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I. Introduction

A. Scope
The Villanova Theater Safety Policy’s purpose is to protect the health and safety of all faculty, students, employees and visitors who can reasonably be expected to be exposed to chemical or physical hazards normally found in a theater. Information found in the policy is applicable to all members of the theater community including directors, performers, production staff, outside contractors, and front-of-house personnel. Any questions or comments regarding this policy should be directed to the Theater Department production manager.

B. Theater Training
A safety orientation program will be developed and instituted that explains the various potential hazards that may be encountered when operating a theater and their controls. Topics will include power tool use, ladders, fall protection, chemicals, electrical safety, emergency evacuations, and personal protective equipment. The format of the orientation shall be high-impact, timely, and easily repeatable.

C. Policy non-compliance
Individuals who do not comply with the Theater Safety Policy will be subject to disciplinary action from the Theater Department.

II. Pyrotechnics, Fire Codes and Work Practices

A. The use of open flames and pyrotechnics in Vasey Hall is strictly prohibited.
B. Students may not work on sets alone, or engage in activities that require the use of ladders or fall protection in the Theater. The Theater Department is responsible for enforcing this policy.
C. The Theater Department must develop a system of random weekly inspections to ensure compliance with housekeeping and safe work practice policies.

III. Emergency Procedures
Dial 9-4444. Your call will be answered by a communications officer in the Department of Public Safety. Public Safety personnel will respond and determine the need for additional assistance.
A. Chemical Exposure

1. If you spill a chemical such as paint thinners or fabric dyes on your skin:
   - Rinse the area with water for at least 15 minutes.
   - Remove any soiled clothing and jewelry while you are rinsing.

2. If you get a chemical in your eyes:
   - Rinse with water for at least 15 minutes, rinsing from the nose outward to avoid contaminating the unaffected eye.

3. If you inhale a chemical or are overcome by fumes:
   - Leave the room and move to fresh air. For any emergency including injury, illness, fire or an explosion, dial 9-4444 from any University phone or call 610-519-4444 by cell phone.
   - Keep door of room open to vent.
   - Do not re-enter a contaminated area.
   - If symptoms do not subside, seek medical attention.

IV. Set Design & Construction

A. Props and Decoration
Decorative materials include curtains, draperies, streamers, fabrics, cotton batting, straw, hay, vines, leaves, stalks, trees and moss. Decorative materials may be used only if they are noncombustible or flame resistant or have been rendered so with commercially available products.

B. Structural Issues for Set Design
Any set design which includes steps, ladders, traps or other specialty devices must be approved by the Villanova University Theater Department production manager. When possible, sets for Vasey Hall should be constructed in a location outside the theater and assembled later in the theater.

The Theater Department is to hang all cable lights before they assemble the set in Vasey Hall to minimize the use of ladders. The only time students should be using ladders after the set assembly is to focus the lighting or make any necessary last minute adjustments. Students and Staff must use the fall arrest system and follow the associated safety procedures while hanging cable lights.
C. Personal Protective Equipment

Personal protective equipment includes all types of equipment used to increase individual safety while performing potentially hazardous tasks. This includes eye and face protection, head protection, foot protection, hand protection, respiratory protection (please note that medical approval and fit testing, provided by the Environmental Health & Safety Department (EHS), is required for individuals who utilize respiratory protection). EHS (9-7838) can help in assessing the need and making selections of personal protective equipment.

Safety Glasses: Always wear safety glasses when using either hand or power tools. Goggles: The EHS department recommends using goggles rather than safety glasses when pouring chemicals that can be corrosive to the eyes. Consult the Safety Data Sheet (SDS), chemical label, or EHS for assistance. Gloves: A leather type work glove should be worn when working with your hands during set construction and tear down. DO NOT wear gloves, loose fitting clothing or jewelry when working with power tools that have rotating parts. Work shoes and boots: Closed toe shoes or boots must be worn during set construction, set up and while working with power tools. Open-toed shoes (sandals, ballet flats, etc.) may not be worn during any phase of set construction.

D. Power and Hand Tools

Shop Technicians may use a power tool only after receiving proper training on its operation. The Technical Director will review the operation of the equipment, making sure to point out safety features and guards. Crewmembers are expected to know both the use and the limitations of a power tool. Some general guidelines for using tools include:

- Inspect tools before use to check for any defects such as frayed wires, or damage. Remove defective tools from service and have repaired or replaced.
- Only use power tools that are grounded with a 3-pronged plug or that are double-insulated.
- Never carry a power tool by its cord.
- Unplug power tools before loading them, changing blades or bits, making adjustments, or cleaning them – and follow the manufacturer's instructions.
- Never use power tools while standing on wet surfaces or in wet weather.
- Discontinue use of defective or unsafe equipment as soon as the defect becomes known.
- Dull tools are unsafe and can damage work. Maintain your tools and always use sharp cutting blades.
- Never alter or remove any machine or blade guards.
o GFCI’s must be used in conjunction with portable tools, particularly in outdoor or wet environments. Portable GFCI’s are available.

E. Ladders
Portable ladders will be inspected daily when in use and maintained in good condition free from oil, grease, or other slippery materials. Defective ladders must be removed from service until repaired. Those that cannot be repaired should be destroyed. Ladders must always be placed on stable bases and, whenever possible, secured near the top and at the bottom. Boxes, barrels, or other unstable surfaces must never be used to extend the reach of a ladder. Never climb higher than the next to top rung of a ladder.

Spotters must be used when setting up and working on ladders. Spotters can help secure the ladder from sudden movements, act as an assistant to the individual on the ladder, and provide a second set of eyes to look out for mishaps. Students or employees ascending or descending a ladder must maintain three point contact. This prevents carrying an object up or down a ladder. Objects must be hoisted. In those instances when it is impossible to maintain three point contact while working from a ladder, personal fall arrest equipment must be utilized.

F. Scaffolding:
Each person working from a scaffold more than 4 feet above a lower level shall be protected from falls by guardrails or a fall arrest system. Scaffolding used in the theater shall be designed and built by a qualified person. Footings and anchorages of scaffolds must be sound, rigid and capable of carrying the maximum intended load without displacement. Planking must be capable of supporting at least 4 times the maximum intended load. The following general requirements apply.

o Where a guardrail is the primary fall protection the top rail must have a minimum height of 42 inches and be equipped with 4 inch high toe board. Scaffolding must be maintained in a safe condition.
o Scaffolding must not be altered or moved horizontally while in use.
o Scaffolding may not be loaded in excess of the working load for which it is intended.
o Material, such as lights, must be hoisted onto the scaffold by a tag line.
o An access ladder or equivalent safe access must be provided.
o Tools, materials and other debris must not be allowed to accumulate on the scaffold.
G. Chemical Hazards
The key to safe chemical usage is to be aware of information on the physical and health hazards of chemicals, safe handling precautions, and emergency and first aid procedures.

Each chemical container bears a manufacturer label with the chemical name(s), hazard warnings, and the manufacturer's name and address. Labels must not be removed or defaced. If the product is transferred from one container to another, the new container must be labeled with the product name, the names of all hazardous chemicals and/or the five most predominant chemical constituents, the Chemical Abstract Service (CAS) number for each chemical, and appropriate hazard warnings. The Technical Director must obtain and maintain a Safety Data Sheet (SDS) for each hazardous material used. These SDSs must be accessible to individuals working with the products during all work hours. If an SDS is not received with a product, the Technical Director must obtain an SDS before the product is used in the work place. A number of SDSs are available through ChemWatch located on Villanova’s EHS web page.

Vapors from flammable liquids ignite readily when mixed in certain proportions with air in the presence of an ignition source and could result in a fire or explosion. Flammable and combustible liquids vaporize and form flammable mixtures with air when in open containers, when leaks occur, or when heated.

- Use nonflammable materials like water based paint whenever possible. Water-based or latex paints are less hazardous and allow for easier clean-up and disposal than oil-based paints.
- Buy as you need it -- quantities should be limited to the amount necessary for the work in progress.
- Control all ignition sources in areas where flammable liquids are used. No smoking or open flames should be present during the use of flammable liquids.
- Spray paint cans are under extreme pressure and could rupture when exposed to fire.
- Never puncture aerosol cans or expose them to high heat.
- Read and follow the manufacturer's label and precautions on aerosol cans.
- Paints and thinners should not be mixed with general trash or poured down the drain. Contact EHS at 9-8989 if you have flammable liquids to be disposed.

H. Chemical Spills
In the event of a chemical spill, the individual(s) who caused the spill is responsible for prompt and proper clean up. Contact Public Safety at 9-4444 if:

- There is a fire or medical attention is needed.
- The quantity of material spilled is more than one gallon.
You are uncomfortable in your ability to clean up the spill.

There is a release to the environment (i.e., soil, waterways, sewer, etc.)

Before beginning work with chemicals, be sure that the appropriate types and amounts of spill clean-up materials and personal protective equipment are immediately available. General guidelines for responding to spills:

- Immediately alert others in the area, and evacuate the area, if necessary.
- Contaminated clothing must be removed immediately and the skin flushed with water for no less than fifteen minutes. Clothing must be laundered before reuse.
- If a volatile, flammable material is spilled, immediately warn others in the area, control sources of ignition and ventilate the area.
- Collect all spill clean-up debris in labeled bags. Contact the EHS department to arrange disposal. DO NOT throw the debris out with the regular trash.

I. Housekeeping

Work areas can become congested while set building and rehearsals take place. Clutter makes it difficult to move around and can be a fire hazard. To prevent accumulation of materials, trash should be removed daily.

- Place trash in the proper receptacles.
- Clean up after each work session.
- Avoid accumulating scrap lumber and materials.
- Purchase materials as needed to avoid the need for additional storage.
- Store tools in the proper areas when not in use.

*Electrical Cords:* Electrical cords can also be a tripping hazard.

- It is a good practice to route cords away from traffic areas to prevent trips and falls.
- Avoid stretching or pinching cords between objects. This can break interior wires, causing overheating and fires.
- Do not cover electrical cords with rugs; this can also result in a fire.

J. Storage of Materials

The proper storage of materials in theater spaces is extremely important to the efficiency of the production and the safety of the cast, crew and audience. The PA Uniform Fire Code mandates certain storage requirements, such as:
Flammable and combustible liquids must be stored in approved flammable storage cabinets.
- Materials must never obstruct an exit from the building.
- Stored materials must be a minimum of three feet in all directions from unit heaters, duct furnaces and flues.
- Materials may not be stored under seating risers or steps.

V. Lighting and Sound

A. Electrical Safety
Many students have never worked with electricity directly before working on stage. To work near electricity safely, it is necessary to understand what hazards it presents, and how these hazards can be controlled.

Preventing Electrical Hazards:

**Repairs:** Equipment that malfunctions or causes shocks must be removed from service and referred to the Facilities Department for repair.

**Extension Cords:** Extension cords are only designed for temporary use. Use of thin, light duty extension cords can increase the risk of fire and shock. Make sure extension cords have adequate current capacity for the equipment being used. Do not pull an electrical cord out of a socket by the cord. This breaks interior wires and can cause a short and, possibly, a fire. Inspect for frayed or split cords or plugs before each use.

**Circuit Protection Devices:** Circuit protection devices are designed to automatically limit or shut off the flow of electricity in the event of a ground-fault, overload, or short circuit in the wiring system. A ground-fault circuit interrupter, or GFCI, should be used in high risk areas such as wet locations or outdoor sites.

**Training:** Training is essential in working with lighting circuitry, dimmers and instruments. Students should be trained before being authorized to work the control areas. Keep food and beverages out of the light control areas to prevent possible shocks and damage to the circuitry.

B. Overhead Lighting
Lighting dimmers have limits to the lamp loads they can handle. Overloading dimmers can cause a fire hazard. There are standard size 1.2 kilowatt (1200W maximum) and 2.4 kilowatt...
(2400W maximum) dimmers used in the Vasey Hall Theater. The spaces also use standard lamps listed as follows:
- Fresnels: BTL 500W
- BTR 250W
- Ellipsoidals: FEL 1000W
- EHD 500W
- EHG 750W
- Source 4: HPL 575W

The wattage of the bulbs MAY NOT exceed that of the dimmers they are plugged into.

VI. Cast & Crew
   A. Cosmetics

   Products approved for makeup use have been tested extensively for toxic hazards. Only these products should be used for stage productions. Old containers of makeup could contain bacteria and should be thrown away. A good practice is to wash your face and hands before and after applying cosmetics. If you are using makeup from a “communal” makeup kit, use a clean brush or your hands to apply. Shared makeup should not be applied directly to your face. The Center for Safety in the Arts offers these guidelines for shared makeup users:

1. Crème sticks: Slice these out with dental spatulas on to individual papers such as butter trays. Label and reuse them individually for touch-ups.
2. Lipsticks: These too can be sliced and labeled. For a long running show, individual lipsticks should be provided.
3. Pancakes and powders: Powdered products provide a less viable environment for infection, but try to individualize usage. Supply powders in the smallest containers available.
5. Eyeliners and Eye makeup: Use individual products.
7. Sponges: Use disposable sponges whenever possible. Reusable ones can be disinfected. Give out individual sponges at the beginning of a show, and maintain separate use.
8. Miscellaneous: Any type of facial hair, skullcaps, sequins, or other face product should be disinfected before used by a new performer. Use an approved bactericide for disinfection. These types of products should be carefully stored in labeled individual plastic bags between performances. Makeup artists should make a practice of washing their hands between actors. Sponges and brushes should be washed after use on each
individual. When removing spirit gum or latex, avoid prolonged skin contact with solvents. Moisturizers can be used to replace lost skin oils and to help guard against dermatitis.

B. Fatigue
Fatigue is a serious safety concern that should be considered during all stage productions. With performance dates approaching, most crewmembers can become severely overworked. Follow these simple guidelines to avoid fatigue:

- Get proper rest. The average person requires 8-9 hours of sleep per night.
- Limit drugs that might contribute to fatigue (tranquilizers and cold/allergy medications.)
- Reduce caffeine, nicotine and alcohol which can also contribute to fatigue.
- Take frequent breaks while working. Repetitive or long work sessions can reduce one’s ability to concentrate on the work at hand.
- Plan ahead. Having your building materials and equipment ahead of time can increase efficiency and reduce the work time required.
- Know when to quit. Recognize signs of fatigue – loss of concentration, slow reaction times, memory loss – and knock off for the day.

C. Heat Stress
Stage lighting can produce an incredibly hot glow. Add to that the stress and/or excitement of performing and cast members are prime candidates for heat stress. Working in hot conditions may pose special hazards to safety and health. Drink plenty of liquids during a performance to replace the fluids lost from sweating – as much as one quart per hour may be necessary. Water and/or sports drinks are recommended. Caffeinated beverages such as cola, iced tea and coffee should be avoided.

VII. Performance

A. Curtain Speech
Each performance must be preceded by a curtain speech to outline the location of all fire exits.

B. Crowd Control
Attendance for all events must be controlled. Observe occupancy limit when selling tickets.
C. Exits (Means of Egress)
The means of egress is the continuous and unobstructed path of travel from any point in a place of assembly to an exit or public way (e.g., sidewalk, street, etc.). All parts of the means of egress must be available for immediate, emergency use.

- Aisles and corridors must be unobstructed and kept free of flammable or combustible materials.
- Event organizers must inspect the means of egress immediately prior to any event and remove any obstructions immediately.
- Exit doors must be unlocked.
- Care must be taken to ensure that the exit discharge is also unobstructed (e.g., not blocked by dumpsters or vehicles, no materials stored against the exit door, all snow removed, etc.).
- All exit signs must be clearly illuminated and unobstructed at all times.
- The width of a means of egress cannot be blocked or reduced.
- Draperies or similar decorative hangings cannot obstruct the view or the access to an exit.
- Mirrors cannot be placed near an exit in any manner that may confuse those trying to exit.
- Exits cannot be used for any other purpose other than a means of egress. Spaces within a stairway enclosure are not to be used for storage of any materials.

VIII. Strike

A. Set Deconstruction & Material Disposal
All items must be returned to storage or otherwise disposed of immediately following the final performance, e.g.:

- lighting instruments, cables and control equipment
- properties
- sound equipment
- scenery and platforms
- costumes
- seating

Set deconstruction should take place in a careful, organized manner.
B. Housekeeping
The facility must be left in good condition after the strike. All trash must be properly discarded.

C. Chemical Waste Disposal
Most commonly used organic solvents (e.g., acetone, methanol, toluene, mineral spirits, and turpentine) and paints are considered hazardous waste and cannot be disposed of with regular trash or poured down the drain. If you have hazardous waste to be disposed of, contact Environmental Health & Safety at 9-8989 for recommendations.
Villanova Scene Shop and Theatre

At Villanova University our number one priority is safety. The scene shop is inherently a dangerous workspace. We will take every precaution to ensure every individual's well-being. Many techniques and materials used in the theatre contain inherent risks to individuals. If those risks cannot be adequately minimized and controlled through proper training, equipment, and use of appropriate precautions, we will not use those items. For example, due to the lack of proper ventilation, working with steel and foam is discouraged. If at any time you feel a situation is unsafe, by lack of proper safety equipment, lack of staffing, or any other reason, please see the technical director. If you observe someone in an unsafe situation, please remedy the situation.

First Aid Locations
- (2) Front of House, (2) Backstage, (1) Paint Room, (1) each Dressing Room, (1) Prop Room

Accident Report
- Please file with Business Manager

Scene Shop Safety Rules
- You are not allowed to work in the shop under the influence of drugs and alcohol.
- No food or drinks are permitted in the shop.
- No mobile phones are to be used during shop hours. Please wait for an appropriate break.
- Proper attire is required. When possible wear pants and full length sleeves. Always wear closed toe and hard soled shoes. Do not wear baggy clothing, dresses, flip flops or sandals. Please keep your hair up. Wear clothing that you expect to get dirty. You will be cutting wood, applying glue, and painting.
- Wear Safety Glasses any time you are in the shop.
- Wear a Dust Mask.
- Wear Ear Protection.
- Always turn off power tools. Always turn it off when you put it down or need to walk away.
- Keep your work area clean and organized. Put away tools you are not using. Sometimes you will have to sweep in the middle of a project.
- Always unplug a tool before changing a bit or blade.
- Undergraduate students are not allowed to operate any power tools without the presence of a graduate student unless approved by the technical director.
Cleanliness is Next to Godliness
- A clean shop is a safe shop.
- Clean up after yourself and periodically during a project.
- Put away tools you are finished with.
- Keep your work area organized. Think about how the air hose and extension cord is running.
- Keep doors, paths, and fire extinguishers clear.
- Put away your trash.
- Put tools away at the end of your day.
- Sweep at the end of your day.

Lifting
- Always bend at the knees.
- Never carry something that you should not on your own. Ask for help.
- Always communicate with whomever you are carrying with.
- When moving tall objects grip with one hand high and one hand low.
- Be aware of your surroundings. What is behind you? What is above you?
- Make sure your path is clear.

Ladders
- Using a ladder is a two person activity. No exceptions.
- When going 4’ or above you must utilize the fall protection system.
- Before going up a ladder, make sure all feet are firmly seated on the ground.
- Anytime you are carrying something (i.e. Crescent wrench) it must be attached to you.
- Make sure any loose items not attached to you are taken off before going up.
- When moving a ladder or scaffolding be aware of your surroundings and what is above you.
- The top of a ladder is not be used for standing. Not a step, is NOT a step.

Scene Shop as a Theatre
The scene shop is also used as the theatre. For this reason, there will be times when the stage must be cleared for other use. The company will rehearse on set before the set is complete. This means each day that this is the case, the shop must be cleared and cleaned prior to rehearsal and set up the following morning to resume construction. Anyone in the university has the right to request use of the theatre. Use of the theatre may be permitted with approval from the technical director.

The stage will be crossed by many people. Without going outside and walking around the building, the stage is the only access to the box office and front of house sound and lighting booths. It is important that while working and at the end of every day, a clear and unobstructed path is left from the door stage right to the lobby doors.
Personal Fall Arrest System

Why do you need a Fall Arrest System?
The majority of accidents happen at 4’ (not fatal ones, but who wants to be in any accident)

When do you use a harness?
- When going on a ladder over 4’
- While building the scaffolding (no harness required for using the scaffold once built)
- While there is no railing on a surface that is 4’ above the ground

A, B, C, D’s of personal fall arrest system:
- Anchorage- what you’re attaching to/tie off point
- Bodywear- harness
- Connecting device- what connects you from the harness to the tie off point
- Decent- how you get down

Parts of Harness: YOU NEED TO INSPECT YOUR HARNESS EVERYTIME YOU PUT IT ON!
- SRL- Self Retracting Lifeline
- Dee ring
- Leg straps
- Chest straps
- Tighten all buckles that harness fits snug using the two finger rule
- Trauma Suspension straps

Demo: Everyone puts on a Harness
- Pull down the SRL
- Attaching to SRL by using sky hook
- When disconnecting use sky hook and don’t let it retract on its own.
- You need to remain in a four foot radius of the SRL. If out of range you need to unhook and find a closer srl. Why? You become a pendulum. So the swing is larger as you go farther away.
- YOU MUST ALWAYS HAVE ANOTHER PERSON IN THE ROOM AT ALL TIMES!!!!!!!

Rescue plan:
- You cannot ever be alone in a room using the system.
- If someone is going to be hanging longer than 2 minutes than pull the trauma straps to help relieve blood flow in the legs.
- Bring ladder over to person – climb ladder, release srl, climb down, disconnect from srl- do not lay the person down! Walk them to a seat.
- Call Public Safety- no matter how big or small a fall. (think cpr protocol)
Figure 11 - Donning the ExoFit NEX™ Vest Style Full Body Harness

Step 1

Step 2

Step 3

Duo-Lok™ Quick Connect Buckles

Connection: Connect buckle ends by inserting the tab into the receptor until a click is heard.

Strap Adjustment: Rotate Webbing Lock to unlocked position. Pull strap to adjust. Rotate Webbing Lock to locked position.

NOTE: The Webbing Lock does not contain engagement of the buckle ends.

Revolver™ Vertical Torso Adjusters

Right
To Tighten: Turn Ratchet Knob in direction A.
To Loosen: Pull Ratchet Knob out and turn in direction B.

Left

NOTE: After adjustment, tug upward on the shoulder straps to ensure that each adjustor is locked in place.
To maintain their service life and ensure performance capabilities, fall protection systems must be inspected before and after each use. Regular inspection by a competent person for wear, damage or corrosion should be a part of your safety program. Inspect your equipment daily and replace it if any of the defective conditions explained in this guidebook are found. For harness inspection, perform the following procedures for all straps.

### 1. Belts and Harnesses

#### Belts: Beginning at one end, holding the body side of the belt toward you, grasp the belt with your hands 6 to 8 inches apart. Bend the belt in an inverted "U." The resulting surface tension makes damaged fibers or cuts easier to see. Follow this procedure the entire length of the belt. Watch for frayed edges, broken fibers, pulled stitches, cuts or chemical damage.

#### Harnesses: Starting at the top of the harness (hold harness by back Dee-ring), grasp one strap and run your hand along the entire length. While running your hand along the strap, bend the webbing over your index fingers. The resulting surface tension makes damaged fibers or cuts easier to see. Follow this procedure for all shoulder straps, back straps, leg straps and the chest strap. Watch for frayed edges, broken fibers, pulled stitches, cuts or chemical damage.

a. **Check Dee-Rings:** Check Dee-rings and their metal or plastic wear pads (if any) for distortion, cracks, breaks, and rough or sharp edges. The Dee-ring bar should be at a 90° angle with the long axis of the belt and should pivot freely.

b. **Attachments of Buckles:** Attachment of buckles and Dee-rings should be given special attention. Note any unusual wear, frayed or cut fibers, or distortion of the buckles or Dee-rings. Rivets should be tight and unmovable with fingers. Body side rivet base and outside rivet burr should be flat against the material. Bent rivets will fail under stress.
The Miller Training Guide to Fall Prevention and Protection

e. Inspect for Frayed or Broken Strands: Broken webbing strands generally appear as tufts in the webbing surface. Any broken, cut or burned stitches will be readily seen. See page 1-20 for detailed chart on visual inspection for chemical, heat and corrosive damage.

d. The Tongue or Billet: The tongue or billet of a belt or strap receives heavy wear from repeated buckling and unbucketing. Inspect for loose, distorted or broken grommets. Belts and straps should not have additional, punched holes.

2. Tongue Buckle

Buckle tongues should be free of distortion in shape and motion. They should overlap the buckle frame and move freely back and forth in their socket. The roller should turn freely on frame. Check the roller for distortion or sharp edges.

3. Friction and Mating Buckles

Inspect the buckle for distortion. The outer bars and center bars must be straight. Pay special attention to corners and attachment points of the center bar. Look for burrs and cracks.

When inspecting lanyards, begin at one end and work to the opposite end. Slowly rotate the lanyard so that the entire circumference is checked. Spliced ends require particular attention. Hardware, i.e. snaps, Dee-ring and thimbles, should be examined under procedures detailed below.

1. Hardware

a. Snaps: Visually inspect the hook and eye for distortions, cracks, corrosion or pitted surfaces. The keeper (latch) should seat into the nose without binding and should not be distorted or obstructed. The keeper spring should exert sufficient force to firmly close the keeper. Keeper locks must prevent the keeper from opening when the keeper lock is not depressed.

b. Thimbles: The thimble must be firmly seated in the eye of the splice. The splice should have no loose or cut strands. The edges of the thimble must be free of sharp edges, distortion or cracks.
MARCH 2003 OHS

Will Your Safety Harness Kill You?

Workers and emergency response personnel must be trained to recognize the risks of suspension trauma.

by Bill Weems and Phil Bishop

I was surprisingly comfortable with my legs dangling relaxed beneath me, and my arms outstretched in a posture that must have resembled a crucifixion. I had no feeling of stress and mused as to why this was considered dangerous. I felt I could stay in this position for a long time. Three minutes later, maybe less, I wondered why I suddenly felt so hot. The next thing I knew, they were reviving me from unconsciousness. I had just experienced what could be deadly for your workers who use safety harnesses. Fortunately for me, my suspension trauma occurred in the safe environment of the research ward of University of Texas Medical Branch Hospital at Galveston, Texas, where I was the first subject in a NASA experiment studying orthostatic intolerance in astronauts. Your workers won’t be so lucky.
Harness-Induced Death
Wide ranges of situations require safety harnesses of various types. Workers requiring fall protection, workers entering many confined spaces, mountain climbers, deer hunters in elevated stands, and cave explorers all try to protect themselves through the use of safety harnesses, belts, and seats. What is little known however, is that these harnesses can also kill. Harnesses can become deadly whenever a worker is suspended for durations over five minutes in an upright posture, with the legs relaxed straight beneath the body. This can occur in many different situations in industry. A carpenter working alone is caught in mid-fall by his safety harness, only to die 15 minutes later from suspension trauma. An electrical worker is lowered into a shaft after testing for toxic gases. He is lowered on a cable and is positioned at the right level to repair a junction box. After five minutes he is unconscious--but his buddies tending the line don’t realize it, and 15 minutes later a dead body is hauled out.
The cause of this problem is called “suspension trauma.” Fall protection researchers have recognized this phenomenon for decades. Despite this, data have not been collected on the extent of the problem; most users of fall
protection equipment, rescue personnel, and safety and health professionals remain unaware of the hazard.

**Suspension Trauma**

Suspension trauma death is caused by orthostatic incompetence (also called orthostatic intolerance). Orthostatic incompetence can occur anytime a person is required to stand quietly for prolonged periods and may be worsened by heat and dehydration. It is most commonly encountered in military parades where soldiers must stand at attention for prolonged periods. Supervisors can prevent it by training soldiers to keep their knees slightly bent so the leg muscles are engaged in maintaining posture.

What happens in orthostatic incompetence is that the legs are immobile with a worker in an upright posture. Gravity pulls blood into the lower legs, which have a very large storage capacity. Enough blood eventually accumulates so that return blood flow to the right chamber of the heart is reduced. The heart can only pump the blood available, so the heart’s output begins to fall. The heart speeds up to maintain sufficient blood flow to the brain, but if the blood supply to the heart is restricted enough, beating faster is ineffective, and the body abruptly slows the heart.

In most instances this solves the problem by causing the worker to faint, which typically results in slumping to the ground where the legs, the heart, and the brain are on the same level. Blood is now returned to the heart and the worker typically recovers quickly. In a harness, however, the worker can’t fall into a horizontal posture, so the reduced heart rate causes the brain’s blood supply to fall below the critical level.

Orthostatic incompetence doesn’t occur too often because it requires that the legs remain relaxed, straight, and below heart level. If the leg muscles are contracting in order to maintain balance and support the body, the muscles press against the leg veins. This compression, together with well-placed one-way valves, helps pump blood back to the heart. If the upper-legs are horizontal, as when we sit quietly, the vertical pumping distance is greatly reduced, so there are no problems.

In suspension trauma, several unfortunate things occur that aggravate the problem. First, the worker is suspended in an upright posture with legs dangling. Second, the safety harness straps exert pressure on leg veins, compressing them and reducing blood flow back to the heart. Third, the harness keeps the worker in an upright position, regardless of loss of consciousness, which is what kills workers.
After a Fall:

1. Workers should be trained to try to move their legs in the harness and try to push against any footholds.
2. Workers hanging in a harness should be trained to try to get their legs as high as possible and their heads as close to horizontal as possible (this is nearly impossible with many commercial harnesses in use today.)
3. If the worker is suspended upright, emergency measures must be taken to remove the worker from suspension or move the fallen worker into a horizontal posture, or at least to a sitting position.
4. All personnel should be trained that suspension in an upright condition for longer than five minutes can be fatal.