2. SETTING UP AND MAINTAINING A SAFE INDUSTRIAL ARTS FACILITY

Achieving a Safe Facility

The intent of this section is to help the teacher achieve and maintain a safe facility.

Topics of this section include

- Safety and Health Inspections
- Personal Protective Equipment
- Machine Guarding
- Hazard Analysis
- Noise Hazards
- Incident Investigation Techniques

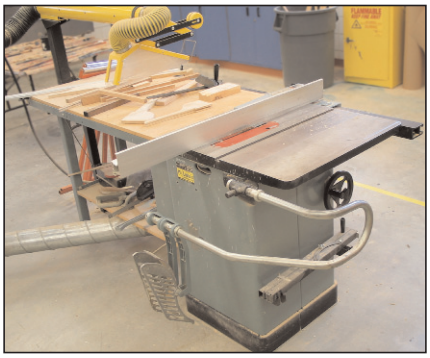
Safety and Health Inspections

Inspection

Purpose

To provide the teacher with an understanding of the inspection process and the ability to carry out an effective safety and health inspection. The following will introduce the teacher to:

1. Purpose of inspections
2. Types of inspections
3. Persons involved in the inspection process
4. Techniques
5. Methods of recording



Introduction

Safety and health inspections are an important part of the hazard control process. Regular inspections play an important part in providing a safe environment for our students.

Mandatory Inspections

Every school facility and each of its processes and operations contain potential hazards, which come about through normal use or through changes and additions of new equipment. One way of keeping aware of hazards is through continuous inspections.

Purpose of Inspection

- To spot potential hazards before an incident occurs.
- To assess the hazard.
- To find improvements and corrections to improve overall operations and increase effectiveness.
- Do all of the above, every day

Inspections may be classified as periodic or continuous.

Types of Inspection

Periodic Inspection

A safety and health inspection is thorough and systematic. These inspections can be conducted monthly or bi-monthly. This type of inspection covers all areas (e.g., operations, equipment, et cetera).

Continuous Inspection

Continuous inspections should be conducted by students, teachers, department heads, or supervisors as part of their instructional, supervisory, or assigned duties. Continuous inspections provide an immediate chance to examine and, if necessary, to correct or to report any unsafe situations (if correction is not possible).

Who Should Make Inspections

Teachers

Teachers must make continuous inspections and be aware of changing conditions, operations, and work methods. These inspections may have to be made several times a day (i.e., at the beginning of each day and, for certain equipment, at the beginning of each class).

Students

Student inspections allow students to take a major role in their lab/facility, thus giving them a sense of ownership of their lab/facility.

Department Head or Supervisors

A school/school division that has a department head or supervisor for industrial arts has a further advantage in safety and health inspections. The department head or supervisor may record any unsafe conditions and practices and forward the information to the teacher and or maintenance personnel if required.

Inspection Procedures

An inspection program requires that those conducting the inspections:

- have a sound knowledge of the facility.
- have a systematic inspection process for the facility.
- have a method of reporting, evaluating, and using the data gathered.

Using Safety and Health Checklist

There are many different types of checklists available for use in safety and health inspections, varying from thousands of items to just a few. Each type has its place and, when properly used, can be a benefit to the particular facility. An example of an inspection format is included at the end of Section 3. This format may be modified to accommodate most facilities.

Be Thorough

Any checklist for use in safety and health inspections is only as good as the method in which it is completed. The checklist is to be used as an aid in the inspection process, keeping in mind other items may have to be recorded. Any observed hazard must be recorded even though it may not be on the list.

What Should Be Inspected

When inspecting, the following should be considered:

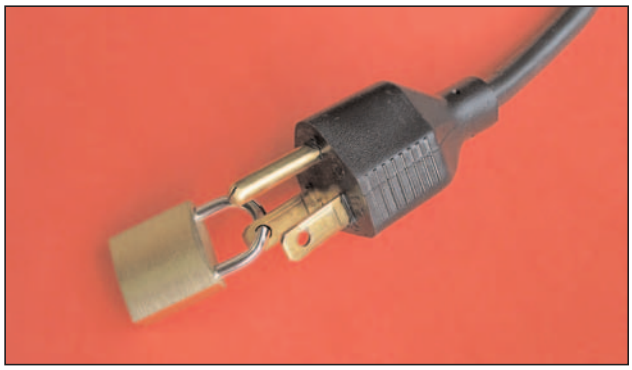
- **Materials and Substances:** Inspect those materials and substances that may cause injury, illness, fire, or other hazards.
- **Machinery, Equipment, and Tools:** Ensure that they are free of defects and other hazards. Make sure guards, grounding (electrical), and exhaust systems are in place.
- **Personal Protective and Safety Equipment**: Ensure that there is adequate protection for all students involved and that the equipment is in good shape (i.e., safety glasses/shields are free from scratches, leather welding gloves are free from holes).
- **Working and Walking Surfaces**: Areas must be clean and functionally safe.
- **Environmental Factors**: Ensure lighting, ventilation, and noise control devices are up to standards.

- **Housekeeping:** Material storage, waste disposal, floor, and counters should be neat and tidy.
- **First-Aid Kit and Eyewash Station:** Ensure the first-aid kit is stocked with adequate supplies and the eyewash station is functioning properly.
- **Electrical:** Switches, breakers, fuses, cords, and plugs must be in compliance with regulations.

- **Chemical Storage, Handling and Use:** Ensure that materials such as paints are stored properly (i.e., five gallons of paint or more must be stored in an approved flameproof cabinet). Specific protective clothing should be available for the chemical requirements. Adequate exhaust ventilation must be in place where stated by chemical requirements.
- **Fire Protection and Extinguishing Systems:** Fire blanket, fire exit doors, exit signs, et cetera, must all be in good order and in clear working condition.
- **Preventative Maintenance:** The teachers' consistent preventative maintenance in the lab/facility and with tools will help to ensure incident prevention and student safety.

Hazardous Equipment

In the process of inspection, various actions or corrections may have to take place. When a broken or damaged tool is found, the teacher should immediately remove it. Large equipment, however, may have to be properly tagged. The teacher may also need to perform an electrical lockout by placing a mini-padlock through one of the tines of the power cord plug to prevent unauthorized use of the tool.



Summary

Acting on the information gathered from an inspection is as important as conducting the inspection in the first place. It is necessary that the inspection team brings problems and recommendations for corrective action to the attention of those involved (i.e., teacher, principal, or Workplace Safety and Health Committee). Based on problems uncovered and recommendations by Workplace Safety and Health, they must decide on the best course of action.

Information from inspections should never be seen as fault finding and criticism, but rather as fact finding with an emphasis on locating potential hazards that may have an adverse effect on the safety of the operation. The information should be viewed as the basis for establishing priorities and implementing programs that will improve conditions to provide a safe environment for our students.

Personal Protective Equipment (PPE)

PPE does not take the place of such engineering controls as substitution, isolation, and ventilation. PPE are such items as helmets, glasses, goggles, face shields, special footwear, respirators, and other items that protect the student against hazards such as flying particles, noise, chemicals, and electric shock.

Sometimes the only practical way to reduce illness and injuries is to use personal protective equipment. The first method is to control the problem at its source; the second is to control it along the path. PPE is regarded as the last line of defense.

Selecting Personal Protective Equipment

- The extent of the hazard's potential to cause harm must be determined.
- The degree of desired protection is in direct proportion to the seriousness of the hazard.
- The equipment's ability to protect must be considered along with its potential to interfere with the students' work.
- Protective equipment, particularly for eyes and face, must be approved by the Canadian Standards Association (CSA).
- Quality is an important factor to consider. Good protective equipment may not be inexpensive, but may last considerably longer than lower grade PPE.

PPE Fit

The PPE must fit the student. Poorly fitted protective equipment discourages students' acceptance, and may hinder their work and safety.

Education

Unless students are educated in the use and care of PPE, it may do little to fulfill its intended purpose.

PPE Requirements

Head Protection

There is always a danger of hair becoming entangled in moving parts. Students with long hair should have their hair tied back, secured, or tucked underneath their clothing.

Helmets are the best means for protecting students against impact blows from falling objects.

Eye and Face Protection

In the industrial arts facilities, students' eyes can be exposed to a variety of hazards (e.g., flying objects, splashes of corrosive liquids or molten metal, dust, and harmful radiation). Manitoba Workplace Safety and Health requires that eye and face protection be designed to meet standards.

The type of face shields and safety glasses used must meet their intended purpose. A variety of types and sizes of safety glasses give the student an opportunity to select his or her "own style." Glasses that are damaged by pitting or scratching must be replaced. A weekly check of their condition is essential.

Personal Protective Equipment

Hearing Protection

The need for hearing protection arises when source control and/or path control are not present, when source and/or path control do not lower noises to safe levels, or when a person in the facility cannot avoid direct exposure to noisy equipment and tools.

Many types of personal hearing protection devices are available, ranging from ear plugs to cup-type hearing protectors. Selection of a protective device is governed by individual preference. Important factors to consider are effectiveness, comfort, and cost.

Respiratory Protection

The human respiratory system presents the quickest and most direct avenue of entry of hazardous materials, because it is connected with the circulatory system and the need to oxygenate tissue cells. Air may be contaminated with dusts, fumes, and sprays. The most important objective is to prevent atmospheric contamination. This should be accomplished by engineering control measures (e.g., enclosure or confinement of operation, general and local ventilation, and substitution of less toxic material). When effective engineering controls are not feasible, appropriate respirators must be used.

Hand Protection

Statistics indicate injuries to the arms, hands, and fingers account for more than a quarter of all disabling mishaps. The hazards in the industrial arts facilities are similar to those in industry: molten metal, heat, sharp objects, and corrosives.

Many industrial incidents are the result of operating machinery, using tools, or handling materials. PPE can do little to prevent incidents in the first of these areas. Gloves can snag in revolving parts and pull the hand into the machinery.

Gloves supplement good work practices to prevent hand injuries during handling of tools and materials. There are many types of gloves that are suitable for abrasions, cuts, oils, chemicals, radiation, heat, and flame.

Body, Foot, and Leg Protection

Students require protection from the hazards of molten metal, sparks, splashing liquids, heat, and cutting.

Welders need aprons made of fire-resistant fabric or leather. Personal protective footwear can protect feet against injuries, such as those from falling objects, accidental contact with sheet metal, and sparks from welding and cutting operations.

Although safety shoes may present the ideal protection for feet, this may be impractical in certain situations. Some alternatives that may better fit particular situations could be foot guards, which protect the toes and instep against falling objects or a combination foot and skin guard, which protects both against flying particles and sparks from cutting/welding.

Machine Guarding

It is estimated that nearly 20 percent of all permanent partial disabilities result from injuries associated with machinery. Poorly designed, improperly guarded, or unguarded machinery are detriments to the educational system.

Machine guarding is of the utmost importance in protecting students in the industrial arts facility. Machine guarding is not optional but required. Guarding is a means of effectively preventing students from coming into contact with those moving parts of machinery or equipment, which could cause physical harm.

Sources to be Guarded Against

Sources of injury that guarding can protect:

- direct contact with the moving parts of a machine
- contact with work in progress
- mechanical failure
- electrical failure
- human failure or error

Hazardous Areas

Typical hazardous mechanisms that need to be safeguarded are:

- rotating mechanisms
- cutting and shearing mechanisms
- screw or worm mechanisms

The Acceptable Guard

The following are requirements for an acceptable guard:

- It should protect the operator.
- It should protect others nearby.
- It should be an integral part of the machine.
- It should be convenient to the operator.
- It should prevent access to the danger zone.
- It should not create an incident hazard in itself.

For more information on guarding, obtain the booklet *Guidelines for Machine Guarding* (September 1988) from Workplace Safety and Health Support and Development. This information is also available online at <http://www.gov.mb.ca/labour/safety/publication/guidelines/machine/>. For regulatory requirements regarding the safeguarding of machinery and equipment, please consult the regulations adopted under *The Workplace Safety and Health Act*.

Hazard Analysis

The benefit of hazard analysis is to increase the awareness of potential hazards.

Results of Hazard Analysis

Hazard analysis should help to:

- improve instructional quality.
- assist in the selection of processes and tasks.
- create awareness of possible incidents.
- establishing control measures (special procedures, guarding, PPE).
- set up equipment and machinery so that students or the teacher will not be exposed to unnecessary hazards.
- identify situational hazards in facilities (equipment, tools, and materials).
- identify human factors responsible for incidents (student capabilities, activities, and limitations).
- identify exposure factors that contribute to injury and illness (contact with hazardous substances and materials).
- determine safe inspection methods and maintenance standards.

Who Should Participate in Hazard Analysis?

The teacher may initiate the analysis of the processes, operations, and tasks; however, others may also give assistance (i.e., Department heads, maintenance personnel, colleagues, manufacturing representatives, and students).

Note: Remember to check out the specific equipment manual for proper procedures.

What To Analyze?

There are many processes, operations, and tasks conducted that have potential hazards.

Consideration should be given to:

- general housekeeping.
- inappropriate use of tools and equipment.
- faulty tools and equipment.
- new or altered processes.
- potential for injury.
- severity of injury.
- frequency of incidents.

The Process of Hazard Control

The four processes in hazard control are:

1. Spot the hazard.
2 Assess the risk.
3. Find a safer way.
4. Practise all of the above every day.

Noise Hazards

Everyone at some time is exposed to noises that have the potential to damage the hearing. Ordinary noises (e.g., those produced by planers and jointers) can cause hearing damage if there is extended exposure time. Noises at high levels of intensity do not require lengthy exposure time to cause hearing damage.

Permanent Threshold Shift

A Permanent Threshold Shift is a condition in which we permanently lose the ability to hear sounds at lower decibel levels. One of the most harmful effects of such a hearing loss is that we lose some of our ability to understand speech. This damage can result from a single exposure to a very high intensity noise but most often is a result of exposure to moderately intense noise over an extended period of time.

How Noise Damages Hearing

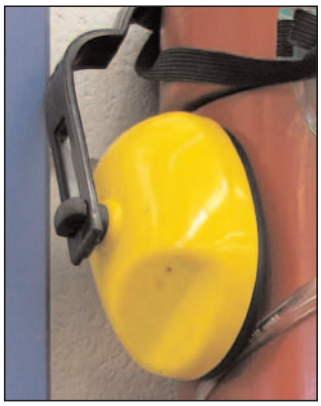
How intense must noise be before it has the potential to either temporarily or permanently damage our hearing? There is no simple definitive answer to this question. There are too many variables involved. The four most significant variables are:

1. the level of sound, as measured in decibels.
2. the length of time to which we are exposed to the sound.
3. the number and length of quiet (recovery) period between period of sound.
4. our personal sensitivity to or tolerance for sound.

Noise Control

There are four basic ways to control noise:

1. At the source.
    - Reduce impact noise.
    - Reduce speed of moving parts.
    - Isolate vibration within equipment.
    - Reduce the leakage of noise.
2. Along the path.
    - Contain or enclose the noise.
    - Absorb the noise along its path.



- Deflect the noise.
- Separate the noise from the hearer.

3. At the point of hearing (PPE).
   - Ear plugs
   - Cup-type ear protectors
4. Management of noise.
   - Schedule activities that create excessive noise.
   - Alternate methods of operation.
   - Vary facility activities.

Purchasing/Procedure

The management of noise control refers to the administrative decisions that are made to purchase certain types of equipment and tools, to use certain procedures, and to schedule work during certain times to minimize the number of persons exposed to high noise levels. Scheduling the noisy procedures for several short periods of time during a day or over a number of days, rather than in one long continuous period, reduces the hazard.

How Much Noise Is in Your Lab?

In order to determine the amount of noise in your facility, you should conduct an exposure assessment. Obtain a sound level meter or decimeter from your supervisor, principal, school division, Manitoba Workplace Safety and Health Division, or hire a consultant to complete the assessment.

The following has been adapted from *Hearing Conservation and Noise Control* Regulation 227/94 from Workplace Safety and Health, Manitoba.

dBA

Noise is measured by A-Weighted Sound Level (dBA). The sound level is measured on a sound level meter equipped with an A-weighting filet that electronically filets out much of the low and high frequency sound in order to simulate the response of the human ear.

Exposure Greater Than 80 dBA

Students and teachers should be provided with training and education to inform them of their exposure assessment results and about the hazards of excessive noise exposure.

Exposure Greater Than 85 dBA

For all students and teachers exposed to greater than 85 dBA, personal hearing protection (and training in its proper use) must be made available. Any worker who is exposed in excess on Lex of 85 dBA, and who requests such protection, must receive it.

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Exposure Greater Than 90 dBA

For all exposures where they exceed 90 dBA, the employer must investigate and implement all reasonable practisable engineering or work practice controls in order to reduce exposures to 90 dBA or lower. Where exposures are not reduced to 90 dBA, provision and use of personal hearing protection is mandatory.

Definition of Lex

Equivalent Sound Exposure Level (Lex): This is the steady sound level that, if present in a workplace for eight hours in one day, would contain the same total acoustical energy as that contained by the actual fluctuating sound levels to which a worker is exposed during the actual work day. Sound exposure level is measured or calculated on the basis of sound levels (dBA) and duration of exposure to each of those sound levels during the workday. It represents the worker's daily average exposure (time-weighted average sound level).

Incident Investigation Techniques

The goal of facility operations hazard analysis is to identify and evaluate hazards in the facility before they result in incidents. The concept behind this is sound, however, there may be times when we will not be able to find and eliminate problems before incidents occur. When an incident occurs, we must be prepared to acquire through investigation as much information as possible about the cause so that similar incidents can be avoided.

Reasons for Investigation

Teachers should become familiar with school/school division policies regarding incident investigation. There are important reasons for investigating incidents.

- To determine the cause of the incident.
- To find out ways to prevent further similar incidents.
- To uncover and reduce indirect incident causes.

Fact Finding not Fault Finding

Remember incident investigation is fact finding rather than fault finding. The intent of the investigation is to find the cause and/or reason of the error/defect, and make the necessary corrections so further incidents can be avoided.

Investigate—Yes or No?

All incidents should be investigated. Most incidents are usually minor, however, there may be a fine line before that situation could have resulted in a serious incident.

Investigation by the Teacher

The teacher is the best one to do the investigation. The teacher is the one who was in the room at the time of the incident. The teacher is:

- familiar with the students, their abilities, and their personal characteristics.
- aware of the equipment, tools, and operations.

Key Points for Interviewing

When investigating an incident, these key points are important:

- Conduct the interview as soon as possible.
- Interview one person at a time.
- Explain the purpose of the investigation.
- Make the witnesses feel at ease.
- Be diplomatic in your task.
- Keep the questions simple.
- Avoid leading questions.
- Allow students to explain in their own words, uninterrupted, their story of the situation.
- Review the information given.
- Allow students to explain how the same incident can be prevented in the future.