FLINN SCIENTIFIC, INC

Science Department Safety Training Notes

Discussion and Notes

Keep a copy of these safety training notes and a signed attendance sheet to verify regular safety training. Regulatory inspectors will usually request proof of safety training. A copy of the sign-up sheet that we suggest using may be found at www.flinnsci.com/media/412875/signup.pdf.

Inquiry Safety and the Next Generation Science Standards

The Next Generation Science Standards (NGSS) integrate scientific reasoning or science practice skills with teaching the principles and concepts of science. Science practice skills include planning and carrying out investigations. Incorporating inquiry investigations into the science curriculum requires that teachers and students adopt new methods to guarantee lab safety.

General Requirements for Inquiry Safety

The first step in designing an experiment is for students to identify the type of data that may be needed to answer a question. Students must then determine the materials, procedures, and conditions for gathering observations and measurements to ensure a "fair test" for the planned investigation and sufficient accuracy and precision in the results to reliably answer the question. *Hazard and risk assessment is an essential part of developing a laboratory procedure.*

Student preparation is an essential element for success in any student-directed inquiry activity. To ensure a safe lab environment, it is critical that the teacher review each group's material lists and their procedure, including any necessary safety precautions, before allowing students to work in the lab.

Levels of Inquiry and Inquiry Safety

Inquiry investigations are generally divided into two main categories or levels depending on whether it is the teacher or the student who (a) generates the "question" or purpose of an experiment and (b) develops the procedure to answer the question. In a guided-inquiry lab the teacher will usually present an overall question to be answered or a general technique to be studied, and students will then decide on the specific variables or conditions to test and write detailed procedures, including safety precautions.

The teacher may limit the choice of different chemicals, organisms or physical processes to test in a guided-inquiry lab in order to simplify the hazard and risk assessment described below. Open-inquiry labs provide more latitude for students to select the questions to be studied as well as the materials and procedures that may be used. Open inquiry therefore places a greater duty of care on both teachers and students to evaluate hazards and develop safe laboratory procedures to reduce risk.

Evaluating Hazards and Writing Safety Precautions

Carrying out the hazard and risk assessment for a lab requires that students identify the nature of all possible hazards, evaluate their relative risk, and write safety precautions and procedure steps to protect against the hazards and minimize the risk. *The teacher must verify all of this information in writing before students may begin an investigation.*

Evaluating the hazards goes hand-in-hand with and thus cannot be separated from developing the procedure. If the risk associated with a certain hazard is found to be high, the procedure must be rewritten to use different materials or techniques to reduce the risk. Students must identify—and teachers must review and confirm—all of the following information.

- Physical hazards of equipment or procedures. Examples include use of a Bunsen burner, build-up of pressure in a container, working with projectiles, and electrical hazards.

Discussion and Notes

- Chemical hazards of all reactants, products or possible intermediates. Types of chemical hazards include flammable liquids, corrosive substances, chemicals that react with water, and reactions that generate a toxic gas.
- Health hazards of chemicals and biological materials. These include toxic chemicals and pathogenic bacteria or microorganisms.
- Safety precautions, including the use of personal protective equipment, to protect against all of the identified hazards. Safety precautions may include working with materials in the hood, ensuring there are no sources of ignition (flames or sparks) when using flammable chemicals, preventing contact of chemicals with water or incompatible materials, and ensuring proper sterile technique when working with microorganisms.
- All personal protective equipment must be specified.

Current Flinn SDS may be accessed and searched on the Flinn website at http://www.flinnsci.com/msds-search.aspx

Safety Data Sheets

Safety Data Sheets provide essential information concerning the physical and health hazards of chemicals and the safety precautions required for their use. These should be included with the written procedure to be reviewed by the teacher.

Scheduling Inquiry Investigations

Many middle-school and high-school experiments are designed to be completed in one lab period. Transitioning to inquiry necessitates a project-based design or approach to scheduling labs, with a series of lab periods devoted to a single, guided-inquiry project. *At least two 50-minute periods will be required.*

The first period may be devoted to a short introductory or background activity that sets the stage for inquiry and allows students to begin planning their experiments. This should be followed by either in-class brainstorming or a homework assignment. Students reflect on the knowledge gained in the introductory activity or through research, design their investigations, and write procedures. The teacher must also schedule in-class or grading time to review and verify all procedures. A second laboratory period may then be devoted to students carrying out their experiments.

Thank You for Your Support

Please continue to support our efforts to improve safety in school science labs by ordering your science supplies and laboratory chemicals from Flinn Scientific.

Next Month's Topic

General Safety Rules

FLINN SCIENTIFIC, INC
"Your Safer Source for Science"