

The “Hort” Module

Awareness of Risks and Attitudes towards Safety and Health in Horticulture

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FLORIDA

IFAS EXTENSION



About Florida AgSafe

Florida AgSafe is a program of the Florida Cooperative Extension Service that provides information and educational materials for agricultural safety and for disaster preparedness and recovery. Materials produced by Florida AgSafe are available on the Web at <www.flagsafe.ufl.edu> and at the Florida Cooperative Extension publication Web site <edis.ifas.ufl.edu>.

Our Goals

- To inform people about ways to be safe and secure, and thereby reduce the number of deaths, injuries and occupational diseases, particularly for agricultural workers and their families.
- To build a safety infrastructure for Florida through five activities: training of workers, training of students, publications, networks, and linkages.
- To encourage adoption of safe practices among employees and clientele. Every employee or client should be exposed to a safety tip or safety practice on a regular basis.
- To prepare the people of Florida to face disaster of any kind, to mitigate losses, both in life and property, and to promote rapid and effective recovery.

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Awareness of Risks and Attitudes towards Safety and Health in Horticulture

Objectives

At the conclusion of this module, students will be able to:

- Understand and be able to apply observation techniques in order to increase their awareness of potential safety hazards on the horticultural job site.
- Identify how certain attitudes and behaviors can contribute to potential safety risks on the horticultural job site.
- Demonstrate increased motivation to learn and use safe work practice techniques.

Note to the Instructor

The main emphasis of this module and the reason for it is to address the safety hazards that are found in the horticulture industry as well as in one's own back yard (In My Back Yard – IMBY; See IMBY materials on <www.flagsafe.ufl.edu>).

Resources & References

Kansas State's OSHA Training Materials On-line for Landscape and Horticultural Industries:

<http://www.oznet.ksu.edu/agsafe/training/OSHA_training.htm>.

National Ag Safety Database (NASD): <www.cdc.gov/nasd>.

Safety Management for Landscapers, Grounds-Care Businesses and Golf Courses

Deere & Co., 1st Edition, 2001.

Note: The fact sheets that are designated "Tailgate Training" are one page with diagrams and also with a brief quiz. They would work well for classroom use. The entire list of Tailgate Trainings can be found at: <<http://www.cdc.gov/nasd/menu/state/ohio.html>>.

Background Core Content Information

Introduction

Defining the horticultural workplace: Horticulture is the industry that produces fruits, vegetables, flowers and plants. Horticultural workplaces can be outdoors (nurseries that grow trees for resale) or they can be indoors in greenhouse settings (plants, seedlings, ornamental plants, and flowers).

Why is safety important for the horticultural enterprise: The safety and health of the worker in the horticultural workplace affects productivity and can be the difference between profit or loss for the business. Injuries or deaths increase the premiums that a company has to pay for Worker's Compensation insurance. If the workplace is in violation of safety and health considerations for the workers, employers can also be fined by the Department of Labor. Injuries result in lost work time or a decrease in the productive output of an individual worker. Injuries can cause workers to develop poor attitudes, which can affect other workers and decrease their productivity levels.

Who manages safety for the horticultural enterprise: In order for safety to be respected and incorporated into the workplace, management must work to promote safety among workers. Effective safety programs solicit workers' input in helping management to develop the company's safety programs and policies. Management can also impact safety by providing incentives and recognizing safe behaviors. Management support is very important for a business's overall safety program.

Regulations and Compliance

Purpose of regulations: Many regulations have been developed because a hazardous condition has been identified. Regulations are then developed to insure that corrective measures are taken to eliminate that hazard or to safeguard against it.

What regulatory agencies do you need to know about(state and federal): Safety and health regulations are developed and enforced through the Department of Labor Occupational Safety and Health Administration (OSHA). Managers should recognize that OSHA standards are a minimum requirement, and many states have stricter safety standards and additional standards. Therefore, it is important that managers know the laws for their particular state.

Managers interested in compliance will need information. Since regulations may change, or may differ somewhat locally, regionally, or by state, it is important to know where to obtain the latest in regulatory information that will be applicable for a specific horticultural enterprise. Local resources such as the Extension office, county government, state Departments of Labor, and OSHA can provide this information. Regulations are also found at the OSHA Web site: <www.osha.gov>.

Hazardous Agents and Concerns

Chemicals

Types of Chemicals Used — Many chemicals are used in the horticultural industry. It is important to identify which chemicals are used, as well as knowing the difference between insecticides, herbicides, and fumigants.

- Pesticide Tailgate Training: <<http://www.cdc.gov/nasd/docs/d001701-d001800/d001726/d001726.html>>

Who Can Use Chemicals — It is important to know that people who apply the pesticides must be certified (by passing a pesticide applicator exam) and must also meet certain criteria in order to obtain a license or permit to use and apply the pesticides.

Importance of the Label — The label on the chemical container is very important. Users of chemicals must understand how to read the label — THE LABEL IS THE LAW. The label will provide information on how to use the chemical, what personal protective equipment is needed to be used, when it is safe to re-enter an area where the chemical has been used, and what to do in case a person is poisoned or becomes ill while using the chemical.

- Restricted Entry Intervals Tailgate Training: <<http://www.cdc.gov/nasd/docs/d001701-d001800/d001737/d001737.html>>
- Reading Pesticide Labels Tailgate Training: <<http://www.cdc.gov/nasd/docs/d001701-d001800/d001729/d001729.html>>

Personal Protective Equipment (PPE) — PPE serves as a barrier to protect the chemical user from coming into contact with the chemicals being used. It is important to be able to identify which PPE to use for a given chemical by reading the chemical label. One possible activity involves

dressing a mannequin in PPE and students must read a chemical label and then identify which PPE would be required. The mannequin can be named PAPA (Proper Attire for Pesticide Application).

Hazard Potential Assessment — Chemical hazards can be looked at in terms of their risk potential, rated high, medium, and low. The objective is to identify areas of high risk and take actions that would bring these areas into the low risk category.

Farm*A*Syst and Home*A*Syst — Materials from these programs are available for mixing and loading, storage, handling, and disposal. These materials are posted at: <www.uwex.edu/farmasyst> and <www.uwex.edu/homeasyst>.

Fire Hazards

Responsibility for Prevention — Everyone is responsible for prevention of fires. Fires can occur easily in greenhouse areas — especially if space heaters need to be used. Management must promote prevention and be responsible for training workers, for example, regarding flammable substances that may be present on site. In rural areas, prevention is crucial, since response time can be considerably longer than in an urban location.

Fire Prevention Plan — It is important to have a fire prevention plan. Everyone on the work site should understand the fire triangle: fuel, oxygen, and heat — all three of these elements are essential to any fire, and if any one is missing or taken away, there will be no fire. Sources of fuel and heat in the workplace can be identified. Worker knowledge of the fire triangle should be reviewed periodically. Fire prevention also includes the presence of ABC type of fire extinguishers. Examine fire extinguishers at least annually to ensure they are properly charged. Plans for fire prevention can include daily clean-up of work areas; proper wiring; disposal of frayed or damaged extension cords; and keeping flammables out of the work area (if possible).

- Fire Extinguisher Tailgate Training:
<<http://www.cdc.gov/nasd/docs/d001601-d001700/d001687/d001687.html>>

Workplace Fire Hazards — Workplace fire hazards may include flammable products used; faulty wiring; improper use of the electrical system; debris and trash; and use of space heaters. [A standard fire safety checklist can be used here if desired].

Fire Protection Equipment and Systems — For indoor locations, have adequate and properly working extinguishers and sprinkler systems. Designate and mark emergency exits and make sure that exit doors are not blocked or locked — either from the inside or the outside.

Fire Detection and Alert Systems — This includes the use of smoke detectors and fire alarms.

Emergency Reporting Procedures — It is important that the workplace has a plan that workers are trained and 'drilled' in for reporting fires and to ensure that everyone is evacuated from the workplace. If a fire is detected, it is necessary to identify who is responsible for reporting it; and who is responsible for trying to extinguish it.

Electrical Hazards

Wiring — Workplace wiring must meet local codes. Wiring must also be used properly; it should not be overloaded. In horticultural work settings, water and wet conditions are common, therefore, it is important to understand the hazards posed by water and electricity.

- Electrical Safety Tailgate Training:
<<http://www.cdc.gov/nasd/docs/d001601-d001700/d001684/d001684.html>>

Equipment — Equipment should be checked regularly for any wear on cords or motor areas. Equipment must be wired in properly (as applicable). UL approved equipment is to be used.

Proper Labeling of Service Areas and Use of Lock-out/Tag-out — An activity may be used for this issue to show that lock-out/tag-out is used to avoid unintentional equipment start-up or energizing the system when someone may be working on it. A case study for this can be found on the NASD Web site.

- California Nurse Project summary report of a worker electrocuted at:
<<http://www.cdc.gov/nasd/docs/d000001-d000100/d000074/d000074.html>>
- Lock-out Tag-out Tailgate Training:
<<http://www.cdc.gov/nasd/docs/d001701-d001800/d001714/d001714.html>>

Machinery and Tools (With Hazards and Protective Measures)

Hand Tools — Hand tools, such as knives, clippers, weed-eaters, cutters, and pliers, are used frequently in horticultural applications. The hazards associated with these commonly used tools include the obvious cuts — which can result in amputations — and the less obvious repetitive motion injuries.

- Safe Use of Hand Held Tools Tailgate Training:
<<http://www.cdc.gov/nasd/docs/d001601-d001700/d001698/d001698.html>>
- Safety information can be found at OSHA at:
<<http://www.osha.gov/SLTC/handpowertools/>>
- A PowerPoint presentation can be viewed at:
<<http://siri.uvm.edu/ppt/handsafe/>>
- A basic fact sheet on hand tool safety is at:
<<http://www.cdc.gov/nasd/docs/d000701-d000800/d000790/d000790.html>>
- Christmas Tree Management Shearing and Pruning Safely With Hand Tools – a publication from Rutgers University is at:
<<http://www.cdc.gov/nasd/docs/d000901-d001000/d000955/d000955.html>>
- Using Horticultural Hand Tools – English & Spanish:
<<http://www.cdc.gov/nasd/docs/d000801-d000900/d000853/d000853.html>>

Machines — Mowers, transplanters, diggers, and tractors are machines commonly used.

- Safer Tractor Operations for Landscape Maintenance and Horticultural Industries publication is available at:
<<http://edis.ifas.ufl.edu/pdf/EA/EA19800.pdf>>
- Roll-over Protective Structure Tailgate Training:
<<http://www.cdc.gov/nasd/docs/d001701-d001800/d001733/d001733.html>>
- Safely Starting and Stopping A Tractor Tailgate Training:
<<http://www.cdc.gov/nasd/docs/d001701-d001800/d001754/d001754.html>>
- Lawn Mowing Tailgate Training:
<<http://www.cdc.gov/nasd/docs/d001701-d001800/d001718/d001718.html>>

Worksite Hazards

Walking Surfaces — Injuries are common due to falls from the same level (trips). Walkways should be kept clear of debris or items which can lead to trips, slips, and falls. Water and/or plant material can make surfaces very slippery — especially in greenhouses that may have cement floors.

- Preventing Injuries from Slips, Trips & Falls:
<<http://edis.ifas.ufl.edu/pdffiles/AS/AS04200.pdf>>
- Preventing Falls Tailgate Training:
<<http://www.cdc.gov/nasd/docs/d001601-d001700/d001686/d001686.html>>

Climbing Structures (Ladders and Stairs) — Proper ladder safety procedures should be included in any training. Ladders are frequently used in the horticultural workplace. Ladders should be inspected to ensure that they are not broken or damaged. Also, aluminum ladders and electrical wires don't make for a safe combination. Stairs should be kept free of debris and also have railings for personnel to use.

- Ladder Safety:
<http://www.cdc.gov/nasd/menu/topic/ladder_safety.html>
- Proper Use of Ladders Tailgate Training:
<<http://www.cdc.gov/nasd/docs/d001701-d001800/d001706/d001706.html>>

Walkways, Aisles, etc. — Again, these need to be kept clear of debris and cleaned up frequently if slippery conditions are common.

Ergonomics in Horticultural Applications

Definition of Ergonomics and How It Applies — Ergonomics is the science of matching the job to the worker and the product to the user. Many occupational injuries and illnesses can be traced to how the worker interacts with the task. Ergonomic assessments of jobs and workplaces are necessary in order to reduce these risks. What body position must the worker maintain to perform a specific task? Are they required to sit at a workbench? If so, what is the height? Are they required to twist and lift at the same time? Are they required to perform the same task repeatedly? These operations can lead to muscle strains, and sprains, as well as permanent back disorders. Cumulative trauma from repetitive wrist motion results in carpal tunnel syndrome.

Lifting — Established guidelines indicate how much an adult can lift, including the weight, the height to which the weight must be lifted, and the number of lifts. Proper lifting techniques have also been developed and are available.

- Ladders and Lifting: <<http://www.cdc.gov/nasd/docs/d000801-d000900/d000826/d000826.html>>
- Preventing Lifting and Overexertion Injuries Tailgate Training: <<http://www.cdc.gov/nasd/docs/d001701-d001800/d001707/d001707.html>>

Repetitive Motion — Trauma to the body results when the body performs the same motion repeatedly. This is a common feature of work in assembly line operations and the horticultural industry. Perhaps a worker cuts leaves or transplants all day — two examples where the same motion is required over and over.

- Repetitive Motion Tailgate Training: <<http://www.cdc.gov/nasd/docs/d001701-d001800/d001734/d001734.html>>

Bending/Standing — There may be a lot of bending and lifting required, depending on the task. As with repetitive motion, this can result in back problems and or knee and joint problems.

- Back Injury Prevention: <<http://www.cdc.gov/nasd/docs/d000101-d000200/d000108/d000108.pdf>>

Environmental Hazards

Weather (Heat, Sun, Cold, Lightning) — Many of the commercial horticultural enterprises are located in warm parts of the country. Workers must recognize the hazards and corrective measures to be taken:

- When working in hot and humid conditions
- When working outdoors the need for protection from the sun
- How to use PPE properly and still be able to avoid heat stress
- What to do if outdoors when a thunderstorm develops and lightning is likely.

Some useful resources for weather issues are:

- A case study on lightning killing two field workers can be found at:

<<http://www.cdc.gov/nasd/docs/d000001-d000100/d000034/d000034.pdf>>

- Lightning safety information can be found at:
<<http://www.lightningsafety.noaa.gov/week.htm>>
- And also at the Web site of the National Lightning Safety Institute:
<<http://www.lightningsafety.com/>>
- Heat Stress Tailgate Training:
<<http://www.cdc.gov/nasd/docs/d001701-d001800/d001702/d001702.html>>
- Sun Exposure Tailgate Training:
<<http://www.cdc.gov/nasd/docs/d001701-d001800/d001749/d001749.html>>

Noise (Definition, Thresholds, Protection) — Guidelines have been developed that define how long a person can be exposed to specific noise levels. Noise is measured in a unit known as decibels. An activity could be done in which students measure noise levels produced by various items, such as saws, lawn mower, tractor, radio, running water, etc. During the activity, students can use different types of hearing protection, which is rated according to the amount of sound it will filter.

- The AgDare video and materials found on NASD at:
<<http://www.cdc.gov/nasd/docs/d000101-d000200/d000153/d000153.html>> show what it would be like to not be able to hear at all.
- Protecting Against Noise Tailgate Training:
<<http://www.cdc.gov/nasd/docs/d001701-d001800/d001721/d001721.html>>

Dust (Likely Types of Exposures and Controls) — Horticulture workers are likely to be exposed to dust from plant materials, soils, fertilizers and other granular substances used. Health hazards from dusts can be from the inhalation of the dust particles themselves, as well as from molds, pollens, etc. This may pose a special risk to certain individuals. Controls include use of masks, respirators, and/or keeping items wet so that dust does not develop. An activity idea for this topic would be to demonstrate the different types of masks and respirators available.

- Environmental Control Technology Can Reduce Health & Safety Problems in Agriculture: <<http://www.cdc.gov/nasd/docs/d000701-d000800/d000753/d000753.pdf>>
- Articles on the topic of respiratory protection:

<http://www.cdc.gov/nasd/menu/topic/ppe_respiratory.html>

- Dust and Mold Tailgate Training:
<<http://www.cdc.gov/nasd/docs/d001601-d001700/d001682/d001682.html>>
- Eye Protection Tailgate Training:
<<http://www.cdc.gov/nasd/docs/d001601-d001700/d001685/d001685.html>>
- A PowerPoint presentation on eye protection is available at the Florida AgSafe Web site: <www.flagsafe.ufl.edu> (Click on "Publications")

Safety Checklists

Make students aware that when looking to make corrections to hazards that they should prepare a safety checklist. In order for a checklist to be useful and effective, it should require more information than just a check. For a checklist to be effective it needs to have, at minimum, the following four items:

1. Identify the problem or the hazard
2. Identify the corrective measure
3. Identify who is responsible for seeing that it gets done
4. Identify a target date for completing the correction

It could also include additional information, such as costs, where to obtain the items for correction, etc., but the above four items are essential.

Hazardous Attitudes

Hazardous Attitude Categories

A hazardous attitude is an underlying predisposition within ourselves towards how we act and interact in situations that could lead to an incident resulting in injury.

1. "It can't happen to me" — The feeling of invulnerability. This is the sense that things always happen to someone else, therefore, 'it can't happen to me.' In confronting this attitude, it is important to find ways to help people identify with the hazard situation in order to 'personalize the risk.' One example is reading a story, such as "Rhythm of the Seasons," that puts faces on the statistics. If someone from the community has been injured, perhaps have them speak to the class. The more localized you can

make the material the better.

2. "Don't tell me what I can't do" — The anti-authority attitude. People with this attitude feel that rules are for other people and not for them, and they will break the rules whenever they feel they can get by with it. It may be helpful to explain to anti-authoritarians that rules are not arbitrary, they are designed to prevent people from being injured or killed.

3. "I'll do it this way and now" — The impulsiveness attitude. Impulsive people take immediate action without stopping to think about what they are doing. They think in terms of doing something — anything — and doing it quickly. It is important to help impulsive people focus on the consequences of hasty action, and the need to pause and think before acting.

4. "I can do it by myself and don't need any help" — This is the attitude some people have of being over-confident in their capabilities and not thinking they have any limitations. This is the person that consistently takes unnecessary chances feeling that they can get away with it. People need to realize that taking unnecessary chances is foolish.

5. "I can't do anything about it anyway" — The resignation attitude. The feeling of 'what's the use?' and feeling helpless and unable to cope. This person will simply give up and not feel like taking a proactive role in their safety.

6. "That would take too much time" — The feeling of being in a hurry and not wanting to take the time to use the safer approach or taking the time to fix something in order to do the job safer.

7. "I didn't see it until it was too late" — By not paying attention to what one is doing, a person will not have time to react to a situation that may occur.

Student Learning Activities

This section contains several activities that may be selected as options to use with your students. They are listed from lowest to highest in degree of difficulty. For example, G and H may be more appropriate for juniors or seniors than they would with middle-school students.

Activity A — Increasing Awareness of Your Surroundings

Objectives

- The students will be able to identify the importance of being aware of their surroundings.
- The students will be able to identify safety hazards in everyday surroundings and situations.

Materials

- Flip-chart, chalkboard, or overheads and projectors
- Slides or videos that the teacher may have that depict hazards
- A volunteer

Activity

Explain to students the importance of noting their surroundings. Take students to a room, shop area, playground, or similar type of area that is available for the specific teaching situation. Instruct them to observe the area and note safe areas as well as hazards. They should make notes on what they observed.

Have the students leave the area for a brief amount of time while someone changes things around – this can include clearing away a hazard as well as creating hazards in areas that were previously considered safe.

Bring the students back to the area to note the differences they have found. They can then provide a discussion of the discrepancies they have found.

Another thing that can be done to enhance this activity and show the importance of being aware of their surroundings is while they are discussing their findings as a group, have a volunteer run past the group and have that person do something that brings attention to him/her (e.g., yell, say 'hi' or whatever – yelling fire is not recommended). After the person is gone from

the area, ask the group to write down their observations of the person – color of clothing, size, gender, age, etc. When the person is then brought back out in front of the students, the discrepancies of the students' observations can be discussed. At this point it should be noted that we need to be aware of surroundings, people, etc. around us as well as being able to determine when things are not safe or not right.

Another interesting exercise to do with this activity would be to have the students simulate talking on a cell phone to show how less aware they would be of their surroundings. Compare the differences in their awareness on the phone and without the phone.

If the teacher has a video (example can be a camcorder footage of a shop area or horticultural enterprise which depicts hazards to be aware of); the video can be shown with no sound while the students identify a specific number of hazards in a video clip. After teaching the module, they can use this list to recommend corrective measures. If the teacher has pictures of horticulture enterprises from their fieldwork or of the area used in teaching production agriculture, the slides can be used to ask the students to identify hazards that they see.

Depending on the class and the level of supervision required, the students can be given an amount of time where they are assigned to work in small groups and walk around the school campus and write down a specific number of hazards they find and make recommendations for corrections. This serves as a good exercise for them to learn to look at things in new ways, from the point of view that 'if something can happen, it will'! Each group can be assigned a specific sector of the campus to search out.

Activity B — Pesticide Labels & PPE

You will need chemical labels. Labels should be readily available in your department. Check with a water quality specialist or pesticide person to get a book full of labels that your graphics people can make mock-ups from.

For the PPE items listed, match each with its identifier from the PPE on the PAPA (Proper Attire for Pesticide Application) mannequin.

In this activity they also can read the label to look for other items:

When is it safe for workers to re-enter the field or area where these chemicals have been applied? (The REI or re-entry interval for this product)

List of PPE includes (but is not limited to):

- Respirator
- Dust mask
- Goggles (Note the difference between chemical goggles and shop goggles. Shop goggles are vented, which would allow for chemical vapors to enter.)
- Rubber boots
- Rubber gloves
- Tyvek suits
- Coveralls
- Long sleeved shirt
- Long pants
- Chemical resistant PVC apron

In this area also, you can display cooling vests and bandanas. These are helpful when discussing the need for PPE and when working conditions are very warm and humid.

Select a pesticide label. For the label you selected, identify the following:

- a. Name of the pesticide _____
- b. Minimum PPE required:
- c. What other safety cautions need to be taken with this chemical?

d. When is it safe for workers to go back into the fields? _____

That time is known as _____.

e. What can be used to help alleviate heat stress when PPE is required during extremely warm and humid weather?

In the activity area, a display of different types of goggles can be set up so that students can identify which ones can be used with which chemicals. (Each pair of goggles is identified with a letter).

Activity C — Hearing Protection and Noise

Objectives

- The students will be able to identify sources of noise in the horticultural workplace
- The students will understand exposures and threshold limits for noise exposures
- The students will identify hearing protection devices that are available

Materials

- Flip-chart, chalkboard, or overheads and projector
- Examples of hearing protection devices (earplugs, earmuffs)
- Examples of hearing protection that indicates the Noise Reduction Rating (NRR) — Provide enough examples so that different ratings can be observed.

If available, a dosimeter or sound meter (these may be available through the school nurse, or an area clinic – if the latter, a guest speaker could be invited to explain about measuring noise and the use of hearing protection.

Activity

If a dosimeter is available, measure noise levels produced by various items such as the following examples:

Noise level measurements for these items by themselves:

- Chain saw
- Tree trimmers
- Hedgers
- Mowers
- Tractor
- Radio at the level the students usually listen to it!

Noise level measurements for items used at the same time:

- Chain saw and radio
- Mower and tree trimmer
- Tractor and radio

Hearing protection:

- Have students identify various hearing protection devices and identify where they find the NRR (Noise Reduction Rating) of the device. The higher the NRR, the more protection that is provided. If the noise levels produced by various devices are available, have students identify which device or combination of noise reduction devices must be used so that their exposure does not exceed 85 decibels. (The threshold for the workplace exposure is set at 85 decibels in order to prevent hearing loss.)

Students can try on the hearing protection examples provided and then discuss their likes and dislikes of the different styles.

Students can also wear earplugs for a period of normal class time to simulate suffering from a permanent loss of hearing.

Record the noise levels for the readings taken:

<u>Device</u>	<u>Noise Level</u>
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The noise level readings are given in dBA. Look at the examples of hearing protectors (hp). The greater the Noise Reduction Rating (NRR), the more protection the hp provides. For the above instances that a worker would be exposed to, select the appropriate hearing protection to be used. Actual exposure must be less than 85 dBA in order to prevent hearing loss.

What are the different types of hearing protection?

Identify likes and dislikes of the styles of hearing protection.

Activity D — Lock-out/tag-out

1. What is lock-out/tag-out?
2. If 6 people need to enter an area to perform maintenance, how many different locks and keys are required? _____

Answer Key

1. Lock-out/ Tag-out is a set of procedures that is followed in order to prevent the "unexpected" energization or start-up of machines or equipment, or the release of stored energy. This is done in order to prevent possible injury to workers or others in the area. For lock-out, everyone that may be working on the machine has a key to a padlock that locks out the energy source (such as a circuit box) — if six people are working on a machine, there would be six locks on the energy source. Each person then removes their lock as they leave the area. Tag-out means that a tag is placed on the item stating that someone is working on the device and that it should not be started up.
2. 6.

Activity E — Fire Prevention and Fire Extinguishers

(If possible, have someone from the local FD give a demonstration on how to use a fire extinguisher.)

1. What is "PASS?"
2. What are the classifications of fire extinguishers and what kinds of combustibles can each type be used on?

Classification

Type of Combustible

3. Which extinguisher is considered the 'all-purpose' extinguisher?

Answer Key

1. **P**ull the pin
Aim at the base of the fire
Squeeze the handle
Sweep across the base of the fire
2. Classification Type of Combustible

A	Wood and paper
B	Oils, gasoline
C	Electrical
K	Kitchen
3. ABC

Activity F – Hazardous Attitudes

These stories are a combination of different types of incidents that could occur taken from different parts of the horticulture industry. Nine stories have been developed. Use a minimum of four stories. Below is a list of hazardous attitudes that the students choose from when they view each story. Use one of the stories as an example of how it should be done. After each story is completed, have the class discuss what they decided was the problem. There may be more than one attitude present for each story. Attitudes may be used more than once.

Hazardous Attitudes

1. "It can't happen to me"
2. "Don't tell me what I can't do"
3. "I'll do it this way and now"
4. "I can do it by myself and don't need any help"
5. "I can't do anything about it anyway"
6. "That would take too much time"
7. "I didn't see it until it was too late"

Story #1

This is a story about Fred, a man who was applying pesticides to his crop and was not using the proper PPE. Fred was in a hurry to get the pesticide applied and was careless in his use of the PPE. He was spraying for about an hour when his co-workers saw him acting weird and rushed him to the hospital, where Fred received an antidote. Fred had poisoned himself. He spent 2 days in the hospital.

Hazardous Attitude:

Story #2

This is a story about Bill, who at the time of the incident was working in the summer transplanting trees and suffered a case of heat stress. Bill was working in the sun on a day when the temperature was above 90 degrees F and the humidity was around 85%. He had not been drinking water and had symptoms of headaches, an upset stomach and dizziness. His boss came out to check on him and noticed that he was walking irregularly and made him go sit down in the shade and drink lots of water.

Hazardous Attitude:

Story #3

This is a story about Heidi, who at the time of the incident was moving a flat of potted plants off the bench and onto the floor. She had been transplanting cuttings to pots all day. Each time she completed a flat of pots, she would set them on the ground where someone else would come and get them with a trailer. While she was moving the flats, she bent wrong and dislocated a disk in her back.

Hazardous Attitude:

Story #4

This is a story about Amy, who at the time of the incident was lighting greenhouse heaters. When the heater had been refueled, some of the fuel had spilled on the side and the ground. The individual who performed the task did not clean it up. Amy came by and lit the heater, and the flame followed down the side of the tank and onto the ground. Around the base of the heater, there were some leftover plant trimmings that had not been cleaned up in some time. They in turn ignited and the fire spread. Amy ran and got a fire extinguisher from the office and returned to the fire. She was able to put the fire out with some help, but not before some of the surrounding plants were destroyed.

Hazardous Attitude:

Story #5

This is a story about Steve, who at the time of the incident was moving a wheelbarrow through the greenhouse and tripped on an unseen object sticking out in the aisle. The previous worker in the greenhouse had left material lying out in the walkway while he went to do another job. Steve had the wheelbarrow full of plant trimmings, and he did not see the object lying on the floor. After the wheelbarrow passed over the object, Steve's foot got caught up in the object, and he tripped. Steve fractured his jaw when it hit the back of the wheelbarrow. His jaw was wired shut for 6 weeks.

Hazardous Attitude:

Story #6

This is a story about Mike, who at the time of the incident was fixing a cooling fan in the greenhouse. Mike had turned off the fan at the breaker box and had not tagged it out. While he was working on it, a co-worker who did not know that someone was working on the fan turned it on. Mike was in the process of wiring up a new motor and was holding one of the electrical leads when a jolt of electricity knocked him off the ladder. Mike was lucky not to have been electrocuted.

Hazardous Attitude:

Story #7

This is a story about Missy, who at the time of the incident was cleaning up the pesticide locker and knocked a shelf down causing several containers of pesticides to break open and spill in the locker and spread to the area surrounding the locker. The accumulation of excess chemicals had been growing for years and had gotten to be quite a large amount. The shelves were overloaded, and the top shelf was getting ready to fall down. As Missy was moving a container, the shelf gave way and knocked the shelf below it and its contents to the ground. As the chemicals mixed, a cloud developed. Missy, fearing for her safety, ran out of the locker and called the fire department. Missy was not hurt, but the owner of the company was fined and had to pay a company to come out and clean up the hazardous waste.

Hazardous Attitude:

Story #8

This is a story about Tom, who at the time of the incident was installing a sprinkler system in a greenhouse and cut his hand with a hacksaw. It was 4 pm on a payday Friday, and Tom could not leave work until the last section of sprinkler was installed. He was not paying attention to where his thumb was, and when he drew down on the hacksaw, his thumb was under the blade. Instead of going out with his friends Friday night, he spent it in the hospital where he received eight stitches.

Hazardous Attitude:

Story #9

This is a story about Jennifer, who at the time of the incident was moving trees with a tractor on a hill and rolled the tractor. Jennifer was using the bucket of the tractor to move the trees. She was on an angle and was ok until she had to turn. The bucket was up in the air because of the way that they attached the tree to the tractor. They had been doing this all day, but the angle had unknowingly increased. When she turned the tractor, it rolled. She was not injured. The tractor had a ROPS and she was wearing a seatbelt.

Hazardous Attitude:

Hazardous Attitude Answer Key

- Story 1: 1 & 6
- Story 2: 1 & Possibly 4
- Story 3: 3, 4 & 6
- Story 4: 6 & 7
- Story 5: 6 & 7
- Story 6: 3 & 6
- Story 7: 6 & 7
- Story 8: 6 & 7
- Story 9: 7

Activity G — Case Study

Note: The information contained in this study is quite extensive, feel free to edit if needed. Recommended strategies for prevention are included at the end of the incident description. Those are the answers for which the students should be expected to come up with after analyzing the case.

Machine Operator Electrically Shocked in Transplant Nursery

- California NURSE project Report Summary: Case 292-327-01: <<http://www.cdc.gov/nasd/docs/d000001-d000100/d000074/d000074.html>>

Some greenhouses grow vegetables from seeds. As these plants grow, they need to be trimmed. A 23-year old Hispanic male who had been cutting celery, returned from his afternoon break to continue cutting. He had been employed at the nursery for 3 years and had worked as a cutter for the last 18 months. The electric cutting machine that he used looked like a lawn mower. An extension cord was needed in order to reach the electrical outlet. The extension cord he was using was missing the third prong. Also, puddles of water were on the floor from watering the plants. Shortly after grabbing the cutting machine, he received an electrical shock. He could not let go of the handle, and he screamed for help.

A co-worker ran over and unplugged the cutting machine. The injured worker fell to the ground, dazed and weak. Their supervisor told the co-worker to drive the injured worker to a walk-in clinic. From there, he was driven to a hospital, where he was treated and spent the night.

The transplant nursery had been in operation for 11 years. It employed 80 full-time workers (working 38 or more weeks per year), 40 seasonal workers (working 13-37 weeks per year), 20 casual workers (working 1-12 weeks per year), and 4 family members. The injured cutting machine operator was a full-time worker. Transplant nurseries grow seedlings of celery, lettuce and other vegetables in protected controlled environments called nurseries. The seedlings are grown until ready to be planted either by hand or machine in an open field.

The safety director, plant engineer, and maintenance workers at the nursery were involved in the investigation of the incident. The nursery was unable to locate their written injury and illness prevention program. In this particular state, all employers are required to have a written seven-point injury prevention program which includes:

- designated safety person responsible for implementing the program
- mode of ensuring employee compliance
- hazard communication
- hazard evaluation through periodic inspections
- injury investigation procedures
- intervention process for correcting hazards
- safety training and instruction.

In this case, the cutting machine operator said that he had received oral safety training from his supervisor for operating the cutting machine.

Other cutting machine operators had complained of receiving electrical shocks from this machine in the past.

The cutting machine is mounted on a large metal frame which holds the machine above the seedlings. This metal frame is secured to the floor of the building. The machine is maneuvered by holding the metal frame. It is powered by 110 voltage, from a long three-prong extension cord connected to an electrical outlet. This cord can be plugged into a ground fault circuit interrupter (GFCI) housed in a 5-gallon bucket; or the GFCI can be bypassed and the extension cord can be plugged directly into the shed's electrical system. The buckets containing the GFCIs are stored in a maintenance shed (away from the nursery building). GFCIs must be used in wet environments since they will cut the electrical circuit if a ground fault occurs — thus preventing the person from being shocked and injured or killed. When a ground fault occurs, the electrical current travels through the machine user to the ground, instead of through the machine to the ground. Electrical current at 110 volts in contact with wet skin can provide a shock powerful enough to kill a person.

The ground was wet from the indoor sprinkler irrigation system, which had been operating while the worker was away on break. He was wearing tennis shoes and had wet feet. The third

(grounding) prong on the machine's extension cord had been broken off, thus there was no continuous ground to the cutting machine. The GFCI had been bypassed, and the faulty extension cord was plugged into a standard electrical socket.

When the worker grabbed the metal and walked a few feet he received an electrical shock which was sufficient to cause his hands to grip the handle, and he could not let go. A nearby co-worker was able to reach the injured worker within seconds and unplug the machine. As soon as the current stopped, the injured worker was able to let go and fell to the ground.

As of a month after the incident the person was still weak and not able to return to work.

Solutions the Students Should Be Able to Come up with Based on Their Analysis of the Case Study

Prevention measures would have included:

- Having the GFCIs with buckets in the area of the work rather than in another location would have prevented the person taking the short cut of just plugging in the cord to the regular socket. Also, the nursery did not have a written policy that these should be used all the time. The operator had not been trained in the importance of using the GFCI in wet environments.
- Inspections would have found the faulty extension cord, and it would have been disposed of and replaced.
- Previous shocks had been mentioned. This should have been further investigated and appropriate repairs made.
- Employees themselves should be trained for inspecting the equipment properly on a daily basis prior to beginning work.
- Safety needs to be considered when building or modifying equipment. The frame of the cutting machine should have been equipped with an electrically insulated plastic handle for the operator to hold while operating the machine. This would have prevented the shock (but not the other unsafe practices!).
- Workers need to be provided with the proper PPE. In this wet environment when working with electrical equipment, electrically insulated boots and gloves should be used.

Activity H — Interactive Story

Use the materials included with "Jesse's Joke: An Interactive Story About Kids and Greenhouses."

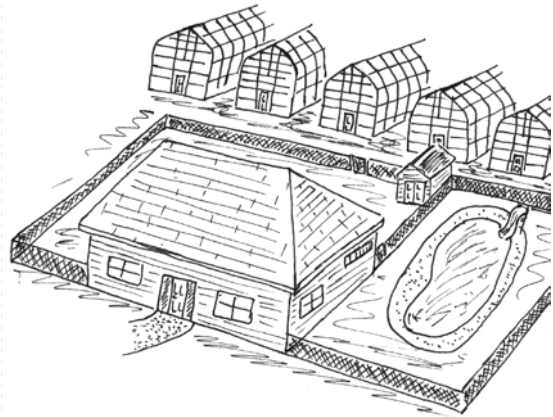
Students can get together in small groups to read and discuss the story, then return to the full class and discuss. The answer key and additional fact sheets are included in the materials with the story.

Jessie's Joke

An Interactive Safety Story about Kids and Greenhouses

Story by Elizabeth Wang, Jennifer Miller, and Carol Lehtola
Illustrations by Sam Hassan

It was a hot, humid day in the middle of July in Palm Beach County, Florida. Five children playing in the backyard of a homestead drew no attention, as two of the children's parents were away from the house and working in the greenhouses and shade houses that composed the entire rear of the twenty-acre property. When Jan and Joe Smith were gone, they tended to leave their kids with strict instructions to not leave the house or the yard. The Smiths had two children, Daniel, 7, and Kasey, 8. Joe and Jan believed their children were



quite mature for their age because they had shown on numerous occasions that they were able to follow instructions and not get into trouble. Surely it was okay to leave them to themselves with their friends for a few hours. Joe and Jan started working on opposite sides of the property vowing to meet in the middle. They worked quickly, watering, checking drip irrigation, and inspecting plants for bugs and disease.

Question Set A

1. T F The backyard was a dangerous place for children to

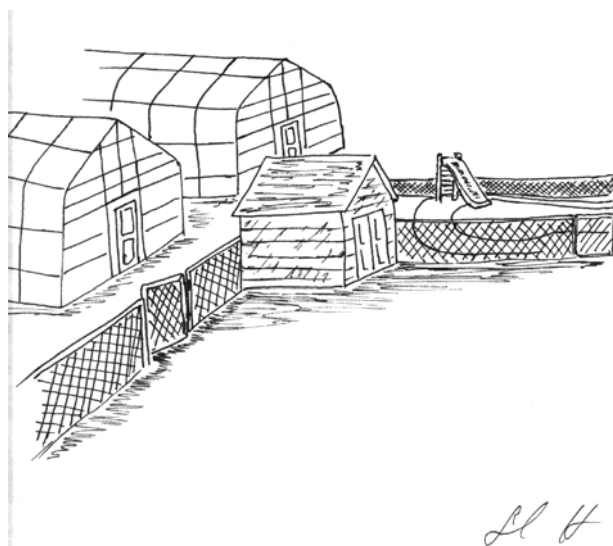
- play if it was also a place of work.
2. T F Nothing bad could happen because the children had proven they were responsible.
 3. T F Adult supervision was not needed as long as the children stayed on the property.
 4. T F These children were more responsible than the average child.
 5. T F Parents and/or guardians are the only people qualified to assess the maturity of their child.
 6. T F Parents should trust that the friends of their children would obey their wishes.

Meanwhile in the backyard, the kids were getting restless. Or better said, Daniel and Kasey's friends were getting restless.

"C'mon Danny. There's got to be something else we can do. I'm getting bored with this," 7-year old Jessie whined.

"Well, let's find more G.I. Joes and Legos, and we'll build another fort and play a new war," Daniel replied as he rose from the ground and headed towards the toy chest.

"What about swimming? It's soooo hot out," asked Becca pointing towards the pool by the deck.



Question Set B

1. T F Pool areas should be secured with fences and locked gates so that no one can unintentionally fall in.
2. T F Children should be warned of the dangers of swimming unsupervised.

"That'd be awesome!!" exclaimed George, "race ya to the house to get our

suits!"

"Wait, wait, WAIT!" Kasey yelled motioning for everyone to stop, "we can't swim without our parents around."

"Aww, don't be a wimp, Kase," Jessie chided.

"Kasey's right. We can find something else to do. Once Mom and Dad come back, we can swim for as long as we want!" Daniel said.

"I guess," Jessie pouted. "So what are we gonna do til then, smarty?"

"Umm, I dunno. Let's see..." said Daniel as he rummaged through the toy chest, "Lincoln Logs — Monopoly — Checkers..."

"Only two people can play checkers, dummy," Jessie said, "I have a better idea," he said after a pause.

"And what is that?" Becca inquired.

"Let's all play hide and seek!" Jessie proclaimed, "George can seek first and the rest of us can hide."

"Too cool!" George spouted.

"Okay, let's set the boundaries. Stay inside the fenced yard. The house is within limits. The pool is home base," Daniel explained, "that all right?"

"Yeah!" everyone agreed.

Question Set C

1. T F Pool and utility sheds should only be locked when no adult is present.
2. T F Pool and utility sheds are harmless to children older than five years old.
3. T F Children explaining rules to other children is more effective than having adults explain rules to children.

"Well then, if everyone's ready, I'll start counting," George said.

He headed to the pool, sat on the chaise, put his hands over his eyes and

starting counting to 50, "1...2...3...4...5...6..."

The kids scattered this way and that like ants flushed from an anthill. Daniel headed to the house as did Kasey. Becca headed to the pool shed. Jessie, feeling he should win, acted like he was darting to find a place in the yard until the others vanished from sight.

George continued to count, "30...31...32...33...34...35...36..."

Jessie then scooted underneath the fence and ran towards the row of greenhouses.

"I'll show them," he puffed. "They'll never find me!"

He stopped at a greenhouse with the door cracked open; it hadn't shut properly when one of the Smiths had exited it.

Question Set D

1. T F Greenhouse doors should be on a lock-out/tag-out system and remain locked when no one is inside.

He scooted into the greenhouse and ran to a corner and crouched down to duck under the bench.

"Boy, it's hot in here," he said as sweat started to pour down his face.

Jessie panted for a bit. Soon, when his squatting position was taking too much energy from him, he sat down and leaned against the leg of the table.

"I wish George would hurry up," Jessie said to himself.

He heard some screaming as his friends were being chased around the yard from their hiding spots. He quickly stopped sweating, but he still felt very hot and his skin was dry. Eventually, the warmth of the greenhouse made him woozy and he passed out under the bench.

Question Set E

1. T F Greenhouses keep the same internal temperature as the temperature outside.

2. T F Dehydration can result from exposure to extreme temperatures.
3. T F The body has an internal thermostat that can regulate the body even under extreme temperature conditions.
4. T F Only adults doing physical or manual labor can suffer from heat stroke or heat exhaustion.

Unbeknownst to the children, Jan and Joe were on their way back to the house, pleased that they had finished in less than two hours. They entered the yard and saw George by himself.

Jan asked, "George, where is everyone?"

George motioned for her to be quiet as he ran over and whispered, "We're playing hide and seek. I found Daniel already. He's over by the pool waiting for me to find the others."

"Oh, okay. We'll let you guys finish then. Hurry so everyone can have ice cream and go swimming, OK?" Jan whispered back.

George nodded yes and rushed off towards the pool shed in search of the others.

Eventually Becca and Kasey joined Daniel by the pool having been flushed from their hiding spots.

"Where's Jessie?" Becca inquired.

"I dunno. I've looked everywhere and I haven't seen him yet. It's weird. There's not that many places in the yard or house to hide," George replied.

"We'll help you look for him," Kasey said. With that, the group set off to look for Jessie together.

Question Set F

1. T F The children understood where they were allowed to go for the game.
2. T F The children knew and understood what areas were

dangerous to hide in.

The children looked and looked again, but still they could not find their friend Jessie. He had all but disappeared. Knowing he could not have walked home, Daniel and Kasey went to their mom and dad to see if they had seen Jessie.

"Maybe you guys didn't look for him hard enough," replied Joe to his daughter.

"No, no, Dad. Really, we've looked everywhere like three times," Kasey answered. "Nobody was supposed to leave the yard or house. I think Jessie may have broken the rules and gone somewhere else."

"Maybe you should take the kids out back and yell around there to see if Jessie wandered to the back," Jan said concernedly.

"All right," Joe sighed. "Kids will be kids."

Question Set G

1. T F Joe, the father, was correct in not being concerned because "kids will be kids."
2. T F If the parents think their children are mature, they should believe what their kids tell them.

The group, led by Joe, headed back to the greenhouses to look for Jessie.

"Jesssssie!!"

"Come on out."

"We're not playing anymore, come out!"

"Jeeessssiiiiiee!"

After twenty minutes and one full circle around, they turned up empty-handed. No one went into the greenhouses, figuring Jessie wouldn't have been able to open the door without someone hearing him.

Question Set H

1. T F Children playing in the yard would have heard a greenhouse door open at the rear of the property.
2. T F Since the greenhouse doors were too heavy, Jessie could not get into the greenhouse.
3. T F Jessie's entering the greenhouse would have been prevented if the doors had been locked.

"All right, guys, you all head back to the house and go see Mom," Joe instructed them. "She's got ice cream ready for y'all. Go on," he said as he shooed them off.

Joe decided he might as well check each house, just in case Jessie wandered into one by chance. Joe didn't really think that Jessie had the strength to pull open one of the greenhouse doors by himself. He started at the front of the property figuring Jessie might be in one of the front houses before he would've made it to the rear. After going through four houses, Joe came upon a door cracked open. Obviously, it had not been closed from the last person who walked through it.

Joe opened the door and walked in.

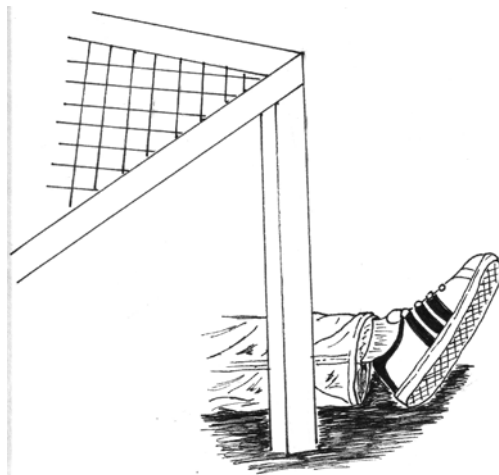
"Jessie are you in here?" his voice boomed.

Not hearing a reply, Joe turned, but something caught his eye. It appeared from his vantage point to be a jeans pants leg.

"This is not funny, Jessie," Joe stated. "You better come out from under there right now. We've been looking for you for over an hour and a half."

Joe glared at the figure huddled under the table.

"I'm not joking around, mister," Joe said as he kneeled down. "Get out of th..."



He stopped upon seeing Jessie. Jessie was moving and did not appear to be breathing.

"Jessie! Jessie!" Joe screamed as he shook the little figure.

He dragged Jessie's body from under the table and threw pots off the top of the table to clear room for him to perform CPR. After a few puffs with no response, he picked Jessie up in his arms and bolted out of the greenhouse and ran towards the house screaming, "Call 911!!"

Question Set I

1. T F The proper way to begin cardiopulmonary resuscitation (CPR) is by checking for a pulse and breathing.
2. T F 911 is the emergency number to call in all rural areas.

The kids and Jan were busy frolicking in the pool by this time and heard Joe's screams before they saw him. Joe appeared quickly, carrying Jessie's limp body in his arms.

"What is going on here?" Jan asked. "Where was he?"

"He must have hidden in the greenhouse. I found him under one of the tables," Joe puffed.

Jan ran to get the phone and started dialing.

"Mommy, what happened to Jessie?" Daniel asked, tears streaming down his face.

"Jessie's not well, honey, we've got to get him help," Jan said.

Kasey, George, and Becca joined Daniel with tears.

"Did we kill him?" Becca sobbed.

"No, no, sweetie. You did no such thing," Jan comforted.

"I should have found him faster," George sobbed. "He'd be okay if I had."

"No one here is to blame," Joe said to the children.

The ambulance tore into the driveway and carried Jessie away. He never woke up.

Question Set J

1. T F The children killed Jessie by playing hide and seek.
2. T F With adult supervision, this situation could have been prevented.
3. T F Joe, the father, was correct that no one was to blame for Jessie's death; however it could have been avoided.
4. T F Heat stroke, dehydration and heat exhaustion were the likely causes of Jessie's death.
5. T F Something as simple as locking the greenhouse doors would have affected the story's outcome.

Optional Assignment

Rewrite the story to have a happy ending! That is, where in the story could the events have been changed, and how could they have been changed to have broken the chain of events that led to Jessie's death?

Answer Key for the Jessie's Joke Interactive Story

Question Set A

1. True The backyard is a dangerous place to play if it is also a place of work.
2. False Even responsible children can not be aware of all the different types of hazards around them. They, too, are at risk.
3. False Adult supervision is always needed around young children.
4. False They may or may not be more responsible than the 'average' child. Every parent thinks their child is 'above average'.
5. False People other than just parents and guardians are qualified to assess a child's maturity. People such as their teachers can certainly assess a child's maturity. In fact, they may be able to

do it better since they would be more objective.

6. False Children may forget what they have been told – so there is no guarantee that they will obey their friends' parents' wishes.

Question Set B

1. True Pool areas should be secured with fences and locked gates so no one can enter the area when it is unsupervised.
2. True Children do need to be warned of the dangers of swimming unsupervised.

Question Set C

1. False Pool and utility sheds should always be locked when not being used – whether an adult is around or not.
2. False Pool and utility sheds can be harmful to persons of any age – even adults.
3. False Children explaining rules to other children is not necessarily more effective than having adults explain the rules.

Question Set D

1. True Greenhouse doors should be kept locked when no one is working in them.

Question Set E

1. False Greenhouses can get warmer than the outside temperature.
2. True One cause of dehydration can be exposure to extremely warm temperatures.
3. False The boy's internal thermostat can fail under conditions of extreme temperatures.
4. False Children as well as adults can suffer from heat stroke or heat exhaustion. It is not just limited to adults nor is it limited to persons doing physical or manual labor.

Question Set F

1. False Obviously the children did not understand where they were allowed to go for the game or what areas were to be off-limits.
2. False Obviously the children did not understand what areas were dangerous to hide in.

Question Set G

1. False The father should be concerned – especially because 'kids will be kids'!
2. True If the parents think their children are mature, they should believe what the kids tell them.

Question Set H

1. False Children playing in the front part of the property would not have been able to hear a door open at the other end of the property – especially when there would have been other noises in the area.
2. False It could not be assumed that just because the greenhouse door was heavy that a child would not be able to enter the building. In this case the door was already partially open.
3. True Jesse could not have entered the greenhouse if the door would have been locked.

Question Set I

1. True Before beginning CPR, one must check for breathing and pulse.
2. False 911 is available in most parts of the country, however, it is not in all rural areas yet. Be aware of the proper emergency number to call. Also when 911 is called on a wireless phone, the operator may not be able to identify your number or your location. See <http://www.cheaptelephonebills.com/wireless911.html> for more information.

Question Set J

1. False The children did not kill Jessie by playing hide and seek. The game in and of itself is not dangerous.
2. True The situation could have been avoided had the children been playing under adult supervision.
3. True The father was correct when he stated that no one was really to blame for Jessie's death. However, the incident could certainly have been avoided.
4. True Jessie's death was due to heat stroke, dehydration, and heat exhaustion.
5. True Something as simple as locking the greenhouse doors and preventing access by unauthorized persons would have affected the story's results.

Greenhouse Production

A Fact Sheet to Accompany Jessie's Joke Narrative Story

Greenhouses are increasingly seen in many different landscapes. These structures are used to produce various kinds of plants within the best possible growing environment to allow for maximum production levels. This is accomplished by taking steps to control all of the inputs the plant receives including sunlight, water, nutrients, and temperature.

The location of a greenhouse directly correlates with the amount of sunlight it is exposed to. The maximum amount of sunlight should be let in. Morning sunlight allows the plant's food-making processes to begin as early as possible. If this path is followed, a greenhouse with a clear area to its south is considered the best choice. This means that the building is located south of any kind of shade, such as buildings or trees. If this location is not available, a site with the best possible exposure to the sun should be selected. Construction of a greenhouse north of any major structures or shade is not generally desired unless it will be used for plants requiring little light.

Shade is also something to consider with a greenhouse location when year-round use is desired. When using trees for shade, deciduous trees are the better choice over evergreen varieties. Deciduous trees can provide shade from intense summer afternoon sun. In winter, they will allow the maximum amount of sunlight due to the loss of their foliage. If trees are not available for shade, then commercial shade cloths are an easily installed alternative.

Growing space inside a greenhouse is also very important. The more benches that can be utilized, the better. The most generic set-up is one central bench with two side benches allowing for two walkways. This allows for room to work without sacrificing storage. Another consideration with a greenhouse is total interior volume. The smaller the greenhouse, the more rapidly the interior environment can change. Greenhouses gain and lose heat very quickly.

Environmental systems are necessary in greenhouses. Environmental control is accomplished with heaters, fans, thermostats, vents and several other kinds of equipment. These must work together properly in order to provide the ideal environment for the plants being grown. These systems are becoming more automated, allowing for all the systems to interact and control the greenhouse conditions from one central location.

Similarly, watering, fertilizing and pesticide application systems are becoming automated and integrated. Often, chemicals are applied to the plants through the irrigation system. This process is known as chemigation. Chemigation reduces workers' exposure and contact with various chemicals and provides more precise application allowing for less waste.

Just as in any other workplace, a greenhouse has many hazards. Proper personal

protective equipment (PPE) and care must be used in order to make the workplace as safe as possible. Properly fitting clothing that will not get caught or snag on protruding objects is important. Good footwear is essential as wet surfaces are ever-present in the greenhouse, often with chemicals also present. Floor material plays a large role in handling wet conditions. Gravel can be safer in wet conditions, but it provides a less consistent walking surface compared to concrete.

Caution must be taken to prevent any heat-related ailments. This is especially important if a greenhouse is smaller. Greenhouses are actually a confined space. Spikes in the inside temperature due to total sun exposure must be realized. Other hazards can exist, depending on the individual structure's design, so time must be taken to look for, identify, and make corrections to the hazards that may be present.

In the event of lightning, workers should take shelter elsewhere. If the greenhouse is made of plastic and it catches on fire, toxic fumes will be produced. Greenhouses should be kept locked when workers are not present. Security measures need to be taken to ensure that unauthorized persons cannot gain access to the facility.

Greenhouse Safety Hazard ID Questions

For each hazard identified, also identify a corrective measure, a target date for making the correction, and designate a person responsible for seeing that it gets done.

- Is proper PPE issued and used?
- Are flats and other plant containers maintained in good condition with no rough edges or splinters?
- Are aisles kept free of gravel, dirt, and other debris?
- Are sharp tools stored properly?
- Are the walkways treated to control algal scum?
- Are personnel with open cuts or abrasions prohibited from handling soil unless wounds are bandaged?
- Are adequate personnel available and proper procedures established for lifting trays and heavy containers?
- Can walk-in refrigerators/environmental chambers be opened from the inside, even when locked?
- Are flammables stored properly?
- Are ground fault circuit interrupters (GFCIs) used in areas near water?

Heat Exhaustion & Heat Stroke FAQ

Why do heat exhaustion and heat stroke occur?

Heat exhaustion and heat stroke both occur when the body is exposed over a prolonged period to hot temperatures, dehydration, and/or problems with the bodily mechanisms that control temperature.

What is the difference between heat exhaustion and heat stroke?

Heat exhaustion is caused by the conditions explained above, but is less severe than heat stroke. Some symptoms of heat exhaustion may include: headache, weakness, lightheadedness, muscle aches, muscle cramps, and agitation. The excessive heat causes the body to lose fluids and salt through sweating. However, if a person continues to remain in the sun without drinking more fluids, the body will be unable to continue to perspire. This means that the body has no way to cool itself, and the body temperature will begin to rise without any way of controlling it.

Heat stroke develops from heat exhaustion that is not controlled; however, the symptoms of heat stroke also include hallucinations, bizarre behavior, seizure, and coma. Heat stroke is defined by a body temperature of higher than 104°F, but can be as high as 106°F.

How should one treat heat exhaustion and heat stroke?

When suffering from heat exhaustion, the most important thing is to try to slowly rehydrate the person using fluids such as water or Gatorade. Also, the person should find a cool area to rest, and avoid physical activities in the sun until the body is rested and fully hydrated.

Heat stroke is significantly more serious than heat exhaustion and requires immediate medical assistance. While waiting for the medical team to arrive, the bystanders should help the person to a cool location and wrap them in cold, wet towels or clothing. Ice should also be placed in areas where there is a lot of blood supply in order to help quickly cool off the body. These areas include: the neck, underarm, beneath the knees, and the groin.

How can one prevent heat exhaustion and heat stroke?

Both can be prevented by avoiding strenuous activity in the sun or in enclosed places such as sheds and greenhouses, where the temperature can exceed the outside temperatures. Caution should be taken if work in these situations is unavoidable, such as making sure that the person is properly hydrated at all times.

Who is at risk for suffering from heat exhaustion and heat stroke?

Heat exhaustion and heat stroke affects different people of different age groups differently. However, no one is safe from these conditions unless they take the proper precautions to prevent it.