success

A Science Odyssey: On the Edge
http://www.pbs.org/wgbh/aso/ontheedge/
These comic-book style stories take you back through time and present scientists soon after they made their discoveries.

A Science Odyssey: People and Discoveries
http://www.pbs.org/wgbh/aso/databank/
What's the story behind electroshock therapy? Who's responsible for increasing the size of the Universe? What laboratory mishap led to the saving of countless lives? The answers to these questions, plus many more, await you in People and Discoveries, a databank consisting of 120 entries about 20th century scientists and their stories.

Scorecard Home
http://www.scorecard.org/
With the Environmental Defense Fund's "scorecard," you can type in your zip code to learn about pollutants in your community.

Maryland Student Service Alliance;
Maryland State Department of Education
http://www.mssa.sailorsite.net/
Service Learning Internet Activities, Resources and Lessons

FSK RESCO Environmental Club's "Mud-Buster Project" (Service Learning)
http://www.fsk.org/resco.html
Mrs. Walls Eighth grade students built this Internet Site. It shows how these FSK students helped to make a difference. In this service learning experience the students researched the problem of sedimentation and non-point pollution due to urban renewal and construction work. They investigated the problem and came up with their own solution.

Educational Computer Software:

Eyewitness Encyclopedia of Science 2.0,
from DK Interactive Learning, 95 Madison Avenue, New York, NY 10016

Multimedia Software:

Life Science Mysteries: The Green Files, and Life Science Mysteries: Beyond the Naked Eye
by Coral Corporation and Educoncept Ltd. At I. Hoffmann + Associates Inc. (H +a) 34 Ross Street, Toronto, Ontario, Canada M5T 1Z9 or Tel: 416-977-6732 Fax 416-977-0766

Discovery Channel CD-ROM, Ocean Planet, from the Discovery Channel Store at the URL, http://www.discoveryschool.com.

BodyWorks CD-ROM, from Softkey International, One Athenaeum Street, Cambridge, MA 02142

Microsoft PowerPoint '98 and Microsoft, Macintosh Edition at the Microsoft Office World Wide Web Site using the URL, http://www.microsoft.com/office

HyperStudio by Roger Wagner, at http://www.hyperstudio.com

Videos:

Program One Release of a PBS series,A Science Odyssey,
"Matters of Life and Death -- Medicine and Health" which can be ordered from http://www.pbs.org

FSK 1997 Symposium for Environment & Education tape was created by Accompany Productions, Concord, NH 03301, Tel: 603-226-3130 for Francis Scott Key Middle School April 27-29, 1997. For information on creating your own videotapes check out the Internet Site,which can be ordered from http://www.videomaker.com/scripts/lobby_table_of_contents.cfm

Digital Images and Quicktime (MPEG) Video:

Discovery CD-ROM Mpeg video clips "Pollution of The Chesapeake Bay ", "Phytoplankton Pollutes the Chesapeake

Discovery Mpeg Video Clip "Can the Chesapeake Be Saved" from the Discovery CD-ROM entitled "Aquatic Habitats"

Note: These CDROM' tittles were especially created for the "***Baltimore Learning Community"*** a special project http://www.learn.umd.edu and cannot be distributed to the public. The entire video format can be obtained on videotape from ***the Discovery Channel Store*** at the URL, http://www.discoveryschool.com

Digital images of Oyster Core and Service Learning Experience were taken with the ***Kodak Digital Camera DC40 and PhotoEnhancer software*** that uses a special disk caching technique to store images on disk as memory gets low. We also used ***Adobe Photo Deluxe*** and ***Graphic Converter*** to prepare images for use in slideshow format.

Print Material, Book(s) and Publication(s):

Animal Tracks Activity Guide For Educators, from the National Wildlife Federation at 1400 16th Street NW, Washington DC 20036 and NEA Professional Library, National Education Association, P.O. Box 509, West Haven, CT 06516-9904.

Educators Guide, A Science Odyssey, which can be downloaded free from the PBS Internet Site, http://www.pbs.org/wgbh/aso/databank/entries/btcars.html.

Teacher Background Information

Over time man has had a negative impact on the environment, but through environmental protection agencies, organizations, foundations and concerned citizens some of the environmental scars are healing. However, the toxins, contaminants, and carcinogens, have entered our waterways, touched the air we breathe and infected everyday products we use in our homes, schools and workplaces. From the fish that we catch, and foods that we eat to the toys that our infants play with, these "Silent-Hidden-Dangers" pose a threat to our health. Such diseases as cancer, endocrine disruption, and hormone confusion have been linked to serious environmental changes.

Francesca Lyman, an environmental and travel Journalist and editor of the recently released, "Inside the Dsanga Sangha Rainforest" writes an article which states "scientists are uncovering disturbing evidence that developing fetuses and infants may be highly vulnerable to certain synthetic chemicals widespread in the environment- even at low levels. The toxicology is still evolving and preparing for a vigilant parenthood may be more complicated than ever."

Two books tell the story well :

According to Mark Hertsgaard, author of "***Earth Odyssey***," the scale and technological power of 20th century civilization has so accelerated beyond that of earlier civilizations, that they form a challenge we have yet to fully reckon with. "In effect, we are playing the sorcerer's apprentice with the planet," he writes, quoting a prominent French scientist.

"***State of the World 1999***" tracks industrial growth over the past century and warns that expanding human demands are colliding already with the earth's natural limits. World energy needs are projected to double, yet world oil production is expected to fall off. While food demands will also double in the century ahead, the authors write, "the world's oceans are being pushed beyond the breaking point, due to a lethal combination of pollution and over-exploitation." Lastly, the book points to the rising threat of climate change as the latest jump in 1998 left the global temperature at its highest level since record-keeping began in the mid-19th century. Higher temperatures are projected to threaten food supplies in the next century, while more severe storms cause economic damage, and rising seas inundate coastal cities." To investigate the fate of the global environment, Hertsgaard set out on foot across the world. But far from being a predictable "journey of discovery" this medley of travelogue and environmental soul-searching harkens back to a true Odysseus journey, made on foot and at certain personal peril. Only here, unlike the classic epic, the Trojan War is the conflict between economic growth and ecological destruction - and the trip to Hades is instead a journey into the bowels of industrial pollution.

The author's first stop is Chongquing, China, a city encircled by mountains that block cleaning winds, so it is naturally foggy and also happens to suffer some of the worst air pollution. When fog and smog combine at their worst, say locals, "If you stretch your hand in front of your face, you cannot see your fingers."

Here, as in some other countries around the world he visits, while people know their air and water are polluted, they just don't know how dangerous the situation has been and can be. The book's opening scene is at the back of the Chongquing Paper Factory. Here a cascade of chlorine was emptying into the Jialing River, revealing "a vast roaring torrent of white, easily thirty yards wide, splashing down the hillside from the rear of the factory like a waterfall of boiling milk." Hertsgaard concludes with what many environmentalists have been saying for years - that unless economies are underpinned by "sustainable" and non-polluting technologies, there will be no future.

Learning Objectives

Students will be able to:

- **Demonstrate** and **observe** how toxic chemicals enter our environment and contaminate our water and food source.
- **Use** Internet sites to explore and investigate where the toxins come from, what happens to certain toxins or carcinogens when it enters the environment, the health effects related to the exposure, and how people are exposed to these toxins.
- **Develop**, **plan** and put into action a Service Learning project that would help the environment, and help educate their community about the possible health effects related to exposure to certain carcinogens like vinyl chloride.
- Form a historical perspective from the days of house calls to the era of high-tech hospitals and **compare and contrast** how medical science dealt with health problems in the early 1900's to today's struggles with illnesses brought on by exposures to toxins in our environment.
- **Simulate** the spread of a disease and locate "patient zero" to understand some factors that affect the spread of disease and the challenges of epidemiology.

Back to Table of Contents

MSPAP/Core Learning Goals

(MSPAP vocabulary is highlighted within the learning objectives above.)

- **GOAL 1: SKILLS AND PROCESSES**
  The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information.
  Expectation 3: *The student will carry out scientific investigations effectively and employ the instruments, systems of measurement, and materials of science appropriately.*

- **GOAL 3: CONCEPTS OF BIOLOGY**
  The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) and major biological concepts to explain the uniqueness and interdependence of living organisms, their interactions with the environment, and the continuation of life on earth.
  Expectation 5: The student will investigate the interdependence of diverse living organisms and their interactions with the components of the biosphere.
  Expectation 6: The student will investigate a biological issue and develop an action plan.

Back to Table of Contents

Vocabulary

Service Learning- Student service-learning is a new way to get back to basics. It's a learn-by-doing approach to the curriculum. Students get real life experience in the subjects they study by meeting community needs.
Epidemiology- Study of the distribution and control of infectious diseases.
Infectious Diseases- Disease that is transmitted among people by harmful organisms such as viruses and bacteria, communicable diseases.
Carcinogens- A substance with the ability to cause cancer.
Soil Erosion- The loss of topsoil due to excessive water run-off.
Soil Permeability- The speed at which water or some other liquid passes through a substrate.
Phytoplankton- Tiny microscopic aquatic plant organisms.
Non-point Pollution- Unlike pollution from industrial and sewage treatment plants, this pollution comes from many diffuse sources and is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even our underground sources of drinking water.
Environmental Estrogens- A wide variety of natural compounds and synthetic chemicals that may mimic natural estrogen hormones. They have been linked to growth, reproductive and other health problems in wildlife and laboratory animals and may affect human health.
Endocrine Disrupters- Any compounds mimicking actions of, or altering levels of neurotransmitters, hormones, and growth factors in the developing brain.
Bay Savers- CBF's education program for middle school and high school students.
Sedimentation- Process in which loose, solid matter settles to the bottom.
Oyster Gardening- People personally raising oysters to contribute to oyster restoration in the Chesapeake Bay.
Contaminant- A substance that taints another substance, something that does not belong.
Run-off- Water, that is not absorbed into the soil.
Groundwater- Water stored beneath the earth’s surface in porous rock and soils.
Toxic- Poisons that usually pose a substantial threat to human health and the environment.
Chemical- A substance made by man or nature, which is composed of molecules, which are atoms (building blocks of matter) joined together.

Back to Table of Contents

Equipment and Materials

Per class:

- Overhead transparencies of activity sheet diagrams
- Class Computers and TV/Monitor with connection device
- Digital Camera
- VCR
- Camcorder

Per investigative team of 4 or 5 students:

- Web-page resource booklets (or computer with Internet connection)
- Materials for laboratory activities (These are listed on the laboratory investigation activity sheets.)

Per student:

- Activity-sheets:
  - Round Table Activity Sheet
  - What Makes Our Chesapeake Sick
  - Soil Permeability Experiment (from Animal Tracks Activity Guide For Educators)
  - Soil Erosion Experiment (from Animal Tracks Activity Guide For Educators)
  - The Seafood Dilemma: To Eat or Not To Eat
  - Service Learning Project- Oyster Gardening
  - Disease Detectives
  - Exploring Service Learning Projects
  - Learning-By-Doing: The Basis of Service-Learning
  - Scavenger Hunt Activity

Back to Table of Contents

Procedures

Day One
PRE-VIEWING ACTIVITIES:
Learning Activity: (An introduction to Service Learning) As an introduction have students recall the Pfisteria outbreaks in the Chesapeake Bay. Use screen shots of articles taken from online newspapers. Remind students that many people are concerned about this problem and the health effects. Ask the question, "Can you think of any other problems and concerns dealing with the Chesapeake Bay?" Use the Round Table Activity Sheet, a cooperative learning activity in which students will brainstorm and list problems of the Chesapeake Bay. After a short discussion show the ***Discovery CD-ROM Mpeg video clips "Pollution of The Chesapeake Bay ", and "Phytoplankton Pollutes the Chesapeake***.

FOCUS FOR VIEWING #1:
The focus for viewing is a specific responsibility or task(s) students are responsible for during or after watching the video, to focus and engage students' viewing attention. While viewing the short video clip from, " ***Discovery CD-ROM Mpeg video clips "Pollution of The Chesapeake Bay ", and Phytoplankton Pollutes the Chesapeake***, students will be given instructions to record their answers and notes on their activity sheet. Students will view and identify specific environmental problems of the Chesapeake Bay that the video clips show.

VIEWING ACTIVITY #1:
"What Makes Our Chesapeake Sick"

BEGIN CD-ROM: To start the video clip from the CD-ROM, insert the CD-ROM into the CD-ROM drive on the computer. In the Apple menu, click and open the Apple Video Player Application. Next mount the CD-ROM video clip aqha001004.mpg, ***Pollution of the Chesapeake***. As students watch the clip, they should write the answers to the questions on the activity sheet. Play the clip several times to give students time to record their answers. Discuss questions 1,2 and 3. Next mount the video clip, aqha001005.mpg, ***Phytoplankton Pollutes the Chesapeake*** and have the students write their answer to question #4, What effect is all this pollution having?

Next ask the question, "Can the Chesapeake be saved? After the discussion show the third ***Discovery Mpeg Video Clip, aqha001006.mpg, Can the Chesapeake Be Saved, from the Discovery CD-ROM entitled Aquatic Habitats***. Discuss causes and effects of the pollution and how the Bay can be saved. Write the answer to the last question on the activity sheet.

Next, show the ***FSK RESCO Environmental Club's "Mud-Buster Project"*** (Service ***Learning)*** Internet Site and how these FSK students helped to make a difference. In this service learning experience the students researched the problem of sedimentation and non-point pollution due to urban renewal and construction work. This will lead to the investigation, "Soil Permeability and Toxic Chemicals" taken from "Animal Tracks Activity Guide For Educators".

Preparation:
What will students do? (Opening Activity)

ACTIVITY #1 (Two hands-on Investigations) #1 Soil Permeability and Toxic Chemicals, and #2 Soil Erosion (Note: These experiments were taken from the Animal Tracks Activity Guide for Educators)

Procedure:

1. Divide the class into investigative teams of 8 students. Each team will conduct both experiments. Four students will do the soil permeability investigation and the other four students will do the soil erosion investigation.
2. Distribute the student Laboratory Investigation Worksheets.
3. While students are preparing for the soil permeability investigation, place several drops of red food coloring into one of the two containers of soil each team is using. Don't let the students know which container the food coloring is in. Next, put red dye into every box used by the team conducting soil erosion investigation.
4. Have the students complete their investigation and answer the questions on their worksheets. When they have finished their experiments, have the teams who conducted the permeability experiment explain to the soil erosion investigative team what they learned, and vice versa.
5. As students discuss their results, begin a short discussion by asking the question: How do you feel about dumping toxic materials in the soil now?
6. For a home assignment, have the students write a story about toxic chemicals and their effect on water and soil. Ask them to explain what might happen to the plants and animals that live in the soil and water. Have them include an idea of how to solve this problem.

Note: After students complete the two hands-on investigations, have them view a short video clip from the Mud-Busters videotape. This is videotape of the FSK -RESCO Environmental Club giving a winning presentation of their project at the 1997 Symposium for Environment & Education. The students demonstrated a similar experiment in their presentation. In their presentation, the Mud-Busters also relates the effects of toxic chemicals and contaminated fish to our health.

While viewing the video, "1997 Symposium for Environment & Education", students will be given instructions to record their answers and notes on their activity sheet. Students will take notes to describe the relationship between toxic chemicals that enter the Chesapeake Bay, contaminated fish and our health. They will also express their opinions concerning why most people are unaware of the problems related to their health. Then using ***the BodyWorks CD-ROM and an Anatomical Model of the Human Body,*** the students will pinpoint particular body organs and organ systems that could be affected by the contaminants. Instruct the students to fill in their answers on the

VIEWING ACTIVITY #2:
(Engagement of Students)

"The Seafood Dilemma: To Eat or not To Eat?" "1997 Symposium for Environment & Education", tape of Francis Scott Key Middle School, RESCO Environmental Club Mud-Buster Project.

BEGIN TAPE:

Start at the point when Jackie uses a series of images in the ***HyperStudio*** stack to explain how the toxic chemicals enter the Baltimore Harbor. In her presentation, she begins with a birds eye view of the Inner Harbor. **PAUSE** the video after Jackie names the toxic chemicals and says that they are harmful to your health. You should see a picture of an underwater scene in the ***HyperStudio*** presentation. Give students time to write their answer to the first two questions on their activity sheet. Push the pause button on the remote to **RESUME** the tape again. Jackie will use the picture of an underwater scene in the ***HyperStudio*** presentation to explain how the contaminants effect the fish and people that eat them. **PAUSE** the video after Jackie introduces Jessica. You will see the ***HyperStudio*** card change to a man holding his stomach and he appears to be sick. Give students time to write their answer to the third question, then **RESUME** the tape. Jessica will now do her presentation on the health effects. As Jessica goes through a series of poster charts the students should fill in their answers to the other questions and activities. **END THE TAPE** after Jessica gives a brief summation of how these toxic chemicals enter our drinking water and contaminates foods we eat.

After the Tape: Tell the class that they will complete one of the Web Quests or explore one of three software programs:
Web Quests

- Exploring Service Learning Projects
- Learning-By-Doing: The Basis of Service-Learning
- Scavenger Hunt Activity

Software Exploration

- Life Science Mysteries: The Green Files
- Life Science Mysteries: Beyond the Naked Eye
- Discovery Channel CD-ROM, Ocean Planet
- Life's Greatest Mystery CD-ROM

They will learn more about Service Learning and why its important that they too should do a Service Learning Project. They will also be able to explore an interactive software program to learn more about the impact of toxic chemicals on the environment. They will work as investigative teams of 2 to 3 to complete at least one of these activities. Each team will give a follow-up report. Next divide the class into two investigative teams. Tell students that the first investigative team will learn about an important service learning project we will be working on throughout the school year, "Oyster-Gardening" and they will learn about the importance of oysters to the Bay. They will also take a closer look at the overall health effects of eating contaminated seafood. They will determine steps people can take to protect themselves and the environment. The second investigative team will become disease detectives. They will simulate the spread of a disease and locate "patient zero"; an Internet Activity from the Internet Site, A Science Odyssey at the URL: http://www.pbs.org/wgbh/aso/databank/entries/btcars.html.

Day Two and Three
POST VIEWING ACTIVITIES:

Activities #3 and #4 (Exploration)

ACTIVITY# 3: Service Learning Project- Oyster Gardening:
While doing this activity the students will consider these three questions:

1. How will the project help control the effects of Non-Point pollution and contamination of the Chesapeake Bay?
2. How will the project help educate people about the threat contaminated fish, oysters and other types of seafood can have on our health?
3. What preparations will the team have to make, and what actions will we take. What reflections will we be able to make on what we learn from doing this Service Learning Project?

VIEWING ACTIVITY #3:
To introduce the idea of doing the service learning project:

1. Bring their attention back to the video clip from the ***Aquatic Habitat CD-ROM***, aqha001006.mpg, *C**an The Chesapeake Be Saved*** and ask why are oysters important to the Chesapeake Bay. Tell them that one team will begin their preparation for the Service Learning project. Remind students that the other two parts, action and reflection will also be completed throughout the school year. What strategies will you be using to try to stop the spread of contaminants in the Chesapeake Bay and the resulting health problems.
2. Video Link: Bubonic Plague: Present the video segment on the plague outbreak in San Francisco. Ask students to note the strategies health officials undertook to try to stop the epidemic. After viewing, discuss these strategies with students.
    - Were they effective?
    - Why or why not?
    - What could officials have done differently?

Next explain that today, infectious diseases have reemerged as worldwide threats to our health. Also, because of mans impact on the environment, we are faced with many related health problems due to non-point pollution and contamination of our drinking water, and certain foods that we eat. Contamination of fish is only one example. Other foods and products can also be a source of contaminant toxins. For a research project have individual students choose a health threat that interests them from a list that you will supply. This can be done inside and outside of the classroom. Group students accordingly. Each group can form a task force to research and advise the government on ways to halt the disease. Download this activity from the Internet Site, A Science Odyssey: Resources: Educator's Guide…..http://www.pbs.org/wgbh/aso/resources/guide/medact1index.html

Add more diseases to the list. Add diseases that could possibly be caused by toxins in our environment today.

ACTIVITY #4:
Disease Detectives: Simulate the spread of a disease and locate "patient zero"; An Internet Activity from the Internet Site:

A Science Odyssey http://www.pbs.org/wgbh/aso/databank/entries/btcars.html

Learning Goal: Understand some factors that affect the spread of disease and the challenges of epidemiology.

Video Link: Bubonic Plague or The Role of Modern Medicine

Introduction:

From bubonic plague to AIDS to the Guinea worm parasite, scientists and public health officials have struggled to understand and contain the spread of infectious diseases. Using common laboratory equipment, students will simulate the spread of a simple imaginary disease in order to explore some factors that affect the rate of infection and the difficulties in tracing the path of transmission. Following the activity, students will view one of the video segments and discuss the importance of tracing an infection's roots.
http://www.pbs.org/wgbh/aso/resources/guide/medact4index.html

Day Four and Five:
After Activities:
"Medical Science and Health Game" (Explanation)

1. After completion of the activities have students **Compare and contrast** how medical science dealt with health problems in the early 1900's to today's struggles with illnesses brought on by exposures to toxins in our environment by sharing what they learned after completion of the various activities. They can play the medical science and health game. Put up two sheets of chart paper. Label one with the heading **"Dangers of Infectious Diseases in 1900".** Label the second one with the heading **"Dangers of Environmental Toxic Diseases Today"**. Make cards with words related to environmental toxic diseases today, and words related to infectious diseases in 1900. Divide the class into two groups. One group will represent how people dealt with health problems in the early 1900's (**"Dangers of Infectious Diseases in 1900"**). The second half of the class will represent how people are dealing with illnesses brought on by exposures to toxins in our environment today (**"Dangers of Environmental Toxic Diseases Today"**). In turns, put a word card on the back of a student from each team. The class has to have a discussion about the word without saying its name. The student representing their team has to guess the word and the team gets points. They must tape the word to the board and write a brief description.

   (Evaluation/Assessment)

2. The students will give an investigative team report using PowerPoint or HyperStudio to show what they learned from completing activities #3 and #4. Use a checklist of criteria to follow in creating and presenting the PowerPoint or HyperStudio stack. Teachers and students will use this Multimedia Project Rubric to evaluate their work during the actual presentations. This Rubric and others can be downloaded from this Internet Site: http://www.ncsu.edu/midlink/rub.mmproj.htm

Back to Table of Contents

Extensions

Field Trip(s)

CBF-Oyster Gardening Workshop:

At this workshop, students will learn all about oyster gardening and how to take care of their oysters. They will build an oyster float and pick a sight for their oysters. If you are interested in having your students become members of the Oyster Corps or the Student Bay Savers Program, contact:

Jamie Baxter, Maryland Restoration Coordinator at the Chesapeake Bay Foundation, jbaxter@cbf.org

Horn Point Oyster Hatchery Tour:

Here, students will take a tour of the oyster hatchery and learn how the oysters are raised. They will actively participate in live oyster spawning, tank preparation and cleaning, and shell bag construction. This is a special Student Bay Savers Oyster Event. Sarah Bodor is the Student Bay Savers Coordinator. She can be contacted at 1-800-445-5572 to learn more about the program.

Snow Goose, Baltimore Harbor:

This is a CBF environmental educational fieldtrip aboard their educational boat called the Snow Goose. After growing the oysters in the floats over a period of months, students will board the vessel to learn more about the Chesapeake Bay. They will participate actively in testing the water quality of various locations and decide on the best location to replant their baby oysters.

Language Arts:

After students have completed all of the activities and the assessment, they can write an online journal to share their experiences with others as well as reflect on their own personal discoveries and feeling about the Service Learning Project. Students can send their journal to the Chesapeake Bay Foundation and their journals can be posted on the Student Bay Savers Internet Site at http://www.savethebay.cbf.org/sbs/bulletin_board/bulletin_board.htm http://www.umbi.umd.edu/~comb/

Social Studies:

Students can create two Public Service Announcement Posters. Both posters should be related to medicine and health, but one for 1900 and the second for today.

Internet:

Post samples of their work from the various activities on their class Internet Site. They can take pictures of their posters using the ***digital camera***, save them as gif or jpeg, and upload them to their School Internet Site. (Example: http:www.fsk.org/index.html)

Back to Table of Contents

Assessment/Evaluation

Learning Logs

Have student's display and explain their products from the various activities and use some peer evaluation techniques. Examples of rubrics can be downloaded from this Internet Site:
http://www.ncsu.edu/midlink/rub.mmproj.htm

Back to Table of Contents

1999 EnviroHealth Link Master Teacher Team: Evelyn E. Walls & Janet Henke

Round Table Activity Sheet
Problems of the Chesapeake Bay

Investigative Team Names

1.
2.
3.
4.
5.

Directions:
Many people are concerned about the problem of pfisteria in areas around the Chesapeake Bay and the health effects. Can you think of any other problems and concerns dealing with the Chesapeake Bay? Use this Round Table Activity Sheet, and in cooperative learning, Investigative Teams brainstorm and list problems of the Chesapeake Bay. Each person must write down one problem when the sheet is passed to you. When the signal is given, pass the sheet on to the next person until each space is filled in.

Problems of the Chesapeake Bay

1.

2.

3.

4.

5.

What Makes Our Chesapeake Sick

Directions:

While viewing the short video clip from, " ***Discovery CD-ROM Mpeg video clips "Pollution of The Chesapeake Bay ", and Phytoplankton Pollutes the Chesapeake*** and write answers to the following questions. Don't worry, the video clips will be repeated to give you extra time for getting your answers and to go over them.

VIDEO CLIP: AQHA001004.MPG

1. How has man changed the ecosystem of the Chesapeake Bay? What is the most striking sign of the change?

2. How would you define ecosystem?

3. What are some of the many causes of changes in the Chesapeake Bay? List them in the space below.

VIDEO CLIP: AQHA001005.MPG

4. What effect is all this pollution having?

VIDEO CLIP: AQHA001006.MPG

5. Write a paragraph using 4 or more sentences to explain your answer to the question, Can the Chesapeake Bay be saved? Explain by listing several reasons and suggest examples of ways people can make it happen.

Name _____

Soil Permeability Experiment

Materials Needed

- Large pans to catch water
- 2 similar-sized coffee cans with 8 to 10 holes punched in the bottom
- 2 cups of water
- Watch to count minutes and seconds
- 2 types of soil, enough of each to half-fill the cans:
    - Sand or gravel
    - Potting Soil

Instructions

1. Fill each can half full with a different type of soil. Each type of soil allows water to move through it at a different speed. The speed that water passes through soil indicates its *permeability*.
2. Write the name of the soil you *think* is most permeable. The water will pass faster through the more permeable soil. My prediction is
3. Place the can of soil over the pan, and pour the cup of water into the can. Have one person be the timer, and time how long it takes for the first drips of water to reach the pan. Time how long it takes for all the water to reach the pan. If the water has not stopped dripping after five minutes, stop timing.

Type of soil:

Time elapsed until first sign of water:

Time elapsed until all the water drips through:

Type of soil:

Time elapsed until first sign of water:

Time elapsed until all the water drips through:

Which soil was the most permeable?

Was your prediction correct?

Name _____

Soil Erosion Experiment

Materials Needed

- 2 large pans to catch water
- shoe box
- 3 small bags of soil collected from the school yard
- large handful of fresh grass or other green waste
- large watering can full of water
- red food coloring

Instructions

1. This experiment will show how water travels over soil when grass is present and when it is absent. Place the dirt in the shoe box. Mound the dirt on one end so it's higher than the other, like a small hill. Place the shoe box over a large pan. Pour water over the higher end fairly fast and let it drain into the pan.
2. Place the shoe box over the second pan. Place the green grasses on top of the soil. Pour water over the higher end and let the water collect in the pan.
3. Answer the following questions:

Which pan is muddier, which means it has the most soil in it?

Which one had the least?

When soil washes away with water in a storm, it may result in *erosion*. From what you observed, how can you prevent erosion?

What happened to the red dye your teacher placed in the soil?

What might have happened if this dye had been toxic?

The Seafood Dilemma: To Eat or Not to Eat

Part I

Directions:
View a short video clip from the Mud-Busters videotape. This is videotape of the FSK -RESCO Environmental Club giving a winning presentation of their project at the 1997 Symposium for Environment & Education. The students demonstrated a similar experiment in their presentation. In their presentation, the Mud-Busters also relates the effects of toxic chemicals and contaminated fish to our health. While viewing the video, ***1997 Symposium for Environment & Education***, record your answers and notes on this activity sheet.

Part I: Write a short answer to the questions in the space provided.

1. How do toxic chemicals enter our waterways?

2. What were the four toxic chemicals identified by the RESCO team?

3. How does this problem effect people who use the water for recreational fishing?

4. In her presentation, how did Jessica compare and contrast the health effects of eating contaminated fish for people of different age groups?

Part II

The Seafood Dilemma: To Eat or Not to Eat
Part II

Fill in the chart to identify the effects these contaminants have on our health, and to tell what parts of our body are effected.

The Contaminant	The Health Effects	The Maximum Allowed in mg/l	The Source	
Arsenic				
Lead				
Nickel				
Mercury				

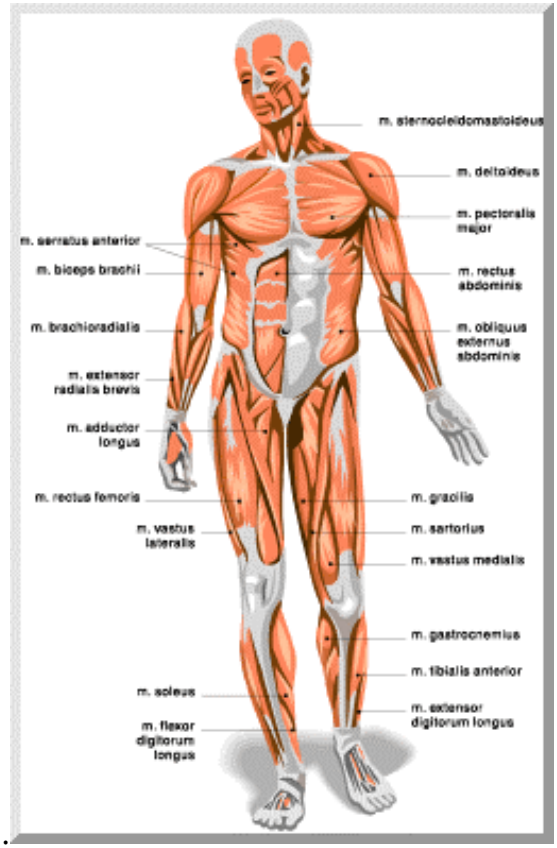
Part III

The Seafood Dilemma: To Eat or Not to Eat
PART III

Mr. Downs read a newpaper article that reported a finding of contaminated fish in the base of the Poteek River. Mr. Downs has been fishing in the river since early childhood. He and his father fished there almost every weekend. If the fish he ate where contaminated with all four chemicals, show the body parts that could be efffected writing the chemical name on the body parts it effects.

1. 

2.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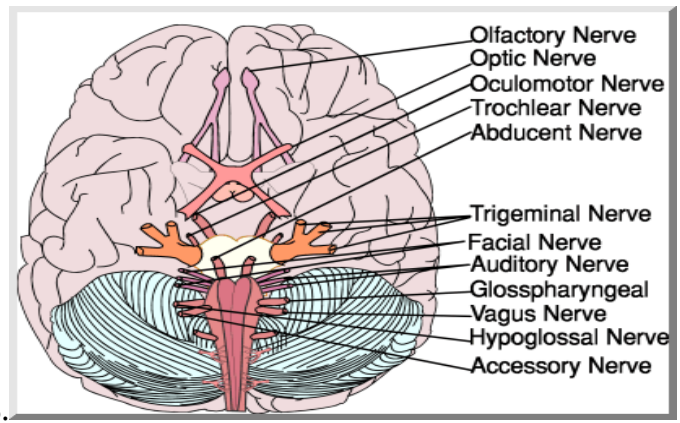
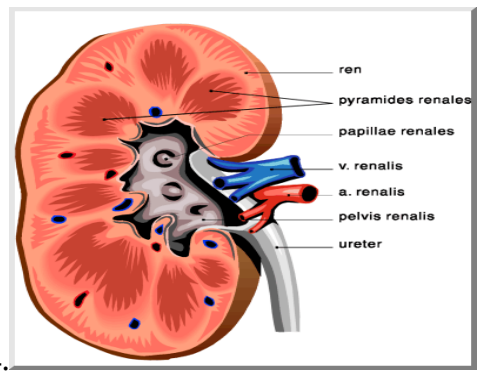
m. deltoideus
m. pectoralis major
m. serratus anterior
m. biceps brachii
m. rectus abdominis
m. brachioradialis
m. obliquus externus abdominis
m. extensor radialis brevis
m. adductor longus
m. rectus femoris
m. gracilis
m. vastus lateralis
m. sartorius
m. vastus medialis
m. gastrocnemius
m. tibialis anterior
m. soleus
m. extensor digitorum longus
m. flexor digitorum longus

3.


Olfactory Nerve
Optic Nerve
Oculomotor Nerve
Trochlear Nerve
Abducent Nerve
Trigeminal Nerve
Facial Nerve
Auditory Nerve
Glossopharyngeal
Vagus Nerve
Hypoglossal Nerve
Accessory Nerve

4.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pyramides renales
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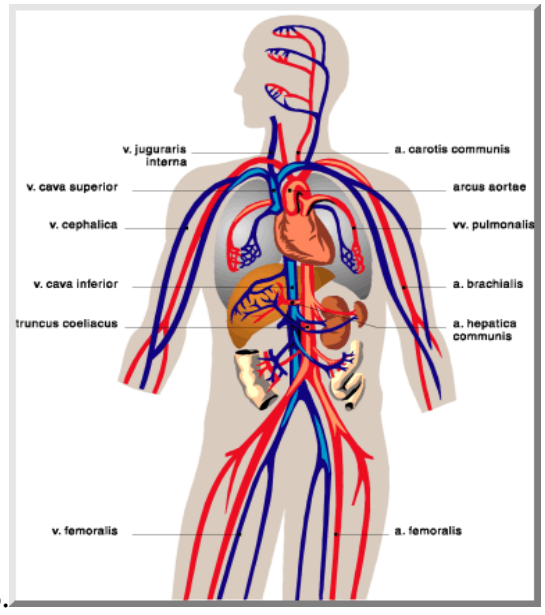
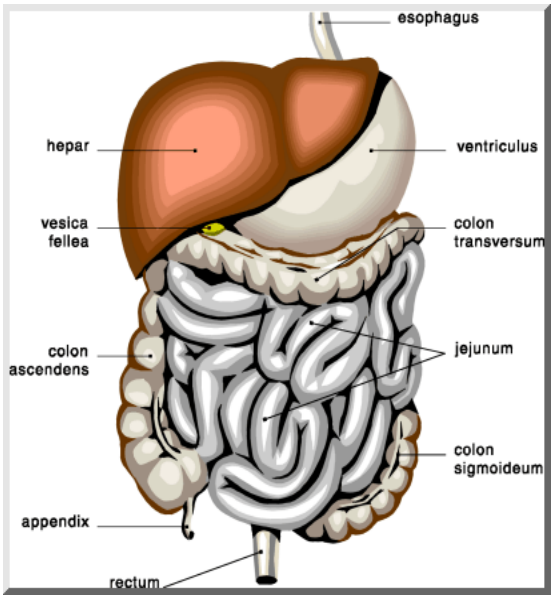
5. 
v. juguraris interna
a. carotis communis
v. cava superior
arcus aortae
v. cephalica
vv. pulmonalis
v. cava inferior
a. brachialis
truncus coeliacus
a. hepatica communis
v. femoralis
a. femoralis

6. 
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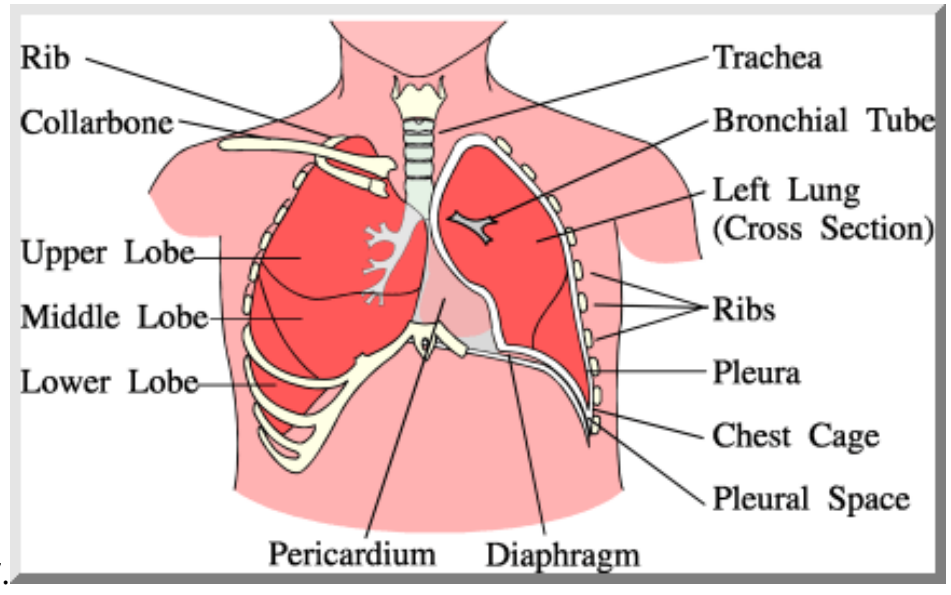
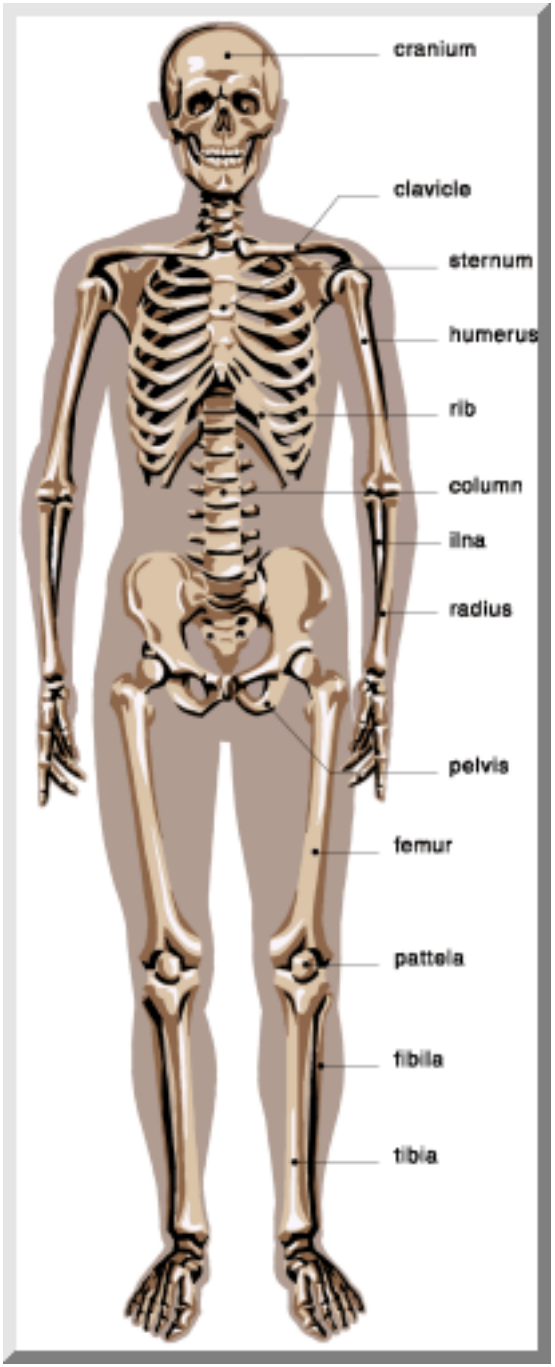
colon transversum
colon ascendens
jejunum
colon sigmoideum
appendix
rectum

7. 
Rib
Collarbone
Upper Lobe
Middle Lobe
Lower Lobe
Trachea
Bronchial Tube
Left Lung (Cross Section)
Ribs
Pleura
Chest Cage
Pleural Space
Pericardium
Diaphragm

8. 

Tech Tip: You can create your own clipart library and make your own worksheets using the images. Download images from the Internet by clicking on the right mouse button (click and hold the mouse button on the Mac.) Click on the words "save this picture" to save it to your hard drive.

Activity Worksheet
Webquest - Exploring Service Learning Projects

Making A Cleaner Chesapeake Bay

1. Click on the URL for the Chesapeake Bay Foundation - http://www.cbf.org/

2. Find the picture of Crabby, and go to the "Megalops-page. The word "Megalops" will be highlighted.
   (You can signup to receive the Megalops newsletter, but get permission from your parents!)

3. Click on "Hook, Line and Thinker in the menu, get the instructions for the Student BaySavers contest!

   Write down what you will have to do to participate. You can copy and paste this text/information.

4. Next click on "Actions and Reactions" in the menu. Find out what other students are doing to get involved with Service - Learning and helping to improve the water quality of the Bay.

   a. What's the Project?

   b. What did you learn?

5. Was the project an example of Service-Learning?

   a. If yes, describe the preparation, action and reflection.

   b. If no, how could you make it a Service-Learning activity. What would be the preparation, action, and reflection?

WEBQUEST
"LEARNING-BY-DOING"
THE BASIS OF SERVICE-LEARNING

In this activity you will learn why service-learning is not volunteerism, community service, or work internship. You will determine why it's important for you and how it benefits the Baltimore Community and Chesapeake Bay.

Directions:
Go online to visit this Web Site, http://www.mssa.sailorsite.net/.
Here you will complete the online activity ***"WEBQUEST***

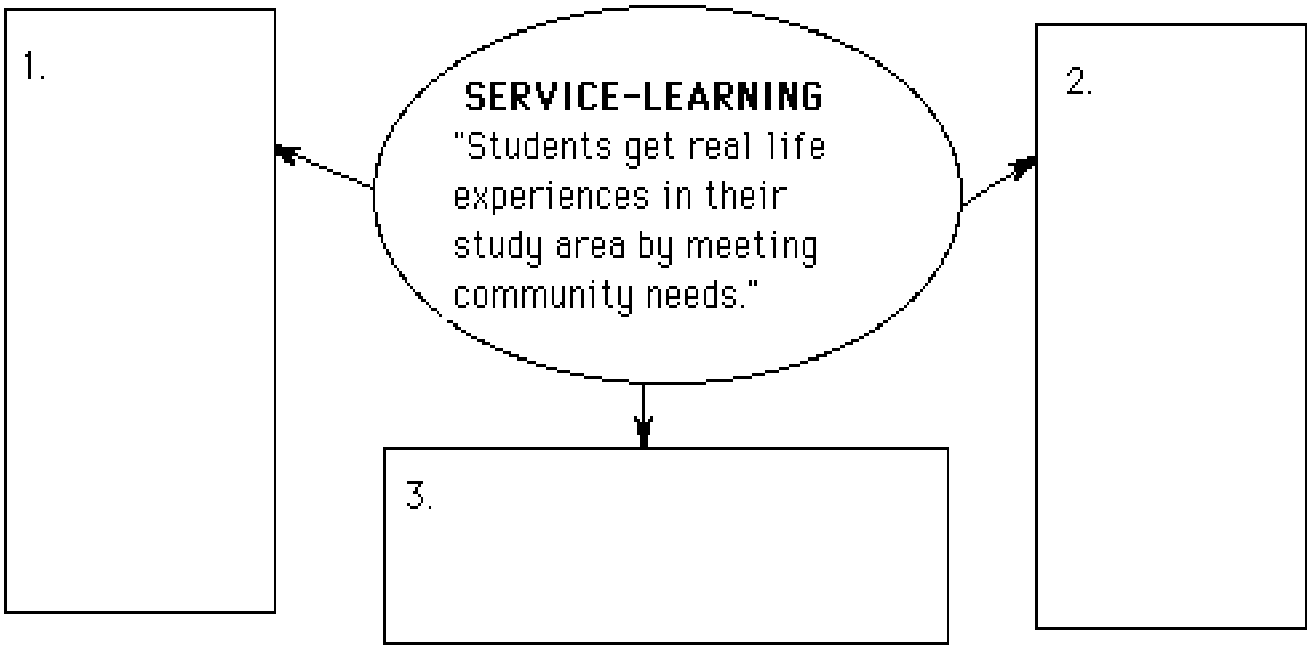
LEARNING-BY-DOINGTHE BASIS OF SERVICE-LEARNING." You will visit the Maryland Student Alliance Homepage by typing in the URL for the Web page, http://www.sailor.lib.md.us/mess/index.html. Download a copy of the activity. Fill in the answers online or in the space below.

1. Visit the Maryland Student Alliance Homepage by typing in the URL for the webpage, http://www.sailor.lib.md.us/mess/index.html. On the lines below, write the slogan by filling in the blanks with the missing words.

   "The courage to _____. The _____ to serve."

2. Click on the word in the slogan that means to perform a duty. The word is _____. Browse through this page and complete the graphic organizer and answer question number three.

THREE COMPONENTS OF SERVICE LEARNING



3. Write a sentence to explain why service learning is not volunteerism, community service and work internship.

4. Youth RISE is a student organization committed to service-learning.
   What does "RISE" stand for? If you find your way back to the Maryland Student Alliance Homepage, you'll find a link to Youth RISE.

5. State the mandate passed by Maryland State Board of Education that lists 2 Maryland Service-Learning graduation requirements.

6. Click on the link at the top of the page and list examples of project ideas that can help meet our community needs in these areas:
   a. Children:

   b. The Chesapeake Bay:

   c. Elderly:

ACTIVITY WORKSHEET
Scavenger Hunt Activity

http://www.savethebay.cbf.org/sbs/index.html

Scavenger hunt:
Start at: http://www.cbf.org/index.html

1. Who is The Student BaySavers mascot?

2. What's the Student BaySavers Pledge?

3. Copy an image that shows the state of the Bay. Paste it in the space below. Describe the transition in the Bay's health from 1600 to 1998.

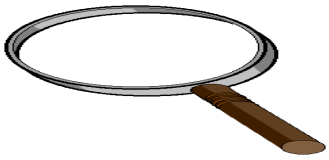
4. On a scale of 100, how does the Chesapeake Bay Foundation report peg the Bay's health?

5. Find and name four sources of the Bay's pollution.
    a.
    b.
    c.
    d.

6. Name one action the CBF has specifically taken to reduce the threat of Pfisteria to the Bay's resources and human health?

7. Find, then copy and paste a map to this worksheet that shows Pfisteria "Hot Spots" in the Chesapeake Bay.

Disease Detectives



NOTE: This activity sheet should be downloaded from the Internet Site, ***A Science Odyssey: Resources: Educator's Guide: Medicine,*** using the URL:
http://www.pbs.org/wgbh/aso/resources/guide/medact4index.html

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Overview: Simulate the spread of a disease and locate "patient zero"

Learning Goal: Understand some factors that affect the spread of disease and the challenges of epidemiology

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Video Link: Bubonic Plague or The Role of Modern Medicine

Introduction
From bubonic plague to AIDS to the Guinea worm parasite, scientists and public health officials have struggled to understand and contain the spread of infectious diseases. Using common laboratory equipment, students can simulate the spread of a simple imaginary disease in order to explore some factors that affect the rate of infection and the difficulties in tracing the path of transmission. Following the activity, have students view one of the video segments and discuss the importance of tracing an infection's roots.

Procedure I
Simulating an Epidemic

Materials:

- test tube and dropper for each student
- distilled water
- 0.1 molar NaOH
- phenolphthalein solution, dissolved in alcohol and diluted in water (pH indicator)

1. Let students know they are going to model the transmission of a disease by exchanging some of their test tubes' contents with that of other students. Mention that one of the test tubes is "infected" with an imaginary infectious disease. (Prepare the test tubes prior to class: Fill one tube halfway with 0.1 molar NaOH; fill the rest of the tubes halfway with water.)
2. Distribute prepared test tubes and droppers randomly to the class. Make a mental note of who receives the test tube containing NaOH.
3. Have students walk around the room with the test tubes. When you say "Stop!" each student should use a dropper to trade a drop of fluid with the person nearest them. Repeat until at least three trades have occurred.

Now it's time to test for the imaginary infection. Put a drop of phenolphthalein in each test tube. If the fluid turns pink, the test tube is "infected" with NaOH. How many students are now "infected"?

CAUTION: Sodium hydroxide (NaOH) and phenolphthalein can irritate the eyes and skin. Alert students to avoid spilling.

Procedure II
Tracing the Source of Infection

1. Now that a portion of the class has been "infected" put students in the role of epidemiologists. Their challenge is to collect data that will help them trace the path of the epidemic and locate the original carriers.
2. As a class, use the data to try to deduce which individual was the original carrier of the disease.

- Why might it be important to locate the source of infection?

- What difficulties arise in trying to collect and interpret data?

Note that the simulated disease has a 100% rate of infection that appears immediately under testing. Some infections, such as AIDS and chicken pox, can remain dormant in the body for a long time. Others, such as Ebola, kill the host rapidly.

- How might each of these factors affect the spread of disease and the ability to identify carriers?

Multimedia Project Rubric

Multimedia Project Rubric					
Assignment: Communicate complete information about _____ _____topic with __ Cards, __ imported graphics, ____ original graphics, ____ animations, ____ video clips or advanced features.					
	Novice: 1 point	**Intermediate: 2 points**	**Expert: 3 points**	**Self Evaluation**	**Teacher Evaluation**
Topic/Content	Includes some essential information and few facts.	Includes essential information. Includes enough elaboration to give readers an understanding of the topic.	Covers topic completely and in depth. Complete information. Encourages readers to know more.		
Technical Requirements (To be filled in by teacher)	Includes ___ cards or less, few graphics from outside sources, few animations and advanced features.	Includes at least ___ cards, 3 graphics from outside sources, 3 animations and some advanced features, such as video.	Includes at least ___ cards, 5 or more graphics from outside sources, 5 or more animations and several advanced features, such as video.		
Mechanics	Includes more than 5 grammatical errors, misspellings, punctuation errors, etc.	Includes 1-4 grammatical errors, misspellings, punctuation errors, etc.	Grammar, spelling, punctuation, capitalization are correct. No errors in the text.		
Cooperative Group Work	Works with others, but has difficulty sharing decisions and responsibilities with others.	Works well with others. Takes part in decisions and contributes fair share to group.	Works well with others. Assumes a clear role and related responsibilities. Motivates others to do their best.		
Oral Presentation Skills	Some difficulty communicating ideas, due to voice projection, lack of preparation, or incomplete work	Communicates ideas with proper voice projection, adequate preparation, and some enthusiasm.	Communicates ideas with enthusiasm, proper voice projection, appropriate language, and clear delivery.		
Scale: 13 - 15=Expert 9 - 12= Intermediate 6 - 8= Novice			**Total Points**		

Developed by Caroline McCullen, Instructional Technologist
SAS inSchool, Cary, NC http://www.sasinschool.com

(This Excel'97 Spreadsheet may be downloaded from *MidLink Magazine:* http://longwood.cs.ucf.edu/~MidLink)

Tackling Toxic Waste (Hazardous Waste)

(Grades 6-12)

Table of Contents

Overview

Eat your vegetables. Exercise often. Drink but a little, and don't smoke at all. Follow these edicts, experts say, and you will probably be one of the lucky ones. Live right, eat right, and you will probable never hear the dreaded words "You've got cancer."

This is what public experts say, anyway. If only it were true, writes Sandra Steingraber, an ecologist and poet. She challenges the experts in her book ***Living Downstream: An Ecologist Looks at Cancer and the Environment.***

While she does not deny the evidence that smoking, poor diet, and other lifestyle choices increase cancer risks, she also considers the effects of the millions of tons of synthetic chemicals in our environment.

Excerpt
From dry cleaning fluids to DDT, harmful substances have trespassed into the lands and have also woven themselves, in trace amounts, into the fibers of our bodies. That much we know with certainty. It is not only reasonable but essential that we should understand the lifetime effects of these incremental accumulations.

The lesson which follows is an attempt to do just that. Students will become educated and informed about the environmental impact of toxic waste as they take on the roles of individuals both pro and con. They will identify social issues surrounding the topic from a variety of perspectives by researching and communicating their assigned roles. As they evaluate and critique other opinions and differentiate scientific facts from media hype, they should begin to develop their own opinions based on a better understanding of the many points of view surrounding this hot topic.

"From the right to know and the duty to inquire," Steingraber writes, flows the need to act." This "need to act" serves as the focus for the final activities of this lesson. As students exercise their right-to-know and identify the toxic dumpers in their communities, they will continue the legacy first begun when Rachel Carson exposed the devastation caused by manmade chemicals. As they write letters, design Green Maps for the community, and recognize the link between earth health and human health, the students will once again break the silence!

More importantly, they will begin to develop their vision of what a better world should look like.

The activities, research and presentations in the following lesson will take approximately 2-3 weeks to complete assuming a computer hub is available for the student research.

Back to Table of Contents

Technology Resources

Beyond a Civil Action
A Science Odyssey: Then+Now: Medicine and Health
http://www.civil-action.com/index.html
Sponsored by W.R. Grace this site explores new information, regarding the events dramatized in a book and a movie by the same name - ***A Civil Action***, in which Grace was accused of contaminating drinking water and causing illness in Woburn, Mass.

Environmental Protection Agency
http://www.epa.gov
Download the ***Pollution Prevention (P2) Toolbox*** for four lesson plans to use for preventing pollution in your school building, and four full pages of other P2 resources with links.

Go to ***Envirofacts Warehouse*** for access to Superfund National Priorities List (NPL) Factsheets, and Record of Decision (ROD) documents, and an explanation of current environmental laws.

Curriculum resources/Superfund Tools available free upon request:

HAZ-ED Classroom Activities for Understanding Hazardous Waste - A 7th to 12th grade curriculum about hazardous waste, environmental issues surrounding site cleanup, and the Federal Government's Superfund Program.

Common Chemicals Found at Superfund Sites which contains one page fact sheets on the most common chemicals found at hazardous waste sites across the nation. Each sheet includes exposure information, health affects government recommendations and methods of treatment and disposal.

Additional free materials including brochures, booklets and fact sheets.

National Pollution Prevention Roundtable
http://www.p2.org
NPPR supports multimedia P2 (pollution prevention) approaches which work to solve environmental problems holistically and do not focus on a single medium (air, land, or water).

Environmental News Network
http://www.enn.com
Offers a good explanation of pollution scorecards on the net.

Environmental Defense Funds Chemical Scorecard
http://www.edf.org/links/scorecard/
This site holds reviews of more than 17,000 polluting facilities nationally, all of which are required to report to the RPA, for listing on the US Toxic Release Inventory (TRI).
The information is broken down by ZIP code, county or state. Other information available at the site includes: the facilities major pollutants, the health effects, how and where to measure a complaint, and environmental groups to network with. There's even a map showing exactly where the polluting company operates.
Free teachers curriculum guide is available from their home page.

Green Map System
http://www.greenmap.org.
Provides instructions for making green maps to identify eco-friendly places in your community. It also offers guidance in designing environmental icons for the maps. This is an excellent Service Learning Project idea!

River of Words
http://www.irn.org
International Rivers Network and The Library of Congress Center for the Book co-sponsor this annual environmental poetry and art contest that helps children discover their "ecological address." Teacher's Guides, curriculum material, t-shirts, posters and other items are available. This is an excellent extension for art and language arts.

Emergency Response Center
http://www.ert.org
At this EPA site free videos are available on request. The videos are about actual sites at which the ERC has taken action. These videos are excellent tools for students to analyze and identify actions taken by EPA/Superfund teams.

Multimedia Software

This Place Called Home - Tools for Sustainable Communities

This CD-ROM is available from Alliance for Community Education by mail at
2041 Shore Drive, Edgewater MD 21037 or Email: aplace@toad.net for a charge of $25 plus $1.50 postage = $26.50. The interactive CDROM includes video , still photos, and hundreds of pages of text from books, articles, interviews, and speeches. This is an electronic tool box for a more sustainable world.

Videos:

A Civil Action
This movie by Disney's Touchstone Pictures has brought to the screen Jonathan Harr's ***A Civil Action***, dramatizing a complex environmental trial in 1986 in Woburn, Massachusetts that pits John Travolta as plaintiffs' attorney, Jan Schlichmann, in a nose-to-nose struggle with Robert Duvall as Beatrice attorney Jerome Facher. The movie is an excellent "hook" for a lesson science inquiry lesson based on a real life event.

Toxic Leak
This Event-Based Science Module covers earth science concepts related to groundwater contamination by a toxic gas leak from a gas station. The "hook" is a video of the first 10 minutes of the WSOC-TV News coverage of an actual gasoline leak . The students complete a task as they take on roles in a community and attempt to find the source of a gasoline leak. To complete the task information is available from science activities, discovery files, etc. This inquiry based module is available for less than $200 from Event Based Science Project; Montgomery County Public Schools; 850 Hungerford Drive; Rockville,MD 20850.

Back to Table of Contents

Teacher Background Information

The number of social issues surrounding hazardous waste problems in the United States are enormous. Most people are concerned at some level, but we still tend to rely on the old adage NIMBY (Not In My Back Yard) to see us through. Considering the widespread movement of such toxic material and the far reaching health impacts of accidental spills during transporting and treating, this adage no longer applies. The following debate style activity encourages student decision making while covering the innumerable issues surrounding this hot topic.

Students are generally highly motivated by this sort of activity because it is based on several reliable precepts. First, kids love to argue and to be in charge. They set the rules, enforce the rules, and make the decisions. They deal with real issues and they're not being proselytized to do so. Perhaps most importantly, students don't want to appear foolish when they give their presentations. Your role as teacher is easy. You're they bailiff you remove the disruptive influences.

A word to the wise, the research can be tricky. To allow more time for a focus on their communication skills, you may choose to provide packets of articles for each role, or if the focus is on research skill development allow them to research the Internet themselves.

The ultimate goal of this activity should be to develop a level of scientific literacy in the students by encouraging them to use scientific facts to support their choices and actions.

Back to Table of Contents

Learning Objectives

Students will be able to:

- Use **graphic organizers** or outlines for researching and speech writing
- **Summarize** and **categorize** issues from a variety of perspectives
- **Read and write for a specific purpose**
- **Clarify** their point of view orally by presenting a speech
- **Interpret** others' perspectives by asking and answering questions
- **Formulate** a feeling about the topic
- **Draw a conclusion** based on a better understanding of the many points of view surrounding the issue of hazardous waste
- **Explain** life cycle analysis and identify natural resources produced during the generation of consumer products
- **Explain** P2 and why it is a preferred practice
- **Listen** to oral descriptions to identify types of hazardous waste sites, cleanup methods, and methods of movement
- **Observe** how a contaminant moves from land to water and between surface and ground water
- Experience the difficulty of cleaning up contaminated water

Back to Table of Contents

MSPAP/Core Learning Goals

(MSPAP vocabulary is highlighted within the learning objectives above.)

Goal 1: Skills and Processes:
The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information.
Expectation 1

Back to Table of Contents

Vocabulary

Natural Capital - both non-renewable and renewable resources
Income - things of value the ecosystem delivers to the economy such as production of raw materials, purification of water, waste decomposition, soil maintenance, etc.
Ecological Economists - those who are creating a new field within the established discipline of environmental economics
GDP - Gross Domestic Product or the nation's expenses.
GPI - Genuine Progress Indicator would add up GDP and factor in sectors usually excluded such as housework, volunteering, and then subtract social ills like crime, natural resource depletion, etc.
GNP - total value of all the nation's goods and services in a given year
Ecology - Nature's household
Economics - Humankind's household
ISEW - Index of sustainable economic welfare which adjusts the GNP for depletion of natural capital, pollution effects, etc.
Sustainability - The amount of consumption that can be sustained indefinitely without degrading capital stocks
P2 - Pollution prevention
Carcinogen - A substance or agent that may produce or increase the risk of cancer
Environmental Risk - likelihood or probability, of injury, disease, or death resulting from exposure to a potential environmental threat
Hazardous Substances - a broad term that includes all substances that can be harmful to people or the environment, toxic substances, hazardous materials and other similar terms.
Hazardous Waste - By-products or waste materials of manufacturing and other processes that have some dangerous property; generally categorized as corrosive, ignitable, toxic, or reactive, or in some way harmful to people or the environment.
Superfund - Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) enacted in 1980 and nicknamed Superfund, this law provides the authority through which the Federal government can compel people or companies responsible for creating hazardous waste sites to clean them up. It also created a public trust fund, known as the Superfund, to assist with the cleanup of inactive and abandoned hazardous waste sites or accidentally spilled or illegally dumped hazardous materials.

Back to Table of Contents

Equipment and Materials

Per class:

- Podium
- Portable PA System
- Empty can of hair spray with added insect killer label

Per investigative team of 3:

- Computer with modem or Internet access
- Character Profiles
- Research packet of specific articles
- Graphic Organizers or Outline
- Black and White USGS Hazardous Waste Poster
- Map of the local community
- Red, green and yellow markers
- One clean plastic cup
- Clean pea-sized gravel to fill the cup ¾ full
- Three paper cups
- One pump dispenser form liquid soap container
- Clean water
- One bottle of food coloring
- References and Internet Resources for Assigned Roles in Debate

Per student:
Xerox copies of following activity sheets:

- Hazardous Waste Sheet
- Tracking Toxins Performance Assessment

Additional materials per student:

- pen, pencil and paper, poster paper, crayons, markers for propaganda posters
- Props, costumes for each character
- Journal for learning log
- Binder to organize materials throughout the unit

Back to Table of Contents

Procedure

Activity 1:
Hazardous Waste: It's Not Black and White
This activity requires one 90 minute block for completion.

The hook used to interest students in the health risks involved with hazardous waste management may be either an appropriate clip from the recent movie ***"A Civil Action"*** or an actual EPA video of a waste site. (Sample videos from Emergency Response Center will be provided to participants during the Institute and are available free from the web site referenced earlier.)

Given a black and white Hazardous Waste Poster, each team of investigators will listen to an oral description of various hazardous waste sites, different types of cleanup methods used on these sites, and a description of how hazardous waste moves once it is released in the environment. Using colored markers, the students will highlight specific parts of the poster to correspond to the descriptive readings as follows: red = sites; green = methods; and yellow = movement.

(Note: These posters are available free to teachers from: U.S, Geological Survey-Branch of Information Services; Box 25286; Denver Federal Center

Denver, Colorado 80225 and a sample poster will be provided to all participants.)

Activity 2: Cleaning Up Hazardous Waste - A Moving Experience
This activity requires one 90 minute block for completion.

Begin by displaying group posters completed in previous activity for review. Each investigative group will fill a plastic cup ¾ full of pea size gravel. Using the point of a pencil or pen, punch 8-10 holes in the bottom of one paper cup. When filled with water, this cup will simulate rain. Fill the remaining paper cup ¾ full with clean water. Instruct the groups to hold the paper cup with holes over the cup containing gravel and pour water through the cup with holes until all but the top 1 cm of the gravel is saturated. Have students did a hole in the center of the gravel to represent a lake. The lake should fill to about ¼ full of water. Add 2 drops of food coloring to the gravel surrounding the lake to represent improper disposal of chemicals. Have the group use the rain cup for precipitation on the gravel until the color contaminate appears in the lake.

Now for the clean up, have students place pump in gravel down to the water level. Be sure to locate the pump on the far side of the lake from the contaminant. Pump water into the extra cup with no holes until the food coloring is visible in the cup of pumped water. Have students continue adding clean water to their models until the water being pumped out becomes clear.

Distribute handout of Interpretive Questions to each group for homework in learning logs.

Activity 4: What Was My Life?
This activity which includes an inquiry-based learning activity and an interactive video will require at least 2 days to complete.

Using learning logs, have students list all the words they can think of in 1 minute to define pollution. As students share their entries, list them on the board to use in developing a working definition of pollution.

Discuss how products we use have a history before and after we use them. Discuss the materials used in their production and create a web of the life cycle of various items (sneakers, lunch, a pencil, etc.)

Categorize parts of each life cycle into 3 phases of production, use and disposal.

Divide the class into 3 groups (a beginning, middle and end)and have each group represent a phase of the life cycle of the fake can of bug spray you provide. The first group should discuss the use of the can, the second discusses the production and materials used at that stage, while the third group speaks about disposal and possible pollution resulting from improper disposal.

Based on the previous discussion, define pollution prevention (P2) and determine why it is a preferred method of dealing with the waste and pollution we generate each day. Discuss benefits and savings relating to P2.

Upon completing the discussion allow students to work together in teams of two to use the CD-ROM, ***"This Place Called Home."*** This interactive software is an electronic tool box which provides an overview of sustainable living through interviews, still photos, and video relating to pollution prevention in action across the country. **Activity 4 : Earth Health -vs.- Human Health, A Debate** This role play activity may be completed in one week. Students will need at least two days for researching their assigned characters point of view and three days for the actual debate or presentation

To begin to develop this activity, first choose a topic. Our topic will be Hazardous Waste.

Continue through the next steps in order:

- identify the topic - Hazardous Waste Issues and Answers
- identify different perspectives - Economic, Transportation, Health, Alternatives, Laws, etc.
- do some research on the topic
- draft the characters - Attorneys, Economists, Doctors NIH/CDC, Environmental Activists, Feds, Media, Isaac Walton League, concerned citizens, kids groups
- develop a scenario for the activity - Select from various actual case studies or make up one - " Yucca Mountain Yuck! "
- write character profiles
- develop evaluation criteria
- plan for student research time
- or research the articles yourself and prepare packets
- provide witness guidelines for the testimonies with an outline if necessary
- now conduct the hearing

Guidelines:
Assign student roles and discuss their task. Allow the students two days for researching their character's point of view. Using the Internet sites provided in the Debate Packet as well as references of their own choosing, students should develop a position statement for their character. The statement should include any facts or points of concern your character should bring to the debate. Students should be encouraged to select three or four of the most important concerns and really try to drive them home at the debate. Allow students to use additional resource materials to gather facts and information to support their positions.

A possible outline for the debate could be:

I. Introduction
   State your name and the group you represent
   Briefly state your main concerns

II. Body
   Explain and elaborate on your points of concern
   Include at least 3 relevant facts from the Internet resource
   Describe the effects of the hazardous waste on your group

III. Conclusion
   Restate your main concerns
   Recommend the appropriate action for the group

Inform the class that there will be opposing points of view for all participants. Encourage them to "arm themselves with knowledge" and try to understand their characters position. Remind them that if they don't know an answer during the debate, they should try and think of something to say that is consistent with their characters beliefs.

Grading:
Advise the students that their grade will be based on 30 points as follows:
10 points - Speaking ability
10 points - Valid points and facts
10 points - Participation

Tips for Success:

- Encourage the students to make propaganda posters to decorate the room.
- Give students extra credit for using props or dressing in costume for the hearing.
- Use a podium and a portable PA system and take on the role of bailiff yourself. Invite parents or other scientists as expert witnesses. Group members may be given specific parts of the speech to prepare. Visuals may be incorporated. Provide graphic organizers for researching and writing. Finally decide on rules as a class.

Back to Table of Contents

Extensions

Language Arts and Graphic Art:
Use contest materials from a *River of Words* to encourage the students to explore their ecosystem through art and words by writing poems, songs and stories relating to the hazardous waste issue.

Social Studies:
Create a map showing the number of hazardous waste sites currently found in each of the 50 states and identify industries responsible for one state's current hazardous waste problem (i.e. hog waste in North Carolina)

Performing Arts/ English:
View the appropriate clips from the recent movie ***"A Civil Action" (***the movie is rated "R" but careful editing should produce a useable clip.) If you are uncomfortable with the movie, you may choose to use the actual book by the same name instead. Compare and contrast the facts from the book and movie with actual facts. Research the Internet for technological innovations which would have impacted the outcome of this famous trial. Visit the web site of W.R. Grace to explore new information regarding the events of the book. Search the web for other points of view relating to the actual event. Attempt to determine which of the resources is more scientifically correct and valid.

Use EPA ***HazEd*** curriculum activities to experience the types of accidents and clean up techniques used in the actual incident. (A similar activity could be designed using free videos from actual waste sites free from the EPA.)

Community Service:
Tracking Toxic Dumpers -
Using Green Map guidelines and icons from the Internet site, students will create a Green Map of their county. In addition to "eco-friendly sites" such as nature trails, parks, etc. the maps could also show various "entertainment sites" for youth in the county such as arcades, bowling alleys, etc. Using the Internet site for EDF's ***Scorecard*** students may also locate the local polluters or "hot spots" in our neighborhoods and identify them on our map. The finished map should have color coded icons for each site as follows:

- green icons - eco-friendly sites
- yellow icons - entertainment sites
- red icons - hot spots

Using other information from the ***Scorecard*** site students can develop a Tool Kit for Tracking Toxic Dumpers to include: fact sheets regarding health impact, where to register a complaint and other environmental groups to network with. Included in the kit could also be guidelines for writing such letters as detailed on various Internet sites. The cover of the Tool Kit might display an appropriate quote such as:

"The Earth is not dying - it is being killed,
And the people who are killing it have names and addresses."

Utah Phillips

The finished maps and corresponding tool kits could be displayed in the community at local schools, libraries, or nature centers, etc. with free copies available for the public.

Back to Table of Contents

Assessment/Evaluation

Performance Assessment:
Analyze Local Pollution

Analyze local pollution problems and write a technical report predicting impact on local life forms and humans.

Each student analyzes the area within ½ mile radius of his home for specific pollution problems. The report should include specific problems located on a map of the area. Students will be graded on the map and the report, as detailed on the Assessment handout and grading criteria.

Back to Table of Contents

1999 Envirohealth Link Master Teacher Team:
Jennie Discepolo and Rosetta Jackson

References and Internet Resources For Assigned Roles in Hazardous Waste Debate

(Sign your name next to the resources you have selected to use)

Agency for Toxic Substances and Disease Registry Office of Children's Health
http://www.atsdr.cdc.gov/child/inventory.html
This reference lists more than 100 child health care projects and public health hazardous substances. Each chemical programs as well as priority lists of hazardous substances. Each chemical includes a public health statement which provides general information on the properties of the chemical and answer many health concerns that are voiced by community groups.
This is a good resource for the role of medical doctor.

National Institute of Environmental Health Sciences
http://niehs.nih.gov
NIEHS primary site features facts about environmental health diseases and risks from A to Z as well as fact sheets, pamphlets and environmental health questions and answers. The ToxFAQs page offers a quick and easy to understand guide which answers questions about exposure to hazardous substances found around hazardous waste sites and the effects of exposure on human health. This site also refers to an innovative K-9 curriculum ***ToxRAP*** for dissemination and teacher training.
Resource: Medical doctor/ parent of sick child

Manufacturing Net.Magazine
http://www.manufacturing.net/magazine/logistic/depts/hazmat
One of the nations leading experts on hazardous-materials transportation, attorney Lawrence W. Bierlein shares key lessons learned from a tragedy.
Resource: Lawyer>

Rachel's Environmental and Health Weekly
http://www.rachel.org
This environmental research foundation provides this electronic version of ***Rachel's Environment & Health Weekly*** free of charge. This weekly publication provides updates on major chemical, industry issues which affect public well-being, food, air, water and analyses the results of corporate philosophy.
Resource: Concerned Citizen; Environmental Activist **Izaak Walton League of America**
http://www.iwla.org
The leagues conservation staff tracks the progress of conservation and environmental legislation on Capitol Hill and follows federal agency regulatory actions that may be of interest to their members. The April 1999 issue focused on nuclear waste storage proposed site at Yucca Mountain Nevada, and discusses the issue of interstate waste disposal.
Resource: Izaak Walton Member

E Magazine
http://www.emagazine.com
The environmental magazine focuses on "Green Taxes" tax reform to save you money, help the environment and make polluters pay by interviewing an environmental tax crusader. They also look at the hazard waste transportation problem in an article entitled "Mobile Chernobyl's" focusing on toxic trains.
Resource: Environmental Economist

Fair Online
http://www.fair.org.
This national media watch group offers well documented criticism of media bias and censorship. Their book review of ***Behind the PR Curtain*** by Sharon Beder identifies the sophisticated strategies corporations employ to avoid environmental regulatory oversight.
Resource: Media

Greenpeace
http://www.greenpeace.org
The overview ***Slowly Poisoning the Planet***, is part of the Greenpeace Toxics Campaign which is a human effects overview focusing on the wildlife/human link, GPI, and Clean Production.
Resource: Environmental Activist

Hazmat Safety Homepage
http://www.hazmat.dot.gov
DOT's office of hazardous materials safety coordinates a national safety program for transportation of hazardous materials.
Resource: Federal Agency Representative

Center for a New American Dream
http://www.newdream.org
This not-for-profit membership-based organization helps individuals and institutions reduce and shift consumption to enhance our quality of life and protect the environment. It is an excellent guide to resources and programs for sustainable living. It offers sample letters to write to the industrial CEO.
Resource: Concerned Citizen (focus Sustained Living)

Global Response
http://www.globalresponse.org
This environmental action and education network offers letter writing tips as well as pages for teens, kids and teachers. Here's how it works. GR issues action bulletins about a specific environmental crisis somewhere in the world and explains how students can help. An index of past actions and successes is provided.
Resource: Concerned kids/teens groups

EPA's Office of Enforcement and Compliance Assurance (OECA)
http://www.epa.gov/oeca/sfi
This web page lists companies that have been fined by the EPA. It also includes demographic data for the surrounding three miles, such as racial mix, educational status and income levels of residents.
Resource: Ethnic Groups (focus polluting in lower income areas, ethnic neighborhoods,, racial issues)

Base Action Network
http://www.ban.org
This is the Internet home of Basel Action Network (BAN), an international network of activists seeking to put an end to the export and dumping of hazardous wastes from rich industrialized countries to poorer less industrialized countries.
Resource: Activist Groups

Name _____ Date _____

Hazardous Waste Activity Sheet

Moving Experience Questions
Answer the following questions based on your observations during the "movement of hazardous waste lab activity."

1. Where did the contaminant pumped from the ground water come from?

2. How was the contaminant transported?

3. Were both the lake and the ground water impacted by the contaminant?

4. Was it easy to clean up the contaminated ground water? Explain how you cleaned it up and how long it took.

5. What would have happened if the water was not cleaned?

6. Design an experiment to test your answer to the previous question.

Discussion Groups

Rejoin your investigative group to discuss the following questions:

1. Discuss the transportation and disposal of hazardous wastes produced in your community. Are hazardous wastes transported past your school? Are waste disposal areas able to safely handle your community's hazardous waste? What could be done to reduce the risk of exposure to hazardous waste in your community? What could be done to reduce the amount of business and household hazardous waste in your community?

2. What can you do? Work with your group to design an action plan. Possible action plans could include:
    - Organize a hazardous waste awareness day.
    - Encourage participation in hazardous waste recycling.
    - Use the Scorecard Web site to find out which companies are polluting your community. Select a way to make this information available to the public.

Sample answers for questions 1-6:

1. From the spill located on the opposite side of the lake.
2. By water.
3. Yes, both lake and ground water were impacted.
4. No. It took a lot of water and time to pump the contaminate out.
5/6. Drinking water might become contaminated; animals in the habitat become sick or die.

Name_____ **Date**_____

Tracking Toxics Performance Assessment

Analyze Local Pollution

Detailed Description

Each student analyzes his/her neighborhood, defined as half-mile radius of home or school, for specific local pollution problems (hazardous wastes, chemical run-off, air quality) and; more global pollution problems (ozone depletion, global warming). Student will construct a graphic organizer to organize key points, supporting information, and details for a technical report. The report will explain findings of the student research and predict the long-range impact (next 35 to 50 years) if current trends continue. The technical report includes:

1. Identification of specific pollution problems in the neighborhood located on a map and explained in detail in the report itself.
2. Identification of current global problems impacting the area.
3. Explanation of how these factors impact the health, economics, and attitudes of humans in the area.
4. Illustrate how the factors currently impact three plant forms, three insect forms, a specific bird species, and a mammal.
5. Justified prediction of how each species will be specifically impacted if the pollution continues.
6. Recommendations for changes to be made and how the changes will impact the health, economics, and attitudes of the humans in the area.

Student Grades on: Map, Technical Report
Time to complete: 3 weeks

Grading Criteria
Specific expectations
- Showing understanding of how pollution affects life forms.
- Correctly identified local species, local pollution, and global pollution.
- Predictions of impact reasonable and justified.
- Recommendations for change justified and consequences of change logical.

General Expectations:
- Format neat and orderly, complete and accurate, organized, correctly spaced.
- Correct mechanics (spelling, punctuation, capitalization).
- Sentences complete, proper word choice, easy to follow.
- Map complete, clear and attractive.
- Followed directions (on time, as assigned).

Three Mile Mess
Nuclear Radiation

(Grades 6-12)

Table of Contents

Overview

On March 28, 1979, a nuclear power plant in Pennsylvania named Three Mile Island malfunctioned sending a burst of radiation into the air. The disaster was the first disaster of its kind in the United States. While nuclear power plants offer a clean and relatively inexpensive supply of energy, the potential side effects of malfunctions such as the one experienced at Three Mile Island, are deadly.

The following four or five-day lesson will use the Three Mile Island incident as a means to inform students of the effects of radiation on the surrounding environment. Students will conduct an Internet research project to learn more about radiation, cancer and Three Mile Island.

Back to Table of Contents

Technology Resources

Internet Sites:

"Meltdown at Three Mile Island" website by PBS

http://www.pbs.org/wgbh/amex/three/

This site details the PBS special, "Meltdown at Three Mile Island." The site provides background information, a complete transcript, maps of nuclear sites, diagrams of the reactor overload, and teacher resources for use in the classroom.

Frontline: Nuclear Reaction
http://www.pbs.org/wgbh/pages/frontline/shows/reaction/
This site contains extensive information about radiation and nuclear power. This site includes interactive quizzes and maps, and a frequently asked questions section which helps dispel misconceptions regarding radiation health concerns.

Question and Answers about Nuclear Energy
http://www.nuc.umr.edu/~ans/QA.html
This site contains frequently asked questions and short, easy to understand responses to those questions. Definitions of radiation as well as a description of environmental impacts are included.

Scorecard
http://scorecard.org/
Offers a good explanation of pollution scorecards on the net.

Inside Three Mile Island
http://www.wowpage.com/tmi/
This site is a minute by minute account of the event at Three Mile Island. Viewers can examine detailed diagrams of the power plant.

Three Mile Island 1: A detailed site by NRC
http://www.nrc.gov/AEOD/pib/reactors/289/289toc.html
This site by the Nuclear Regulatory Commission provides extremely detailed information about the power plant from the blueprints to actual emergency plans. This is an official site.

Video Resources
Meltdown at Three Mile Island (PBS: 1 hour)

Software Resources
Microsoft PowerPoint
http://www.microsoft.com/powerpoint/

Back to Table of Contents

Teacher Background Information

Three Mile Island is a nuclear power plant located on the Susquehanna River near Harrisburg, Pennsylvania. In the early spring of 1979, the core began to malfunction. Plant operators intervened and nearly caused a nuclear meltdown. A total nuclear meltdown occurs when the core of the nuclear reactor gets so hot that it turns into a molten mass and plunges through the plant floor. The core continues into the earth's crust, mixing with the ground water along the way, and sends a superheated, radioactive cloud into the atmosphere. The radiation cloud, guided by the wind, bring harmful effects to everything in its path. Fortunately, Three Mile Island suffered only a partial meltdown.

The purpose of this lesson is to teach students about nuclear energy by examining the Three Mile Island disaster. Students need to be familiar with other forms of energy in order to understand the reasons for choosing nuclear energy as an alternative. Students will use the Internet sites listed on the "Oral report Guideline Sheet" and work in cooperative groups to research several topics related to radiation, nuclear energy, and Three Mile Island. The product of the student's research will be a cumulative oral report. Students will take notes on the sections with which they are not familiar and gain a comprehensive understanding of each topic. Students will complete a post-assessment activity using their research and notes.

Back to Table of Contents

Learning Objectives

Students will be able to:

- **Brainstorm and predict** possible outcomes of the Three Mile Island incident.
- **Analyze and summarize** the crisis at Three Mile Island to determine the environmental impact.
- **Explain** how and why nuclear energy is used.

Back to Table of Contents

MSPAP/Core Learning Goals

(MSPAP vocabulary is highlighted within the learning objectives above.)

Goal 2: Concepts of Earth/Space Science: The student will demonstrate the ability to use scientific skills and processes to explain the physical behavior of the environment, earth and the universe.
Expectation 8

- **Goal 4: Concepts of Chemistry:** The student will demonstrate the ability to use scientific skills and processes to explain composition and interaction of matter in the world in which we live
  Expectation 2, 3

Vocabulary

Atom - The smallest part of an element that still has all properties of that element.
Background Radiation – Radiation that comes from natural sources and is always present in the environment. Average annual dose of background radiation for an American is 360 millirems.
Chain Reaction – When neutrons produced from one fission event cause another fission event to occur. A continuing series of these reactions takes place inside a nuclear reactor.
Fission – The process of splitting a heavy atom into two or more lighter atoms. The process generates a large amount of energy.
Mrem (millirem) – A unit of radiation dose that measures the amount of damage to human tissue due to the dose.
Radiation – Particles or rays emitted by radioactive substances from unstable nuclei of atoms.

Back to Table of Contents

Equipment and Materials

Per class:

- TV and VCR
- Video tape of "***Meltdown at Three Mile Island***"
- Overhead Projector

Per investigative team of 3-4:

- Computer with modem and Internet Access
- Three Mile Mess: Oral Report Internet Guidelines Sheet

Per student:

- The Nuclear Power Puzzle: Background Information Sheet
- The Nuclear Power Puzzle: Puzzle Sheet
- Three Mile Mess: Post Assessment Activity

Back to Table of Contents

Procedure

Procedures
ACTIVITY 1: Creative Writing about Three Mile Island Video

Focus for Viewing
The focus of viewing is a specific responsibility or task(s) students are responsible for during or after watching the video, to focus and engage students' viewing attention. To give students a specific responsibility while viewing ***Meltdown at Three Mile Island***, each student will be required to take notes in order to write a creative short story predicting the outcome and consequences of the Three Mile Island incident.

Viewing Activities
BEGIN at the title screen, which appears after a brief sponsor advertisement. The narrorator begins by introducing the program and describing the setting. Notify students that they will be required to answer the questions, "Where is Three Mile Island?" and "What happened as a result of the water supply being shut off?" Post these questions on an overhead projector or on the chalkboard. The narrator shifts tones and sets up the disaster about to unfold.

STOP the video after the narrator says,"…the nuclear core began to overheat." This occurs immediately after discussion of the water systems failing in the nuclear reactor. Ask students to respond to the previous questions.

Post-Viewing Activity

Students will use the information seen in the video and written in their notes to write a short story, create a story map or create a sequence chain predicting what will happen at Three Mile Island. Make the video clip available to students who may want to watch it again. Students will use peer response in order to edit and revise their short story. Students will share their stories at home with an adult and, in the process, conduct an interview to inquire about the adult's recollection of the events of Three Mile Island. Students are encouraged to interview more than one adult. Students will bring the results of their interviews to class to use for the next activity.

ACTIVITY #2: Radiation Oral Report

Students will work cooperatively as a group and as a class to present an oral report on nuclear energy, radiation and Three Mile Island. Separate students into groups so that there are 8 groups for this activity. Assign each group a topic from the "Nuclear Power Puzzle" worksheet and assign one group to research the Three Mile Island incident. Students will be responsible for gathering information for their topic from the websites listed on the worksheet. Students must respond to each of the sub-topic questions **and** find some additional information on their topic. Students will conduct research for 1-½ class periods. They will organize their presentation during the last half of the third day and present their information on the fourth. Students may present in person, on videotape, or with the aid of Microsoft PowerPoint. The presentations will complete the "Puzzle" which is organized to provide a comprehensive explanation of nuclear power.

Extensions

Math

Students will study the shape of nuclear reactors, hyperbolas. Students will investigate the equations and graphs of hyperbolas. Students will also research the reasons behind the hyperbolic shape of a nuclear steam towers. Students will also calculate the energy and cost savings based on nuclear power usage compared to other forms of energy.

English

Student will write business letters to local power plants inquiring about the plant's history, safety procedures and emergency plans. Students will use the "Three Mile Mess: Reference Sheet" for address information.

Social Studies

Students will research the impact of nuclear power on society by focusing on the pros and cons of nuclear power via an Internet search. Students will investigate how nuclear protests were spawned from lack of public understanding regarding nuclear power. Several social impact questions are available at the PBS website at nttp://www.pbs.org/wgbh/pages/amex/three/filmmore/index.html.

Art

Student's could construct a model of a nuclear power plant, create a drawing depicting the potential nuclear disaster at Three Mile island, or create posters that support or reject nuclear energy.

Field Trip

Students will take a trip to Calvert Cliffs nuclear facility in southern Maryland. Students will tour the facility and learn more about nuclear energy.

Back to Table of Contents

Assessment/Evaluation

Students will complete a post assessment activity. The worksheet "Three Mile Mess: Post Assessment Quiz" requires students to write about facts that they obtained from their research and from the oral report presentation. Students will also be asked to offer opinions based on their learning. The post assessment activity should be given as homework assignment or on the fifth day of the lesson.

Back to Table of Contents

1999 EnviroHealth Link Master Teacher Team:
Bill Barnes & Jeremy Carlino

Three Mile Mess: Oral Report Internet Resource Sheet

Directions: Your group has been assigned a topic from the "Nuclear Power Puzzle" worksheet. Use the Internet sites listed below to prepare a short presentation on the material. You will have five minutes to present your information.

Websites about Three Mile Island

- The American Experience: Meltdown at Three Mile Island
  http://www.pbs.org/wgbh/pages/amex/three/index.html
- The American Experience: Meltdown at Three Mile Island
  http://www.pbs.org/wgbh/pages/amex/three/sfeature/index.html
- Inside Three Mile Island
  http://www.wowpage.com/tmi/
- The American Experience: Meltdown at Three Mile Island
  http://www.pbs.org/wgbh/pages/frontline/shows/reaction/interact/
- The American Experience: Meltdown at Three Mile Island
  http://www.pbs.org/wgbh/pages/amex/three/maps/index.html
- Three Mile Island 1
  http://www.nrc.gov/AEOD/pib/reactors/289/289toc.html

Websites about Nuclear Energy

Questions and Answers about Nuclear Energy
http://www.nuc.umr.edu/~ans/QA.html

- The American Experience: Meltdown at Three Mile Island
  http://www.pbs.org/wgbh/pages/frontline/shows/reaction/

Websites about Radiation

- Questions and Answers about Nuclear Energy
  http://www.nuc.umr.edu/~ans/QA.html
- The American Experience: Meltdown at Three Mile Island
  http://www.pbs.org/wgbh/pages/frontline/shows/reaction/interact/facts.html

Websites about Environmental Impacts of Nuclear Energy

- Questions and Answers about Nuclear Energy
  http://www.nuc.umr.edu/~ans/QA.html
- The American Experience: Meltdown at Three Mile Island
  http://www.pbs.org/wgbh/pages/frontline/shows/reaction/

Names:

_____

_____

Three Mile Mess: Post Assessment Activity

Directions: You have researched important information about nuclear energy, radiation, and the events of Three Mile Island. Work with a partner to complete the following questions. Make sure that you give specific examples for each question. You may use your notes, your partner's notes, and share experiences from web searches and adult interviews.

1. What happened at Three Mile Island and why is it a significant event in the development of nuclear energy?

2. What is radiation and how does it impact the environment?

3. It has been claimed that nuclear power is "clean, safe, and abundant."

    a. Discuss this statement from the standpoint of a nuclear power proponent.

    b. Discuss this statement from the standpoint of a nuclear power opponent.

4. Do you believe that we should continue to use nuclear energy based on the pros and cons presented during the oral report? Site specific examples to support your opinion.

INTERNET RESOURCES

internet resources

The Internet is undergoing constant change and rapid growth. Web site addresses (URL's) can change suddenly. Use a search engine to locate a site if the URL appears to be incorrect, and please e-mail Cynde at cyndemutryn@mpt.org with any corrections!

It must be emphasized that these Internet resources are greatly enhanced in the educational setting when teachers can knowledgeably guide students' use and effectively integrate information, entertainment, and resources into current curricular themes.

Choose the section you'd like to look at:

Search Engines

There are many ways to search the Internet. One way is to look at a large "Table of Contents," such as the web sites below which are designed to go out onto the Internet and search the Web's hundreds of thousands of other servers for information requested. Search engines are like electronic scouts that do nothing but search and tell people what can be found and where. Please note that search engines are NOT the same: if you are unable to locate a site on one, try another, and another...!

- Dogpile http://www.dogpile.com/
- Yahoo http://www.yahoo.com
- Yahooligans http://www.yahooligans.com/
- Internet Sleuth http://www.isleuth.com/

Environmental Health Resources

- Maryland Public Television http://www.mpt.org/
- Johns Hopkins University - School of Hygiene & Public Health http://www.jhsph.edu/
- The National Institute of Environmental Health Sciences http://www.niehs.nih.gov/
- K-12 Environmental Health Science Education Web Site http://www.niehs.nih.gov/od/k-12/k12home.htm
- Exploring the Environment http://www.cotf.edu/ete/
- Institute for Environmental Toxicology http://www.iet.msu.edu/
- Environmental Health Perspectives http://ehpnet1.niehs.nih.gov/EHPhome.html
- Environmental Health Clearinghouse http://infoventures.com/e-hlth/
- Starfish - Educational Resource for Sustainability http://www.starfish.org/
- Center for Occupational & Environmental Medicine http://www.coem.com/
- Children's Environmental Health Network http://www.cehn.org/
- Sharing Environmental Education Knowledge http://www.seek.state.mn.us/
- The Microbe Zoo http://commtechlab.msu.edu/sites
- ThinkQuest's "Dangerous Little Monsters Under the Microscope" http://library.advanced.org/11743
- American Environmental Health Foundation http://www.aehf.com/
- Earth Watch Field Research http://www.earthwatch.org/ed/home.html
- Nuclear Science and Technology http://shell.rmi.net/~jgraham/Nuclear_Science.html
- Radiation and Us http://www.sph.umich.edu/group/eih/UMSCHPS/radrus.htm
- Chernobyl: A Nuclear Disaster http://tqd.advanced.org/3426/
- U.S. EPA Office of Air and Radiation Basic Facts Web Page http://www.epa.gov/oar/oarfacts.html
- Radon in Earth, Air and Water http://sedwww.cr.usgs.gov:8080/radon/radonhome.html
- Toxic Waste Internet Resources http://www.igc.org/igc/issues/tw/or.html
- Ozone Depletion http://solstice.crest.org/environment/eol/ozone/ozone.html
- Ozone ACTION http://www.ozone.org/
- Educating Young People About Water http://www.uwex.edu/erc/ywc/
- The Environmental Protection Agency, Office of Water http://www.epa.gov/OGWDW/programs.html
- Office of Ground Water and Drinking Water http://www.epa.gov/OGWDW/index2.html
- Drinking Water: Kids' Stuff http://www.epa.gov/OGWDW/kids/
- Facts about Water http://www.epa.gov/OW/facts-quotes/facts.html
- The Water Quality Association Home Page http://www.wqa.org
- Water: A Never - Ending Story
- Surf Your Watershed http://www.epa.gov/surf2/
- Give Water a Hand http://www.uwex.edu/erc/
- River of Words http://www.irn.org/row
- Take A Cool Tour of Water http://www.nwf.org/nwf/kids/cool/index.html
- WetNet http://www.wetlands.ca/
- Wetlands Round Table Unit
- Louisiana Coastal Erosion Interactive Lesson Plan http://www.leeric.lsu.edu/index3.htm
- Clean Water Act http://even.tamuk.edu/cwa/
- Scorecard http://www.scorecard.org
- U.S. EPA AirLinks (Gateway to Air Pollution Information) http://www.epa.gov/airlinks/
- Snapshots of Science & Medicine http://science-education.nih.gov/snapshots.nsf
- BrainPOP http://www.brainpop.com/

Environment

- The Environmental Protection Agency's web site http://www.epa.gov
- EPA Students and Teachers Page http://www.epa.gov/epahome/students.htm
- EPA Student Center http://www.epa.gov/students/
- EPA Kids' Page http://www.epa.gov/OGWDW/kids/index.html
- A Citizen's Guide To EPA's Superfund Program http://www.epa.gov/unix0008/sf/citizen.html
- Enviroene http://es.epa.gov/index.html
- Common Chemicals Found at Superfund http://www.epa.gov/docs/oerrpage/superfnd/web/oerr/atsdr/index.htm
- Region 3 Superfund Sites http://www.epa.gov/reg3hwmd/super/npllist.htm
- The Environmental Defense Fund http://www.edf.org/
- The Environmental Education Network http://www.envirolink.org/enviroed/
- Environmental Working Group http://www.ewg.org/
- The Texas Environmental Center: Internet Resources http://www.tec.org/tec/othernews.html
- The Global Recycling Network http://grn.com/grn/
- The Academy of Natural Sciences Environmental Research Division http://www.acnatsci.org/erd/ea/KYE_mainpage.html
- World Resources Institute Environmental Education Pagehttp://www.wri.org/wri/enved
- InfoJump Environment and Nature http://www.dominis.com/Zines/ByCategory/Environment/
- Science and the Environment E-Journal http://www.voyagepub.com/publish/voyage.htm
- Environmental Database for Schools http://www.soton.ac.uk/~engenvir/
- Environmental Contaminants Encyclopedia http://www.aqd.nps.gov/toxic/
- EnviroNet http://earth.simmons.edu/
- EE-Link http://eelink.net/
- The Amazing Environmental Organization Web Directory http://www.webdirectory.com/
- Rivendell Educational Archive http://www.watson.org/rivendell/index.shtml
- Grounds and Gardens http://www.newhorizons.org/gng_intr.html
- E-Patrol http://www.sprint.com/epatrol/
- The Evergreen Project Adventures http://www.mobot.org/MBGnet
- Environmental and Energy Daily News http://www.serve.com/commonpurpose/news.html
- Living Things http://www.fi.edu/tfi/units/life/
- Center for Environmental Education at Antioch New England http://www.cee-ane.org
- Environmental Literacy Council http://www.enviroliteracy.org
- The GLOBE http://www.globe.gov
- Sierra Club Environmental Education http://www.sierraclub.org/
- ERIC Clearinghouse for Science, Mathematics, and Environmental Education http://www.ericse.org
- Bureau of Land Management's Environmental Education Homepage http://www.blm.gov/education/education.html
- NOAA Environmental Information Services http://www.esdim.noaa.gov
- Earth Force http://www.earthforce.org/
- The Clean and Green Club http://www.worldkids.net/clubs/green/
- The Earth Angels http://members.aol.com/Halo4Earth/index.html
- SEAC: Student Environmental Action Coalition http://www.seac.org
- Sierra Student Coalition http://www.ssc.org
- EPA Student Center http://www.epa.gov/students
- Free the Planet! http://www.essential.org/freetheplanet
- MY DNR www.dnr.state.md.us/mydnr
- Sustainable Development Timeline http://iisd.ca/timeline/

Health/Medicine

- InteliHealth http://www.intelihealth.com/IH/ihtIH
- National Center for Health Education (NCHE) http://www.nche.org
- Martindale's Health Science Guide http://www-sci.lib.uci.edu/HSG/HSGuide.html
- HealthAtoZ http://www.healthatoz.com/
- Medical Matrix http://www.slackinc.com/matrix/
- American Medical Association Site http://www.ama-assn.org/
- Mayo Clinic's Health Oasis http://www.mayohealth.org/
- National Jewish Medical and Research Center http://www.NationalJewish.org
- MedicineNet http://www.medicinenet.com/
- KidsHealth.Org http://kidshealth.org/index2.html
- Bandaids and Blackboards http://funrsc.fairfield.edu/~jfleitas/contents.html
- Maryland Dept. of Health and Mental Hygiene http://www.dhmh.state.md.us/
- Go Ask Alice! http://www.goaskalice.columbia.edu/
- OnHealth.com: Your Personal Guide to Health http://www.onhealth.com/ch1/index.asp
- Longevity Game! http://www.northwesternmutual.com/games/longevity/longevity-main.html
- KidSource Online for Healthcare http://www.kidsource.com/
- Health Information Resources http://nhic-nt.health.org/AlphaKeyword.htm
- HealthFinder http://www.healthfinder.gov/
- National Women's Health Information Clearinghouse http://www.4woman.org/
- The Wellness Web: The Patient's Network http://www.wellweb.com/
- drkoop.com http://www.drkoop.com/
- American Medical Association Health Insight http://www.ama-assn.org/insight/gen_hlth/atlas/torso/navbar.htm
- WebMedLit http://www.webmedlit.com/
- Personal Trainer http://www.itdc.sbcss.k12.ca.us/curriculum/personaltrainer.html
- Emerging Infections Information Network http://www.info.med.yale.edu/
- Neuroscience for Kids http://weber.u.washington.edu/~chudler/neurok.html
- BioTech http://biotech.icmb.utexas.edu/
- Access Excellence http://www.accessexcellence.org/
- Cells Alive! http://www.cellsalive.com/
- The Cell http://tqd.advanced.org/3564/
- Body Systems Web Resources for Students http://www.stemnet.nf.ca/CITE/systems.htm
- Human Anatomy Online http://www.innerbody.com/htm/body.html
- Human Anatomy Online II http://www.gsm.com/products/hastud.htm
- Teach Your Patients About Asthma http://www.meddean.luc.edu:80/lumen/MedEd/medicine/Allergy/Asthma/asthtoc.html
- American Academy of Allergy, Asthma, and Immunology http://www.aaaai.org
- American College of Chest Physicians (ACCP) http://www.chestnet.org/
- Asthma Management Handbook http://hna.ffh.vic.gov.au/asthma/amh/amh.html
- Claritin Allergy Report Web Site http://www.allergy-relief.com/index.php3
- Allergy and Asthma FAQ http://www.cs.unc.edu/~kupstas/FAQ.html
- Pollen Allergy Info http://www.hoptechno.com:80/book46.htm
- The Real Scoop on Tobacco http://www.itdc.sbcss.k12.ca.us/curriculum/tobacco.html
- Foundation for a Smoke-Free America http://tobaccofree.com
- Tobacco-Related Internet Resources http://www.tobacco.org/Resources/tobsites.html
- The Food and Nutrition Information Center http://www.nal.usda.gov/fnic

- Tufts University Nutrition Navigator http://navigator.tufts.edu/
- The Nutrasweet Homepage http://www.nutrasweet.com/html/home.html
- A Recall on the Drug Aspartame http://www.dorway.com/recall.html
- International Food Information Council (IFIC) http://ificinfo.health.org/brochure/food-add.htm
- Food Additives and Processing Aids http://ifse.tamu.edu/CKNOWLEDGE/FoodAdditives.html
- Food Risks: Perception vs. Reality http://vm.cfsan.fda.gov/
- Food Finder http://www.olen.com/cgi-bin/food2
- Food Zone http://kauai.cudenver.edu
- University of Pennsylvania OncoLink http://cancer.med.upenn.edu/
- Fact Sheets from the National Cancer Institute http://wwwicic.nci.nih.gov/clinpdq/facts.html
- CancerNet http://cancernet.nci.nih.gov/
- Cancer Research Foundation of America http://www.preventcancer.org/
- Cancer Resource Center http://www.mayo.ivi.com/mayo/common/htm/canhpage.htm
- American Institute for Cancer Research http://www.aicr.org
- SunGuardMan Online http://www.SunGuardMan.org/core.html

Science

- Eisenhower National Clearinghouse http://www.enc.org/
- Internet Resources for Science and Mathematics Education http://www.inform.umd.edu/UMS+State/UMD-Projects/MCTP/Technology/MCTP_WWW_Bookmarks.html
- The Guide (to Math and Science Reform) http://www.learner.org/theguide
- Maryland Association of Science Teachers Online http://mast.walkersville.fr.k12.md.us
- CRPC GirlTECH Lesson Plans http://www.crpc.rice.edu/CRPC/Women/GirlTECH/Lessons/
- TERC http://www.terc.edu/
- Oasis http://www-co-cas.colorado.edu/oasis/
- Electronic Games for Education in Math and Science http://www.cs.ubc.ca/nest/egems/home.html
- The Explorer http://explorer.scrtec.org/explorer/
- Newton's Apple http://www.askeric.org/Projects/Newton/
- Nova Odyssey of Life http://www.pbs.org/nova/teachers
- National Science Teachers Website http://www.nsta.org/
- Math and Science Gateway http://www.tc.cornell.edu:80/Edu/MathSciGateway/
- "Possibilities! - Using the Internet in the Science Classroom." http://kendaco.telebyte.com/billband/Possibilities.html
- The Center for Science Education http://cse.ssl.berkeley.edu/
- Science Education and the Internet http://www.acs.oakland.edu/~eabyrnes/webthesis.html
- Global Lab http://globallab.terc.edu/home.html
- Al Bodzin's Home Page http://www.ncsu.edu/servit/bodzin/
- "Incorporating the World Wide Web in the Science Classroom" http://unr.edu/homepage/jcannon/
- Ronald J. Riley's Invention/Inventors Site http://www.rjriley.com/
- The Science Teachers Lounge http://www.deepwell.com/ccimino/
- The Australian Virtual Science and Technology Center http://mag-nify.educ.monash.edu.au/
- Joan Berger's (INCREDIBLE LIST OF) Science Web Sites http://www.inform.umd.edu/mdk-12/resource/www/science.html
- 1999 Carolina® Science and Math http://www3.carolina.com/general/Cat.htm
- Science Learning Network http://www.sln.org/
- Schoolnet http://www.schoolnet.ca/
- Sympatico http://www1.sympatico.ca/home
- Science Update & Why Is It? http://www.aaas.org/EHR/Sciup/documents/home.html
- The Why Files http://whyfiles.news.wisc.edu/welcome
- Exploratorium http://www.exploratorium.edu/
- Science Web Goes to the Movies http://scienceweb.dao.nrc.ca/movies/movies.html
- Ontario Science Centre http://www.osc.on.ca/
- SCIENCE HOBBYIST http://www.amasci.com/
- Mad Scientist http://www.madsci.org/
- IMSENET: Instructional Materials in Science Education http://www.ncsu.edu/imse/
- Access Excellence: A Place in Cyberspace for Biology Teaching & Learning http://www.gene.com/ae/
- Chem-4-Kids http://www.chem4kids.com
- Chem Team http://dbhs.wvusd.k12.ca.us/ChemTeamIndex.html
- MIT Chemistry Review http://www.med.unibs.it/~marchesi/review.html
- PALS http://pals.sri.com
- Using the Internet as an Effective Science Teaching Tool http://www.gsu.edu/~mstjrh/nsta.html
- The Brainium http://corp.brainium.com/

- Living Things http://www.fi.edu/tfi/units/life/
- ERIC Clearinghouse for Science, Mathematics, and Environmental Education http://www.ericse.org

Addendum

- Snapshots of Science & Medicine http://science-education.nih.gov/snapshots.nsf
- BrainPOP http://www.brainpop.com/
- MY DNR http://www.dnr.state.md.us/mydnr
- SunGuardMan Online http://www.SunGuardMan.org/core.html
- Learning About Urban Heat Islands http://EETD.LBL.gov/HeatIsland/LEARN/
- Sustainable Development Timeline http://iisd.ca/timeline/
- National Library of Medicine's PubMed http://www.ncbi.nlm.nih.gov/PubMed/
- The Online Medical Dictionary http://www.graylab.ac.uk/omd/
- The Visible Human Viewer http://www.npac.syr.edu/projects/vishuman/VisibleHuman.html
- AltaVista Translations http://babelfish.altavista.com/
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