

MIDDLE SCHOOL LABORATORY SAFETY MANUAL

2023

DISCLAIMER

The materials in this manual have been compiled from sources believed to be reliable and to represent the best current opinions on the subject in

order to provide a basic safety manual for use in Richmond County schools. This manual is intended to provide basic guidelines for safe practices and does not purport to specify minimum legal standards.

Therefore, it cannot be assumed that all necessary warnings and precautionary measures are contained within this document and that other or additional measures may not be required.

Note: This manual was originally created by Nathalie Thrash.

SECTION 1: PROFESSIONAL AND LEGAL RESPONSIBILITIES

Safety in the science classroom requires thorough planning, careful management, and constant monitoring of student activities. Teachers should be knowledgeable of the properties, possible hazards, and proper use and disposal of all materials used in the classroom. This information is available through Materials Safety Data Sheets (MSDS; See Appendix C). Federal law requires

that vendors of laboratory chemicals provide an MSDS for each substance they sell. The sheets provide detailed information about the physical and chemical properties, proper storage, disposal, toxicology, etc., of substances. The law also requires that MSDSs be available at the worksite.

Support for laboratory safety programs is the responsibility of school system administrators. School system administrators should appreciate the need for establishing safety and health instruction as a fundamental part of a science curriculum and should operate their schools in as safe a manner as possible. All safety programs must actively involve the school administrators, supervisors, teachers, and students, and all have the responsibility for safety and health of every other person in the laboratory and school.

1.1 Stakeholders' Responsibilities

1.1.1 Emergency Procedures

- Make sure emergency contact numbers are displayed prominently in all laboratory areas.
- Identify all students with chronic conditions that may place the student in danger in a laboratory setting (serious food and substance allergies, blindness, deafness, epilepsy). These students MAY NOT be excluded from laboratory activities, and appropriate accommodations must be made to enable them to participate.
- All schools must have a written safety plan that includes procedures for first-aid, electric shock, poisoning, burns, allergic reactions, fire, evacuations, spills, or animal bites. All teachers should have a copy of these procedures readily available in the laboratory.
- All teachers must undergo mandatory training in how to respond to emergencies in the laboratory setting.

1.1.2 Administrators' Responsibilities

- Provide a safe and effective laboratory area for science activities.
- Provide safety items and ensure they are in good condition.
- Provide regular inspections of the laboratory.
- Document inspection and maintenance of safety equipment.
- Develop a chemical hygiene plan.
- Become familiar and comply with **O.C.G.A 45-22-2– Public Employee Hazardous Chemical Protection and Right to Know Act of 1988**.
- Become familiar and comply with state and federal regulations for the procurement, use, storage, and disposal of chemicals.
- Establish a school safety committee and ensure that it meets regularly.
- Attempt to provide a class size appropriate to the laboratory and in keeping with recommendations of professional societies.
- Provide time for and monitor participation in mandatory safety training for science teachers, administrators, public safety officers, and maintenance personnel.

1.1.3 Teachers' Responsibilities

- Set a good example by observing all safety rules, wearing proper protective equipment, and being enthusiastic about safety.
- Know the properties and hazards associated with each material used in a laboratory activity before the students carry out the procedure.
- Ensure that all safety equipment is present in the laboratory and is in good working condition.
- Provide eye protection and other necessary personal protective equipment for students and instruct students in their use.
- Before each laboratory experiment, instruct students about the hazards associated with each activity. Reemphasize the use of eye protection and other necessary personal protection equipment.
- Ensure that all containers are properly labeled with their contents and hazards (section
- Make sure that all safety rules are obeyed.
- Promptly clean up or direct the clean-up of spilled chemicals and remains of biology experiments.
- Dispose of chemical and biological wastes properly.

- Return laboratory equipment and chemicals to a locked storeroom after use.
- Comply with the procedures in the school chemical hygiene and safety plans.
- Report any accidents or unsafe conditions in writing to your department chairperson, principal, AND other appropriate administrators.

1.1.4 Students' Responsibilities

- Understand the experimental procedure before starting to work in the laboratory.
- Be familiar with the hazards of the equipment, materials, and chemicals with which you are working.
- Sign a safety contract and obey all safety rules and regulations.
- Know the location and know how to use of all safety equipment in the laboratory.
- Clean your work area immediately after use. Obey good housekeeping practices.

1.1.5 Parents' Responsibilities

- Read the laboratory safety rules. Discuss these rules with your child.
- Sign the safety contract indicating that you have read and understood the safety rules.
- Work with the teachers and administration at your school to develop a strong safety program.

1.2 Legal Responsibilities

The legal definition of "negligence" is important for every teacher to know. **Negligence**, as defined by the courts today, **is conduct that falls below a standard of care established by law or profession to protect others from an unreasonable risk of harm, or the failure to exercise due care.**

The science teacher has three basic duties relating to the modern concept of negligence:

- Duty of instruction.
- Duty of supervision.
- Duty to properly maintain facilities and equipment.

1.2.1 Duty of Instruction

Duty of instruction includes adequate instruction before a laboratory activity (preferably in writing) that is accurate; is appropriate to the situation, setting, and maturity of the audience; and addresses reasonably foreseeable dangers. Regardless of the grade level being taught, all teachers should

- provide sufficient instruction to make the activity and associated risks understandable, and demonstrate the essential portions of the activity.
- provide prior warning of any hazards associated with an activity.
- control access to materials and equipment having the potential for harm or misuse (e.g., chemicals, heat sources, sharp objects)

1.2.2 Duty of Supervision

Duty of supervision includes adequate supervision as defined by professional, legal, and district guidelines to ensure students behave properly in light of any foreseeable dangers.

Points to remember include:

- Misbehavior of any type must not be tolerated.
- Failure to prevent accidents, instruct students, supervise students, or act appropriately in the event of an emergency is grounds for liability.
- The greater the degree of hazard the higher the level of supervision should be.
- The younger the age of students or the greater the degree of inclusion of special population students, the greater the level of supervision should be.
- Students must never be left unattended, except in an emergency where the potential harm is greater than the perceived risk to students. Risk should be minimized or responsibility transferred to another authorized person if the situation allows.

1.2.3 Duty of Maintenance

Duty of maintenance includes ensuring a safe environment for students and teachers. This requires that teachers:

- never use defective equipment for any reason.
- file written reports for maintenance/correction of hazardous conditions or defective equipment with responsible administrators.
- establish regular inspection schedules and procedures for checking safety and first-aid equipment.

- follow all safety guidelines concerning proper labeling, storage, and disposal of chemicals.
- keeping files of all hazard notifications and maintenance inspections, teacher liability in the event of an accident is minimized in cases where no corrective actions were subsequently made.

1.3 Protection Against Claims of Negligence

In the event of a charge of negligence in the science laboratory, several parties are potentially liable: the state, the school district, the school board, the school administration, and the teacher. Among persons potentially liable, the classroom teacher is most often considered to be placed in the accountable position. Legal action against a teacher stems from the presumption that he or she is the expert in the laboratory and, as such, has the responsibility to ensure that activities are carried out in a prudent and safe manner. The descriptions of and cautions concerning negligent acts are clearly outlined. To defend against claims of negligence, teachers should take the following steps:

1.3.1 Know the Law

All teachers should become familiar with state and federal statutes regarding laboratory safety (See Appendix B). If questions arise regarding accountability under a given law, these should be addressed to the appropriate legal representative for the district.

1.3.2 Maintain a Safe Laboratory Environment

All teachers should report unsafe laboratory conditions to building administrators as soon as the condition becomes known. This information, as well as any follow-up action taken, should be documented in a separate file.

1.3.3 Keep Detailed Written Records

Document everything related to the establishment of a safe laboratory environment. This can be done in your lesson plan book, which can be, and often is, subpoenaed in legal cases concerning laboratory injuries. Documentation could include, but is not limited to,

- signed safety contracts.
- results of a safety quiz, oral, written, or computer based.
- pre-lab tests with safety questions.
- safety rules written into a laboratory notebook prior to performing the experiment.

SECTION 2: SAFETY IN THE LABORATORY

Safety in the science laboratory requires common sense, preparation, and knowledge on the part of both the teacher and students. The use of unfamiliar equipment and chemicals in the science laboratory requires extra rules for behavior.

Safety education must be an ongoing process and cannot be done only once during the year. Students cannot be expected to remember everything from the safety lecture given during the first week of class. Like any other activity, safety is learned only by continual reinforcement and practice.

Clearly, students will not take safety rules seriously unless the teacher obeys and strictly enforces these rules. Science activities in the elementary classroom are safe provided that teachers and students are aware of potential hazards and take all necessary and appropriate precautions. By modeling safe lab practices and instructing students to do the same, students will not only avoid accidents and injuries but they will also be better prepared for lab experiences in their upper level science classes.

2.1 Physical Management of the Laboratory/Classroom

Physically managing students, furniture, materials, and equipment during a laboratory exercise can be a daunting task. Supervising several groups of students as they perform the actual laboratory exercise can be equally overwhelming. Careful consideration of how to use the available space in the classroom can go a long way toward reducing the level of stress.

- A written safety plan and first aid kit should be readily accessible in every classroom.
- Emergency procedures and phone numbers must be posted and easily accessed.
- Laboratory safety rules should be posted in an area that is easily seen by all persons in the room.
- Whenever possible, basic safety equipment should be present within each classroom; if not possible, then equipment such as fire extinguishers, fire blankets, spill kits, and first aid kits should be in a central location that is readily accessible to teachers.
- Students should have enough room to work in groups and to move about without bumping into each other or objects in the room.

- Aisles or spaces between lab stations should be clear of books, book bags, coats, and other objects that can present a safety hazard.
- Lab stations/tables/desks should be clear of all materials except those needed for lab.
- There must be a reasonable amount of space for emergency equipment and storage facilities. Materials, storage space, and evacuation routes must be clearly marked.
- Teachers need to know the location of gas and electric cut-offs.

2.2 General Safety Practices

Teachers should include safety concerns and precautions specific to each topic or experiment as part of their lessons throughout the year. When appropriate, require students to include safety information in laboratory written work such as a statement or paragraph indicating the safety equipment used and safety practices followed. Students' compliance with safe techniques and practices may become part of a teacher's evaluation of laboratory work. A record of this evaluation should be included in the teacher's lesson plan as legal proof of this additional safety instruction.

- Make safety an integral part of every science activity. In each class preparation, anticipate potential accidents and problems.
- Review possible hazards and safety concerns with students before each activity.
- Practice the experiment before presenting it to the class.
- Keep students on task and allow ample time for cleanup and waste disposal.
- Do not allow eating or drinking during a laboratory exercise.
- Encourage students to wash their hands after each science activity.
- Students should wear chemical splash safety goggles when working with laboratory chemicals.
- Students should be instructed not to taste any laboratory substances and to always wash their hands after use. Provide materials for washing hands at the conclusion of the activity.
- Instruct children not to mix substances at random to satisfy their curiosity.
- Never pipette by mouth. Always use a pipette aspirator bulb.
- Be alert to possible hazards presented by chemicals used in an activity.
- Keep flammable materials (e.g., cooking oil or paper) away from flames.
- Instruct students to smell odors by wafting the odor toward them with a cupped hand.

2.3 Laboratory Safety Rules for pre-K to Grade 5

Teachers should develop a set of safety rules for students. Specific sanctions should be identified for student violations of the rules. The rules and sanctions should be spelled out in a rules agreement that is signed by the students and parents. Signed copies of the agreement should be kept on file by the teacher. This is not a legal document but can help make students aware of their responsibility for safety and the seriousness of the matter. The school administration should give written acknowledgment of its support of the rules agreement and sanctions.

Even very young students in pre-kindergarten and kindergarten classes must follow safety rules and have a sense of whether or not a behavior will be safe. Introduce safe practices and help your students understand why and how these practices are used. Then review and practice these rules on a regular basis to reinforce their importance of laboratory safety. Make sure students understand these rules and why they are necessary.

SAFETY



IS PART OF
SCIENCE

1.



**DO NOT TOUCH ANY
EQUIPMENT,
CHEMICALS, OR
OBJECTS IN THE LAB
UNTIL YOU ARE TOLD
TO DO SO BY YOUR
TEACHER.**

2.



**NEVER WORK ALONE
IN THE LAB.**

3.



**DO NOT EAT OR
DRINK IN THE LAB.**

4.



**DO NOT PLAY IN THE
LAB. HORSEPLAY,
PRACTICAL JOKES,
AND PRANKS ARE
DANGEROUS AND ARE
NOT ALLOWED.**

5.



**KEEP YOUR WORK
AREA CLEAN.**

6.



**DO NOT TOUCH YOUR
FACE, EYES, EARS,
NOSE, OR MOUTH
WHILE YOU ARE
WORKING IN THE LAB.**

7.



**KNOW WHERE THE
FIRE EXTINGUISHER
AND FIRST AID KIT
ARE LOCATED.**

8.



**KNOW WHERE THE
EXITS ARE.**

9.



**ALWAYS WEAR
SAFETY GOGGLES
WHEN YOU ARE
DOING LAB
ACTIVITIES.**

10.



**DRESS PROPERLY FOR
LAB: TIE UP LONG
HAIR, TUCK IN BAGGY
SHIRTS, WEAR
CLOSED SHOES, AND
TAKE OFF DANGLING
JEWELRY.**

11.



**REPORT ALL
ACCIDENTS AND
INJURIES TO YOUR
TEACHER
IMMEDIATELY.**

12.



**DO NOT HANDLE
BROKEN GLASS.
REPORT ALL BROKEN
GLASS TO YOUR
TEACHER.**

13.



**REPORT ALL SPILLS
IMMEDIATELY.**

14.



**WASH YOUR HANDS
WITH SOAP AND
WATER AFTER ALL
LAB ACTIVITIES.**

SECTION 3: CHEMICAL MANAGEMENT

Laboratory chemicals pose a potential hazard in the elementary science classroom. Safe management of chemicals in the classroom requires that the teacher have adequate knowledge of the chemicals to be used and their interactions

3.1 Substances Too Hazardous for Elementary Schools

The following substances should not be used in the classroom because they present too great a safety hazard.

3.1.1 Acids

Acids such as hydrochloric, sulfuric, or nitric acid should not be used. Even "dilute" solutions of these acids can cause skin and eye burns. Two acids generally safe to use are vinegar (weak acetic acid) or a weak citric acid solution. When working with acids, always wear chemical splash safety goggles.

4.1.2 Bases

Sodium hydroxide (lye) or potassium hydroxide are extremely strong bases. Even dilute solutions will irritate the skin and, if splashed in the eyes, may cause injury before one can begin to wash the eye out. For acid-base (pH) activities, the teacher should consider sodium bicarbonate (baking soda) when making a basic solution. When working with bases, always wear chemical splash safety goggles.

3.1.3 Mercury

Mercury compounds should not be present in the elementary school classroom. Any thermometers or other instruments containing mercury have no place in the elementary classroom and should be properly disposed of. (Mercury thermometers can be identified by their silver-colored liquid.)

3.1.4 Flammable and Combustible Chemicals. Any chemical that readily catches fire (ex. alcohols, gasoline, liquid acid-base indicators) and any chemical that may create an explosion (ex. ether, compressed gases other than helium, azides of any kind) is strictly forbidden in the elementary school setting.

3.2 Using Chemicals in the Elementary School Laboratory

3.2.1 Household Chemicals

For the purposes of this manual a household chemical is any item that is commonly found in most homes AND can be used as a reactant in a laboratory activity. Most K–6 science activity procedures call for household chemicals. The majority of teachers assume that because these chemicals are readily available in the grocery and household sections of the local grocery/department store they are not as hazardous as 'real' chemicals. They are usually surprised to discover that common items such as vinegar, baking soda, cooking oil, and play sand require an Material Safety and Data Sheet (MSDS) and appropriate safety warnings to students prior to use. MSDS for select household chemicals can be found on the Science Curriculum page at <http://www.rcboe.org>

Before using any household chemical study the product label carefully to learn the hazards and warnings. Make sure that there is an MSDS on file for each chemical present in the room, and make sure that each chemical is included on the inventory list. Keep the MSDS handy when using a chemical. If a student is injured as a result of coming into contact with the chemical, the MSDS will explain what to do. Be sure to send the injured student to the nurse's office along with the MSDS.

Be sure to dispose of chemicals properly. If you have any questions about how to do this, consult the MSDS or your science supervisor. Regulations vary, so it is best to contact local experts.

3.2.2. Other Chemicals

Teachers should use only those chemicals that are on the local school system's list of approved chemicals or those approved by the school system science supervisor.

When using an approved chemical, teachers may obtain technical information on the chemical from the Material Safety Data Sheet (MSDS) provided by chemical supply companies. The MSDS describes the hazards of using the chemical, along with proper storage and disposal information.

The MSDS for an individual substance should always be consulted before a chemical is used for any reason. It is the best source of information about possible hazards, spill procedures, handling procedures and first aid for any substance.

3.2.3 Safety Guidelines for Using Chemicals in Experiments

- Use the smallest amount of the chemical possible in any experiment. Microscale experiments should be considered.
- Consider distributing the amount of chemical for an experiment into vials for each student. This minimizes waste and can save time during the class period.
- Use proper containers for dispensing solids and liquids. Solids should be contained in wide-mouthed bottles and liquids in containers that have drip-proof lips.
- Label all containers properly.
Never return dispensed chemicals to stock bottle, as it inevitably results in contamination despite your best precautions.

3.3 Chemical Safety Practices

3.3.1 General Considerations

Using laboratory chemicals in the elementary science program requires thorough planning by the teacher. The teacher should be familiar with the intended use of the substance, how to handle it safely, and what precautions to use with students.

Try to minimize the total quantity of each hazardous material in storage to just what will be actually needed before the next order. Purchase the least hazardous chemical that will do the job. “Green” and low volatile organic compound (VOC) cleaners and paints are preferable from both a hazardous material management and an indoor air quality (IAQ) standpoint. Do not accept samples or donated chemicals or products unless they are needed for a specific purpose or project.

Maintain an MSDS for each chemical or product used or present in the school. These documents need to be readily accessible to both personnel who use the products and to emergency responders. A copy of all MSDSs should be kept in the chemical coordinator’s office. An MSDS for each chemical in a given storage area should be kept near, but not inside, that storage area.

Minimize the number of chemical storage locations. Each department should have a storage location that is accessible only by them. When a chemical or product is received, mark the date on the package or case. When an individual container is opened, mark this date on it, along with the expiration date, for products that have a limited shelf life after opening.

Perform an annual inventory and inspection, looking for signs of leaking or bulging containers, damaged labels, deteriorated chemicals and containers, and products past their expiration date. Immediately replace damaged labels, and remove expired products.

3.3.2 Chemical Storage

- Label all containers with the substance's common name, precautions, date, and storage area. For each substance, teachers should have available the information listed on the MSDS form.
- Storage areas and containers should be labeled.
- Access to these storage areas should be limited so that students cannot remove substances from them.
- Always store chemicals and solutions in properly labeled containers meant for holding chemicals and solutions. Never store chemicals in containers that were originally used for food.
- Laboratory chemicals should be stored in a cool, well-ventilated room with shelving spacious enough to maintain separation of incompatible substances.
- Store dry chemicals above liquids, and store oxidizers away from all other chemicals.
- When transporting chemicals from the storage area to the classroom, use a cart with shelves that have raised edges.

SECTION 4: FIRE HAZARDS

Fire is a real danger in any laboratory setting, and all teachers need to be aware of how to prevent fires. In the event a fire does occur, teachers need to know how to respond appropriately. The following information is provided as guidance in preventing or combatting fires in the science laboratory.

4.1 Preventing Burns and Fires

4.1.1 When planning to heat materials or use open flames

- Instruct students on STOP DROP AND ROLL in the event clothing catches fire.
- Make sure students know how to evacuate the classroom in the event of a large fire.
- Know the location of the nearest fire extinguisher and make sure you know how to use it.
- Have a bucket of sand or a fire blanket nearby in the event that the nearest fire extinguisher is too far outside of the classroom.

4.1.2 When heating materials

- **DO NOT USE ALCOHOL BURNERS!** They are extremely hazardous. Safer alternatives to alcohol burners include candles and hot plates.
- **DO NOT USE STERNO HEATERS!**
- Make sure that the area surrounding a heat source is clean and has no combustible materials nearby.
- Do not allow students to work with hot materials, such as very hot water.
- Do not use household glass. Use only borosilicate laboratory glassware, such as Kimax™ or Pyrex™ when heating substances.
- Do not heat common household liquids, such as alcohol or oil; these are flammable and should not be heated. Heat only water or water solutions.
- Handle all hot materials using the appropriate type of tongs or heat resistant gloves (those made of asbestos or thick silicon rubber).

4.1.3 When using Hot Plates

- Do not use hotplates designed for use in home kitchens. Use only laboratory type hot plates. These are sealed against minor spills.

- Do not place the hot plate on paper or wooden surfaces.
- Place the hot plate in a location where a student cannot pull it off the worktop or trip over the power cord.
- Never leave the room while the hot plate is plugged in, whether or not it is in use.
- Keep students away from hot plates that are in use or still hot, unless you are right beside the students and have given them specific instructions.
- Make sure that the hotplate is both unplugged and cool before handling a hotplate. You can check to see if a hot plate is still too hot by placing a few drops of water on the surface. If the water does not evaporate, it should be cool enough to touch.

4.1.4 When using open flames

- Use only safety matches. Make sure the matches are stored in a secure place between uses.
- Closely supervise students when they use matches. Make sure students are dressed properly (baggy clothes are tucked in, long sleeves are rolled up, smocks/aprons are properly tied) and have long hair/braids tied up.
- Closely supervise students when they use candles. Make sure students are dressed properly (baggy clothes are tucked in, long sleeves are rolled up, smocks/aprons are properly tied) and have long hair/braids tied up.
- Use tea candles that are short and wide, and cannot be knocked over in normal use.
- Place all candles in a “drip pan,” such as an aluminum pie plate, that is large enough to contain the candle if it is knocked over.
- Never leave the room while a flame is lit or other heat source is in use.

4.1.5 In the event of a large, uncontrollable fire

- Evacuate the classroom immediately.
- Locate and pull the nearest fire alarm.
- Notify public safety and/or administration about the fire. Make sure you include the location and source (chemical, paper, petroleum) of the fire.

4.1.6 In the event of a small, containable fire

- Identify the type of fire. The table below lists the four classes of fires and methods for extinguishing them:

Class	To Fight Fires Involving	Method to Extinguish
A	wood, paper, cloth	Use water or dry chemical extinguisher.
B	gasoline, alcohol, paint, oil, or other flammable liquids	Smother by using carbon dioxide or dry chemical extinguisher.
C	fires in live electrical equipment	Cut off power to electrical equipment. Use multiple purpose (ABC) or carbon dioxide fire extinguisher.
D	metals (Na, K, Mg, etc.)	Scoop dry sand onto fire.

- Use the appropriate method to extinguish the fire.
- File an incident report.

4.1.7 In the event a student's clothes catch fire

- Roll the child on the floor to smother the fire. Use a fire blanket if one is available. Do not direct a carbon dioxide (CO₂) fire extinguisher at an individual because such extinguishers produce dry ice that can cause frostbite. Periodically check on the location and condition of fire extinguishers.
- DO NOT ATTEMPT TO ADMINISTER FIRST AID TO ANY BURNS THE CHILD MAY HAVE SUSTAINED!** Immediately notify the school administrator, school nurse, and public safety.

SECTION 5: EYE PROTECTION

5.1 What is your obligation?

Teachers owe their students a duty of care. A teacher must reasonably address all foreseeable dangers inherent in any laboratory experiment or demonstration that will be performed in the

science laboratory or classroom. A teacher must also instruct and ensure that students demonstrate the proper use of protective equipment.

An important obligation of science teachers is to provide students with appropriate eye protection. **Provision and Maintenance of PPE - 29 CFR §1910.132(d) Personal Protective**

Equipment, General Requirements Standard requires a hazard assessment to determine PPE needs and teachers must be trained in use and care of goggles.

5.2 What circumstances require eye protection?

Eye protection is a must in any hazardous laboratory activity or demonstration in science. As a responsible teacher, you must select eyewear that provides you and your students with the most appropriate protection for the hazards of your science activities. Effective eye protection must include adequate instruction on the hazards of the particular activity and of the precautions to be followed to reduce the risk of injury. It must also include instructions and modeling of the protective equipment.

Protection of the eyes is essential in any laboratory activity. Eye protection is required (but not limited to):

- When chemicals, glassware, or a heating source is being used
- When working with solid materials or equipment under stress, pressure, or force that might cause fragmentation or flying particles
- When an activity generates projectiles, or uses elastic materials under stress (e.g., springs, wires, rubber, glass), or causes collisions
- When dust or fumes are present (Eye protection reduces the dust or fumes reaching the eye.)
- When using preserved specimens

5.3 What is the best eye protection for elementary science activities?

Only safety goggles provide the level of protection needed for your laboratory activities when dealing with hazardous liquids or solids. A safety goggle fits the face surrounding the eyes; it should have a soft pliable flange, which seals around the eyes snugly to protect the eyes. In addition, safety goggles, with side shields or without side shields, provide adequate protection for laboratory activities involving use of solids such as meter sticks, projectiles, etc. Safety goggles should also be the standard for eye protection when chemicals, glassware, a heating source, or preserved specimens are being used.

5.4 Disinfecting Goggles

- When using the safety goggle cabinet, the ultraviolet light timer should be set for a minimum of ten (10) minutes.. Sanitation of goggles is accomplished best by usage of a UV cabinet. Treatment with UV light will destroy the goggles over several years.
- Hot soapy water and thorough drying between use of shared goggles is also recommended by the ACS.
- Chemical Disinfection: After student use, wash the goggles in soapy water followed by a ten (10) minute rinse in five percent bleach solution (10:1 ratio - 10 parts water to 1 part bleach). The goggles should be allowed to air dry.

5.5 What is the current recommendation for wearing contact lenses?

- The American Chemical Society Committee on Chemical Safety states that contact lenses can be worn in the laboratory provided that approved eye protection is worn as required of others in the laboratory.
- The National Institute for Occupational Health and Safety (NIOSH) recommends that workers be permitted to wear contact lenses when handling hazardous chemicals provided adequate face and eye protection is worn.
- The Council of State Science Supervisors states that contact lenses can be worn provided "specially marked, non-vented safety goggles are available to contact lens wearers".
- The Occupational Safety and Health Administration (OSHA) believes that contact lenses do not pose additional hazards to the wearer and has determined that additional regulation addressing the use of contact lenses is unnecessary.

- The agency wants to make it clear, however, that contact lenses are not eye protection devices. If eye hazards are present, appropriate eye protection must be worn instead of, or in conjunction with, contact lenses."
- Regulations (Preamble to Final Rules) Personal Protective Equipment for General Industry (Amended Final Rule, April 1994) Section 3- III Summary and Explanation of the Final Rule 1910.133 p. 16343.

SECTION 6: GLASSWARE

6.1 Injuries from Glassware

Glassware is the number one source of injury in the laboratory setting. More students are cut by damaged glassware and burned by heated glassware that are harmed by any other object or

circumstance in the lab. To ensure the safety of students in the elementary school laboratory, substitute plastic lab ware for glassware where possible. New plastics like polycarbonate (Lexan®) have been successfully used for laboratory containers. While not useful for heating, the plastic is clear and extremely hard and can be used for almost all water soluble compounds. Beakers, flasks, graduated cylinders, and thermometers now are available in plastic. Check with your science supply company.

6.2 General Cautions

6.2.1 Broken Glass

- Use glassware that is without defect and has smooth edges.
- One of the most important ways to prevent glassware related injuries is to check the pieces for chips or cracks. Any damaged glassware should be disposed of in the appropriate container.
- Glassware should have no cracks, chips, or scratches. In particular, be wary of “star cracks” that can form on the bottom of beakers and flasks. Any glassware with such cracks should be properly disposed of immediately.
- All glass tubing should be fire-polished.

6.2.2. “Frozen” Glass

Be careful with glassware that is “frozen.” Only teachers, wearing goggles and gloves, should try to release the “frozen” glassware. If this fails, discard the glassware. Some common cases of “frozen” glassware are:

- nested beakers that have been jammed together.
- stoppers that cannot be removed from bottles.
- stopcocks that cannot be moved.

6.2.3 Hot Glass

- Use only Kimax® or Pyrex® brand glassware when heating substances. Common glass can break or shatter, causing serious injuries in the lab.
- Use care when working with hot glass. Hot glass looks exactly the same as room temperature glass.
- Do not leave hot glassware unattended, and allow ample time for the glass to cool before touching.
- Check the temperature of the glassware by placing your hand near, but not touching, the potentially hot glass.
- Have hot pads, thick gloves, or beaker tongs available for grasping hot glassware.
- Never set hot glassware on cold surfaces or in any way change its temperature suddenly. Even a Pyrex® or Kimax® beaker will break if cold water is poured into a hot beaker.

6.2.4 Glass Tubing

- Make sure that the tubing is without chips or cracks.
- Use the appropriate diameter tubing for the task.
- Make sure the ends of the tubing are fire polished.
- When breaking tubing.
 - Use gloves or towels to protect hands when breaking glass tubing. Use goggles to protect the eyes.
 - Scratch the glass once with a file or score.
 - Wrap the glass in a towel.
 - Place the thumbs together opposite the scratch.
 - Pull and bend in one quick motion.
 - Fire polish the broken ends: hold the glass so that the sharp end is in the top of the flame of a gas burner.
 - Rotate the tube so all sides are heated evenly, causing the sharp edges to melt and become smooth.
 - Place the glass on insulating material to cool.

6.2.5 Bending.

Bending glass tubing is often necessary. Follow these procedures:

- Place a wing-top attachment on a gas burner and heat the area of the glass to be bent while holding it with one hand on each end, rotating to ensure even heating.
- When the glass is soft and pliable, remove it from the flame and quickly bend to the desired shape.
- Place on insulating material until cool.

6.3 Types and Appropriate Use of Glassware

To prevent glassware related injuries always use the correct type of glass for the task you are doing. For example, a graduated cylinder should be used to measure the volume of a liquid, not as a container in which to run chemical reactions. Likewise, a watch glass should not be used to mix chemical compounds, but as a cover over a heated reaction vessel.

6.3.1 Proper Use

Each type of glassware has its proper use and should be used only for its intended purpose.

- **For measuring volume:**

pipets	burets
graduated cylinders	volumetric flasks
dropper pipets ("medicine droppers")	

- **For storing solids and liquids:**

bottles	vials
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- **For containing reactive chemicals during experiments:**

beakers	flasks
test tubes	watch glasses
test plates	well plates
crucibles	

- **For transferring liquids and gases:**

glass tubing funnels

pipets

- **For measuring temperature:**

digital thermometers alcohol thermometers

6.3.2 Cleaning

- Clean immediately after use. The longer glassware sits, the harder it is to clean.
- Use laboratory-grade detergents or liquid dishwashing detergent such as Dawn® for cleaning glassware.
- When using brushes, make sure to use the appropriate size brush; make sure the metal part of the brush does not scratch the glass.
Rinse glassware with deionized water.
- Allow glassware to air dry on paper towels, drying pads, or drying racks.

6.3.3 Disposal

- Defective glassware should be disposed of correctly.
- Glassware should be disposed of in a separate container from normal trash. Such container should be clearly labeled *BROKEN GLASSWARE ONLY*.
- When handling broken glassware, wear gloves or use a dustpan and broom. Do not pick up broken glass with bare hands.

SECTION 7: PLANTS

7.1 Plants in the School

Plants can be used effectively to provide a living laboratory for elementary school science instruction. By providing experiential learning opportunities, science educators can help students to develop the kind of reasoned thinking

that will result in responsible decision-making regarding human/ecosystem interaction. However, certain plants can trigger severe allergic reactions in the form of skin rashes and breathing difficulties in susceptible children. The following guidelines will help teachers determine how to best use plants as effective teaching tools.

7.1.1 Poisonous Plants and Plants with Spines

- Teachers should confine their lesson on poisonous plants (poison ivy, poison oak or poison sumac) to pictures.
- Cacti and other plants with spines should not be kept in the classroom. Spines can become embedded under the skin and become infected if not removed correctly.
- When using an outdoor learning area, examine the site for the presence of poisonous plants. When visiting these sites, carefully monitor the children to keep them away from the poisonous plants.
- Children should not put any plants or plant parts in their mouths.

7.1.2 Plants in the Classroom

- Only plants that are not hazardous to children and with which you are should be used.
- Breathing spores or pollen can cause reactions in some students. Provide face masks to susceptible students as needed.
- When using commercial seeds treat them with care because they may have been treated with toxic fungicides.
 - Have students wear gloves when handling them.
 - Alternatively, you may obtain untreated seeds from local farm equipment stores or online at www.seedsavers.org/
 - Make sure potted plants are placed on sturdy surfaces in order to prevent pots from tipping over.
 - Do not allow students to move large potted plants.

- Supervise children closely and
 - make sure that they never place any plant or part of a plant in the mouth.
 - make sure that they do not touch any part of their face; even 'safe' plants can have hairs, oils, and other compounds that can irritate the skin.
- Make hand washing routine procedure after any laboratory activity even when working with plants.

SECTION 8: ANIMALS IN THE CLASSROOM

8.1 Introduction

The use of live animals in the classroom can help students understand and appreciate life processes. Before bringing animals into the classroom, teachers should check the school or school system policy. It is important to select animals that are appropriate to the instructional needs and are practical to maintain. Good safety procedures should be established for the protection of students from the hazards of classroom animals as well as to ensure the humane treatment of animals.

The humane treatment of animals in research and teaching is a sensitive issue. The Council of State Science Supervisors, the National Association of Biology Teachers, the National Science Teachers Association, the Humane Society of the United States, the Animal Welfare Institute, and the National Society for Medical Research all have established guidelines and position papers supporting the safe and humane treatment of animals used for the cause of science.

The following websites offer more information on this topic:

www.enc.org/csss/index.html - Eisenhower National Clearing House

www.nabt.org - National Association of Biology Teachers

www.nsta.org - National Science Teachers Association

www.hsus.org/programs/research/animals_education.html

www.animalwelfare.com - Animal Welfare Institute

8.2 Before You Bring Animals into the Classroom

8.2.1 Permission to Keep Live Animals on Campus

You must complete a **Richmond County School System Permission to Keep Live Animals on Campus** (Appendix A) and submit it to the Curriculum and Instruction Department attn. Science Curriculum Department. It will help you think through some necessary planning measures such as animal enclosure options, how the enclosure will be cleaned, and weekend, holiday and summer care arrangements.

8.2.2 Parental Notification

You must obtain **Parental Notification Forms** (Appendix A). It is not recommended that students be permitted to handle any animal(s) or be given caring or cleaning duties without prior parental/legal guardian consent.

8.2.3 Hand Washing Education

You must educate all students, paraprofessionals, and adult volunteers on proper hand washing. If anyone does handle an animal, they should wash their hands with hot soapy water for at least 60 seconds (instant hand sanitizers should only be used in addition to proper hand washing, NOT IN LIEU OF).

8.2.4 Educational Purposes

Animals in the classroom must have an educational purpose. Classroom animals should be limited to animals that are bred in captivity, and necessary to achieve the learning objectives. Wild animals can be a source of infectious agents, parasites, and are likely to bite.

8.2.5 Healthy Animals

Make sure all animals are healthy. All potential classroom animals should be examined by a veterinarian prior to being introduced to a classroom. The animals should be up to date on all vaccinations recommended by the veterinarian, and follow all of the veterinarian's guidance on proper handling, habitat, feeding, care, and other conditions for the particular type of animal(s).

8.2.6 Allergies

Be aware of allergic reactions. Allergies and sensitivities of students should be considered before bringing any animal into the classroom, and students should be observed for signs that they are becoming sensitive to an animal (allergies can develop at any time). Please communicate with parents to determine what allergies and sensitivities are known.

8.2.7 Special Permits

Avoid animals requiring special permits. Some animals require a written permission from the local health department, the Georgia Department of Natural Resources, and/or the United States Department of Agriculture to be kept in a classroom setting. These include venomous and nonvenomous snakes, wild and domestically bred turtles, certain species of frogs, wild newts and wild salamanders hogs, deer, cattle, alligators, crocodiles, caimans, sheep, goats, llamas, captive wild fowl, and all domestic fowl. DO NOT attempt to keep any of the animals mentioned above.

8.2.8 Animals Not Recommended in School Settings

- Inherently dangerous animals (e.g., lions, tigers, cougars, and bears).
- Nonhuman primates (e.g., monkeys and apes).
- Mammals at higher risk for transmitting rabies (e.g., bats, raccoons, skunks, foxes, and coyotes).
- Aggressive or unpredictable animals, wild or domestic.
- Stray animals with unknown health and vaccination history.
- Venomous or toxin-producing spiders, insects, reptiles, and amphibians.

8.3 Housing and Caring for Your Classroom Animal(s)

8.3.1 Habitats

Ensure that a proper habitat can be kept for the animal(s) (free of drafts and harsh sunlight). Also consider what type of care the animal will receive over weekends, and during school breaks (paying close attention to building heat and air conditioning status during times when school is not in session).

8.3.2 Food

Store all animal food in rigid containers with tight fitting lids to prevent access to food by pests. Also, some animals require fresh foods that may require refrigeration, or live foods. Should this be the case, make sure you have necessary equipment before bringing the animal in to the classroom. Food and water bowls should be thoroughly scrubbed and rinsed with hot soapy water.

8.3.3. Enclosures

Animals should be housed in an enclosure constructed from a nonporous material that is easily cleanable. Cleaning of animal(s) enclosures should be done as often as necessary to keep the animal healthy, prevent odors from building up, and eliminate any unsanitary conditions. It should be noted that cleaning and disinfection may be necessary as often as daily, however it should be done weekly at a minimum.

8.3.4 Sanitation

Enclosures should be sanitized after each cleaning with a fresh bleach solution (4oz of 5.25% unscented chlorine bleach to one gallon of water) OR a quaternary ammonia solution

at a dilution suggested by the manufacturer for food service uses (NEVER MIX CHEMICALS!!!). As animals can be sensitive to sanitizers, care should be taken in adequately rinsing and drying the enclosure before putting the animal back in the enclosure. Some pathogens will not be killed by the sanitizers, but may be removed by rinsing thoroughly with water (this will also remove residual amounts of sanitizers). An animal's sensitivity is not an adequate reason to avoid the use of sanitizers.

Animal enclosures must never be cleaned in plumbing fixtures used for food service, drinking water, or hand washing purposes. After cleaning the enclosure, the fixtures used to clean the enclosure should also be cleaned and sanitized.

8.3.5 Security

All animal(s) enclosures should be securely covered and locked if possible. This will help protect the students and animals from one another by discouraging unsupervised handling and reducing potential of escape.

8.3.6 Aggressive Animals

It should be noted that any animal may behave aggressively, naturally aggressive species, and animals that are unusually aggressive or those displaying odd or uncharacteristic behaviors for their species should be removed immediately. Animals capable of causing substantial injury through aggressive or defensive reflexes should also be avoided (i.e. snapping turtles, venomous snakes, poisonous frogs, large birds).

8.3.7 Injured and Sick Animals

Animals that are injured or in poor health should be removed from the classroom immediately and given proper care. It should be noted, however that even animals that are or appear to be in good health can still shed potential pathogens.

8.3.8 Animal-Specific Guidelines

- Fish --- Use disposable gloves when cleaning aquariums, and do not dispose of aquarium water in sinks used for food preparation or for obtaining drinking water.
- Nonpsittacine birds --- See General Guidelines.

- Psittacine birds (e.g., parrots, parakeets, and cockatiels) --- Consult the psittacosis compendium, and seek veterinary advice. Use birds treated or testing negative for avian chlamydiosis.
- Domestic dogs, cats, rabbits, and rodents (e.g., mice, rats, hamsters, gerbils, guinea pigs, and chinchillas) --- See General Guidelines.
- Baby chicks and ducks --- To prevent *Salmonella* or *Campylobacter* infection, children aged <5 years should not have contact with baby chicks and ducks.
- Reptiles (including turtles, lizards, and snakes) and amphibians --- To prevent *Salmonella* infection, children aged <5 years should not have contact with reptiles and amphibians.
- Ferrets --- To prevent bites, children aged <5 years should not have direct contact with ferrets.
- Farm animals --- See General Guidelines. Certain animals (e.g., young ruminants and young poultry) excrete *E. coli* O157:H7, *Salmonella*, *Campylobacter*, and *Cryptosporidium* intermittently and in substantial numbers; therefore these animals are not appropriate unless meticulous attention to personal hygiene can be assured.
- Mammals at high risk for transmitting rabies (e.g., bats, raccoons, skunks, foxes, and coyotes) --- Students should not be permitted to touch these animals, nor are these animals appropriate as residents in the classroom.
- Owl pellets --- Assume owl pellets to be contaminated with *Salmonella*. Dissections should not be done in areas where food is consumed. Thoroughly clean and disinfect contact surfaces. Wash hands after contact.

APPENDIX A: FORMS

Richmond County School System

Permission to Keep Live Animals on Campus

School		Principal
Name of Teacher	Subject	Grade(s) Taught

CARE PLAN

Type and quantity of animal proposed:
Provide a brief explanation of how the animal(s) will be used to achieve learning objectives in your classroom:
Who will be the primary caretaker? (name, position)
Who will care for the animal over weekends and over holiday breaks?
Who will pay for the health care of the animal(s)?
Primary Veterinarian
Name:
Clinic Address:
Phone:

Date of Examination(s):

If required, are the animal(s) up to date on vaccines recommended by primary veterinarian?

Yes or No (circle one)

Will students be permitted to handle animal(s), and will students be given care or cleaning responsibilities for the animal(s)?

Yes or No (circle one)

If so, have parents signed permission slips for such activities?

Yes or No (circle one)

How will you protect the students from bites, scratches, and/or disease transmission?

How will the animal(s) be fed?

Who will pay for the food?

What type of enclosure will be used to house the animal(s)?

How often will the enclosure be cleaned and sanitized?

What type of sanitizer will be used when sanitizing the enclosure?

What will be the final disposition of the animal(s)? If the animal(s) must be euthanized, how will this be accomplished?

**RICHMOND COUNTY SCHOOL SYSTEM
PARENTAL NOTICE FORM**

**Your student's teacher is required to notify you that your student's
classroom plans to keep classroom animals.**

School	Principal
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Name of Teacher	Subject	Grade(s) Taught
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The specific animal(s) planned are:

The animal(s) for your student's classroom may aid in achieving the following learning objectives:

Should you have any concerns regarding this animal (ex. student allergies, other medical sensitivities, sanitation practices, etc.) you may contact:

INFORMATION BELOW TO BE COMPLETED BY A PARENT OR GUARDIAN

In addition to this notification, we would like to ask whether you would like your student to participate in any of the following activities (check all that apply):

- ☐ Handling of animal(s)
- ☐ Providing care for animal(s)
- ☐ Given cleaning responsibilities for animal(s)

I, _____ acknowledge that I have been informed of plans for my student, _____'s, classroom to house animals as specified above. I have had the opportunity to express any concerns I may have about this plan. I have notified the school that my student HAS/DOES NOT HAVE allergies to the animal(s) that the teacher plans to use.

Signature: _____ Date: _____