Singleton Tower, LLC

Safety Plan

CONTENTS

Chapter 1 Injury and Illness Prevention Program

Written Plan

Every employer should have a written Injury and Illness Prevention plan. This is our plan. Please read it carefully. While no plan can guarantee an accident free workplace, following the safety procedures set forth in this manual will significantly reduce the risk of danger to you and your co-workers. Thank you for all our safety.

Introduction to Our Program

State and federal law, as well as company policy, make the safety and health of our employees the first consideration in operating our business. Safety and health in our business must be a part of every operation, and every employee's responsibility at all levels. It is the intent of Singleton Tower, LLC to comply with all laws concerning the operation of the business and the health and safety of our employees and the public. To do this, we must constantly be aware of conditions in all work areas that can produce or lead to injuries. No employee is required to work at a job known to be unsafe or dangerous to their health. Your cooperation in detecting hazards, reporting dangerous conditions and controlling workplace hazards is a condition of employment. Inform your supervisor immediately of any situation beyond your ability or authority to correct. Employees will not be disciplined or suffer any retaliation for reporting a safety violation in good faith.

Safety First Priority

The personal safety and health of each employee is of primary importance. Prevention of occupationally-induced injuries and illnesses is of such consequence that it will be given precedence over operating productivity. To the greatest degree possible, management will provide all mechanical and physical protection required for personal safety and health, but our employees must bear primary responsibility for working safely. A little common sense and caution can prevent most accidents from occurring.

Individual Cooperation Necessary

Singleton Tower, LLC maintains a safety and health program conforming to the best practices of our field. To be successful, such a program must embody proper attitudes towards injury and illness prevention on the part of supervisors and employees. It requires cooperation in all safety and health matters, not only of the employer and employee, but between the employee and all co-workers. Only through such a cooperative effort can a safety program in the best interest of all be established and preserved. Safety is no accident; think safety and the job will be safer.

Safety Program Goals

The objective of Singleton Tower, LLC, is a safety and health program that will reduce the number of injuries and illnesses to an absolute minimum, not merely in keeping with, but surpassing the best experience of similar operations by others. Our goal is zero accidents and injuries.

Safety Policy Statement

It is the policy of Singleton Tower, LLC that accident prevention shall be considered of primary importance in all phases of operation and administration. It is the intention of Singleton Tower, LLC's management to provide safe and healthy working conditions and to establish and insist upon safe practices at all times by all employees. The prevention of accidents is an objective affecting all levels of our company and its operations. It is, therefore, a basic requirement that each supervisor make the safety of all employees an integral part of his or her regular management function. It is equally the duty of each employee to accept and follow established safety regulations and procedures. Every effort will be made to provide adequate training to employees. However, if an employee is ever in doubt about how to do a job or task safely, it is his or her duty to ask a qualified person for assistance. Employees are expected to assist management in accident prevention activities. Unsafe conditions must be reported immediately. Fellow employees that need help should be assisted. Everyone is responsible for the housekeeping duties that pertain to their jobs. Every

injury that occurs on the job, even a slight cut or strain, must be reported to management and/or the Responsible Safety Officer as soon as possible. Under no circumstances, except emergency trips to the hospital, should an employee leave the work site without reporting an injury. When you have an accident, everyone is hurt. Please work safely. Safety is everyone's business.

Safety Rules for All Employees

It is the policy of Singleton Tower, LLC. that everything possible will be done to protect you from accidents, injuries and/or occupational disease while on the job. Safety is a cooperative undertaking requiring an ever-present safety consciousness on the part of every employee. If an employee is injured, positive action must be taken promptly to see that the employee receives adequate treatment. No one likes to see a fellow employee injured by an accident. Therefore, all operations must be planned to prevent accidents. To carry out this policy, the following rules will apply :

1. All employees shall follow the safe practices and rules contained in this manual and such other rules and practices communicated on the job. All employees shall report all unsafe conditions or practices to the proper authority, including the supervision on the project, and, if corrective action is not taken immediately, a governmental authority with proper jurisdiction over such practices.
2. The RSO shall be responsible for implementing these policies by insisting that employees observe and obey all rules and regulations necessary to maintain a safe workplace and safe work habits and practices.
3. Good housekeeping must be practiced at all times in the work area. Clean up all waste and eliminate any dangers in the work area.
4. Suitable clothing and footwear must be worn at all times. Personal protection equipment (hardhats, respirators, eye protection) will be worn whenever needed.
5. All employees will participate in a safety meeting conducted by their supervisor once every ten working days.
6. Anyone under the influence of intoxicating liquor or drugs, including prescription drugs which might impair motor skills and judgment, shall not be allowed on the job.
7. Horseplay, scuffling, and other acts which tend to have an adverse influence on safety or well-being of other employees are prohibited.
8. Work shall be well planned and supervised to avoid injuries in the handling of heavy materials and while using equipment.
9. No one shall be permitted to work while the employee's ability or alertness is so impaired by fatigue, illness, or other causes that it might expose the employee or others to injury.
10. There will be no consumption of liquor or beer on the job.
11. Employees should be alert to see that all guards and other protective devices are in proper places and adjusted, and shall report deficiencies promptly to the RSO.
12. Employees shall not handle or tamper with any electrical equipment, machinery, or air or water lines in a manner not within the scope of their duties, unless they have received specific instructions.
13. All injuries should be reported to the RSO so that arrangements can be made for medical or first aid treatment.
14. When lifting heavy objects, use the large muscles of the leg instead of the smaller muscles of the back.
15. Do not throw things, especially material and equipment. Dispose of all waste properly and carefully.
16. Bend all exposed nails so they do not hurt anyone removing the waste.
17. Do not wear shoes with thin or torn soles.

Employee Compliance

This written plan contains incentives designed to promote employee participation in the safety program. These incentives are not part of your regular compensation and are not intended to discourage you from reporting accidents.

Agreement to Participate

Every employer is required to provide a safe and healthful workplace. Singleton

Tower, LLC is committed to fulfilling this requirement. A safe and healthful workplace is one of the highest priorities of Singleton Tower, LLC. The information in this manual constitutes a written injury and illness prevention program. While Singleton Tower, LLC cannot anticipate every workplace hazard, the following general principles should guide your conduct. To be safe, you must never stop being safety conscious. Study the guidelines contained in this manual. Discuss the workplace situation with the RSO. Attend all company sponsored training and safety meetings. Read all posters and warnings. Listen to instructions carefully. Follow the Code of Safe Workplace Practices contained herein. Participate in accident investigations as requested. Accept responsibility for the safety of others. Maintain all required documentation. By signing the acknowledgment at the end of this handbook, each employee promises to read and implement this injury and illness prevention program. If you don't understand any policy, please ask your supervisor.

Accident Free Workplace

To help us all meet our goal of an accident free workplace, we have instituted a contest: we will offer a prize for each month in which there is not a single time-loss accident at work. The prize will be awarded at random. Each month, the prize will be announced in advance. All employees who worked more than 120 hours in the month are eligible. Failure to report an industrial injury will suspend the prize for two months.

Employee Safety Suggestion Box

From time to time, Singleton Tower, LLC will award a prize for the best safety suggestion. To be eligible, please give your written safety suggestions to your supervisor before or during the safety meetings. All these safety suggestions will be discussed at the meeting. Management is the sole judge of the value of safety suggestions, and will implement as many of the good suggestions as possible.

Training

Employee safety training is another requirement of an effective injury and illness prevention program. While Singleton Tower, LLC believes in skills training, we also want to emphasize safety training. All employees should start the safety training by reading this manual and discussing any problems or safety concerns with your direct supervisor. You may wish to make notes in the margins of this manual where it applies to your work.

Safety and Health Training

Training is one of the most important elements of any injury and illness prevention program. Such training is designed to enable employees to learn their jobs properly, bring new ideas to the workplace, reinforce existing safety policies and put the injury and illness prevention program into action. Training is required for both supervision and employees alike. The content of each training session will vary, but each session will attempt to teach the following: a) the success of Singleton Tower, LLC's injury and illness prevention program depends on the actions of individual employees as well as a commitment by the Company. b) each employee's immediate supervisor will review the safe work procedures unique to that employee's job, and how these safe work procedures protect against risk and danger. c) each employee will learn when personal protective equipment is required or necessary, and how to use and maintain the equipment in good condition. d) each employee will learn what to do in case of emergencies occurring in the workplace. Supervisors are also vested with special duties concerning the safety of employees. The supervisors are key figures in the establishment and success of Singleton Tower, LLC's injury and illness prevention program. They have primary responsibility for actually implementing the injury and illness prevention program, especially as it relates directly to the workplace. Supervisors are responsible for being familiar with safety and health hazards to which employees are exposed, how to recognize them, the potential effects of these hazards, and rules and procedures for maintaining a safe workplace. Supervisors shall convey this information to the employees at the workplace, and shall investigate accidents according to the accident investigation policies contained in this manual.

Periodic Safety Training Meetings

Singleton Tower, LLC has safety meetings every 3 months. The purpose of the meeting is to convey safety information and answer employee questions. The format of most meetings will be to review, in language understandable to every employee, the content of the injury prevention program, special work site hazards, serious concealed dangers, and material safety data sheets. Each week, the RSO will review a portion of the

company's safe work practices contained in this booklet, or other safety related information. Whenever a new practice or procedure is introduced into the workplace, it will be thoroughly reviewed for safety. A sign-up sheet will be passed around each meeting, and notes of the meeting will be distributed afterwards. A copy of the notes will also be placed in the file of each employee who attends the meeting. Employee attendance is mandatory and is compensable unless part of an official state approved training program or pre-employment requirement.

Employee Responsibility for Training

Teaching safety is a two-way street. Singleton Tower, LLC. can preach safety, but only employees can practice safety. Safety education requires employee participation. Every 3 months, a meeting of all employees will be conducted for the purpose of safety instruction. The employees will discuss the application of the Company's injury and illness prevention program to actual job assignments. They will also read and discuss a section of the manual and review application of general safety rules to specific situations. Remember, the following general rules apply in all situations: a)no employee should undertake a job that appears to be unsafe. b) no employee is expected to undertake a job until he/she has received adequate safety instructions, and is authorized to perform the task. c) no employee should use chemicals without fully understanding their toxic properties and without the knowledge required to work with these chemicals safely. d) mechanical safeguards must be kept in place. e) employees must report any unsafe conditions to the job site supervisor and the Responsible Safety Officer. f) any work-related injury or illness must be reported to management at once. g) personal protective equipment must be used when and where required. All such equipment must be properly maintained.

Communication

Employers should communicate to employees their commitment to safety and to make sure that employees are familiar with the elements of the safety program. Singleton Tower, LLC communicates with its employees orally, in the form of directions and statements from your supervisor, written, in the form of directives and this manual, and by example. If you see a supervisor or management do something unsafe, please tell that person. We sometimes forget actions speak louder than words.

Accident Prevention Policy Posting

Each employee has a personal responsibility to prevent accidents. You have a responsibility to your family, to your fellow workers and to the Company. You will be expected to observe safe practice rules and instructions relating to the efficient handling of your work. Your responsibilities include the following:

* Incorporate safety into every job procedure. No job is done efficiently unless it has been done safely.
* Know and obey safe practice rules.
* Know that disciplinary action may result from a violation of the safety rules.
* Report all injuries immediately, no matter how slight the injury may be.
* Caution fellow workers when they perform unsafe acts.
* Don't take chances.
* Ask questions when there is any doubt concerning safety.
* Don't tamper with anything you do not understand.
* Report all unsafe conditions or equipment to your supervisor immediately.

A copy of this manual will be posted in the work area. It is the policy of Singleton Tower, LLC to provide a safe and clean workplace and to maintain sound operating practices. Concentrated efforts shall produce safe working conditions and result in efficient, productive operations. Safeguarding the health and welfare of our employees cannot be stressed too strongly. Accident prevention is the responsibility of all of us. Department heads and supervisors at all levels shall be responsible for continuous efforts directed toward the prevention of accidents. Employees are responsible for performing their jobs in a safe manner. The observance of safe and clean work practices, coupled with ongoing compliance of all established safety standards and codes, will reduce accidents and make our Company a better place to work.

Hazard Identification & Abatement

This written safety and health plan sets out a system for identifying workplace hazards and correcting them in a timely fashion. Please review it carefully with your supervisor. Remember, safety is everyone's responsibility.

Safety Audits

The best method to establish a safer workplace is to study past accidents and worker compensation complaints. By focusing on past injuries, Singleton Tower, LLC hopes to avoid similar problems in the future. Therefore, whenever there is an accident, and in many cases upon review of past accidents, you may be requested to participate in a safety audit interview. During the interview, there will be questions about the nature of the investigation and the workplace safety related to the incident. Please answer these questions honestly and completely. Also, please volunteer any personal observations and/or suggestions for improved workplace safety. Based upon the study of past accidents and industry recommendations, a safety training program has been implemented. In addition to other preventative practices, there will be a group discussion of the cause of the accident and methods to avoid the type of accidents and injury situations experienced in the past. Work rules will be reviewed and modified based upon the study of these accidents. In addition to historical information, workplace safety depends on workplace observation. Your supervisor is responsible for inspecting your working area daily before and while you are working, but this does not mean you are no longer responsible for inspecting the workplace also. Each day, before you begin work, inspect the area for any dangerous conditions. Inform your supervisor of anything significant, so other employees and guests are advised. You may also be given written communications regarding unsafe conditions or serious concealed dangers. Review this communication carefully and adjust your workplace behavior to avoid any danger or hazards. If you are unclear or unsure of the significance of this written communication, contact your supervisor and review your planned actions before starting to work. It is better to wait and check, then to go ahead and possibly cause an injury to yourself and others. Managers must provide written notice to employees of any serious concealed dangers of which they have actual knowledge. In addition to providing written notice of all serious concealed dangers to employees managers are required to report serious concealed dangers to either OSHA or an appropriate administrative agency within fifteen days, or immediately if such danger would cause imminent harm, unless the danger is abated. Merely identifying the problem is not sufficient. The danger must be reported to the appropriate supervisor and the Responsible Safety Officer, who then will correct the problem. If the danger cannot be corrected, then all employees will be warned to take protective action so that the danger will not result in any injuries.

Workplace Inspections

In addition to the examination of records, workplace safety inspections will occur periodically every 3 months, when conditions change, or when a new process or procedure is implemented. During these inspections, there will be a review of the injury and illness prevention policy and Singleton Tower, LLC code of safe work practices.

Accident Investigation

A primary tool used by Singleton Tower, LLC to identify the areas responsible for accidents is a thorough and properly completed accident investigation. The results of each investigation will be reduced to writing and submitted for review by management and Singleton Tower, LLC's insurance risk management advisors, and, if the accident resulted in serious injury, to Company attorneys. If the accident resulted in serious injury, the procedure will be directed by the attorneys to provide the most reliable evidence or description legally permissible. All investigations pursuant to the directions of legal counsel will be protected by all applicable privileges, if any. The attorney will provide more detail on this topic during the investigation. A written report should be prepared from notes and diagrams made at the scene, or a portable Dictaphone will be used to record direct eyewitness statements as near to the actual time of observation as possible. All statements should include the time and date given, and the town or county where the statement was made. If the statement is intended to be used in court proceedings, a suitable jurat is required, otherwise, a simple statement that the description is sworn to be true under penalty of perjury with the date, place and time should be included. All pictures should be similarly identified. Let people know on tape that they are being recorded. Also, make sure that the names and

addresses and day and evening phone numbers of all eye witnesses are noted or recorded. If a formal police report or other official investigation is conducted by any government agency, get the name and badge number of the official, or a business card, and find out when a copy of the official report will be available to the public. If you are requested to make a statement, you have the right to have the Company lawyer attend your statement at no cost to you. A satisfactory accident report will answer the following questions:
1. What happened? The investigation report should begin by describing the accident, the injury sustained, the eyewitnesses, the date, time and location of the incident and the date and time of the report. Remember: who, what, when, where and how are the questions that the report must answer.
2. Why did the accident occur? The ultimate cause of the accident may not be known for several days after all the data are analyzed. However, if an obvious cause suggests itself, include your conclusions as a hypothesis at the time you give your information to the person in charge of the investigation.
3. What should be done? Once a report determines the cause of the accident, it should suggest a method for avoiding future accidents of a similar character. This is a decision by the Responsible Safety Officer and the supervisor on the project, as well as top management. Once a solution has been adopted, it is everyone's responsibility to implement it.
4. What has been done? A follow up report will be issued after a reasonable amount of time to determine if the suggested solution was implemented, and if so, whether the likelihood of accident has been reduced.

Records

Singleton Tower, LLC maintains records of employee training, hazard identification and abatement, and accident investigation.

OSHA Records Required

Copies of required accident investigations and certification of employee safety training shall be maintained by the Responsible Safety Officer. A written report will be maintained on each accident, injury or on-the-job illness requiring medical treatment. A record of each such injury or illness is recorded on OSHA Log and Summary of Occupational Injuries Form 200 according to its instructions. Supplemental records of each injury are maintained on OSHA Form 101, or Employers Report of Injury or Illness Form 5020. Every year, a summary of all reported injuries or illnesses is posted no later than February 1, for one month, until March 1, on OSHA Form 200. These records are maintained for five years from the date of preparation.

General Statement on Safety

Singleton Tower, LLC strives to maintain a safe place to work and to employ safe workers. It is your responsibility to conduct your work in a safe, responsible manner. Immediately report all accidents occurring on Company premises to your supervisor. Each employee has an individual responsibility to prevent accidents. It is to the benefit of all employees and Singleton Tower, LLC that you report any situation or condition you believe may present a safety hazard, including any known or concealed dangers in your work area. Singleton Tower, LLC. encourages you to report your concern either to your immediate supervisor or to a member of the Safety Committee. The supervisor or Safety Committee will take immediate action to investigate the matter.

Safety Equipment

Proper safety equipment is necessary for your protection. The Company provides the best protective equipment it is possible to obtain. Use all safeguards, safety appliances, or devices furnished for your protection and comply with all regulations that may concern or affect your safety. Wear your gear properly -- all snaps and straps fastened, cuffs not cut or rolled. Your supervisor will advise you as to what protective equipment is required for your job. Certain jobs require standard safety apparel and appliances for the protection of the employee. Your supervisor is aware of the requirements and will furnish you with the necessary approved protective appliances. These items shall be worn and effectively maintained as a condition of your continued employment and part of our mutual obligation to comply with the Occupational Safety and Health Act. Safety goggles, glasses and face shields shall correspond to the degree of hazard, i.e., chemical splashes, welding flashes, impact hazard, dust, etc. Do not alter or replace an approved appliance without permission from your supervisor. Rubber gloves and rubber aprons shall be worn when working with acids, caustics or

other corrosive materials. Specified footwear must be worn. No jewelry shall be worn around power equipment. Hearing protection appliances (approved muffs or plugs) shall be worn by all employees working within any area identified as having excess noise levels. Your supervisor will instruct you in the proper use of the appliance.

Protective Clothing

Proper safety equipment is necessary for your protection. The Company provides the best protective equipment it is possible to obtain. Use all safeguards, safety appliances, or devices furnished for your protection and carry out all regulations that may concern or affect your safety. Wear your gear properly - all snaps and straps fastened, cuffs not cut or rolled. Your supervisor will advise you as to what protective equipment is required for your job.

Smoking & Fire Safety

Fire is one of the worst enemies of any facility. Learn the location of the fire extinguishers. Learn how to use them. You can help prevent fires by observing the smoking rules:

* Smoking is not allowed in any part of Singleton Tower, LLC offices or vehicles.
* If you are not sure about where you may smoke, ask the supervisor.

Reporting

All serious accidents must be reported to OSHA. In cases of hospitalization or death, a full investigation with copies to governmental authorities will be required. In less serious cases, the investigation report must be presented to the company for disclosure to its insurance carrier and for remedial action at the work site.

Chapter 2 General Code of Safe Work Practices

General Fire Safety

Our local fire department is well acquainted with our facility, its location and specific hazards. All fire doors and shutters must be maintained in good operating condition. Fire doors and shutters should be unobstructed and protected against obstructions, including their counterweights. Fire door and shutter fusible links must be in place. All automatic sprinkler water control valves, if any, air and water pressures should be checked routinely. The maintenance of automatic sprinkler systems is assigned to the Responsible Safety Officer. Sprinkler heads should be protected by metal guards if they could possibly be exposed to damage. Proper clearance must be maintained below sprinkler heads. Portable fire extinguishers are provided in adequate number and type and are located throughout the facility. Fire extinguishers are mounted in readily accessible locations. Fire extinguishers are recharged regularly and the date of last inspection noted on their tags. All employees are periodically instructed in the use of extinguishers and fire protection procedures. Notify the Responsible Safety Officer of any damage to fire protection equipment.

Powder Actuated Tools

The employees using powder-actuated tools must be properly trained and will be issued a card as proof of that training. Some of the powder-actuated tools being used have written approval of the Division of Occupational Safety and Health. Check to see which tools require a certification and which certificates have been issued. Each powder-actuated tool should be stored in its own locked container when not being used. Signs measuring at least 7" by 10" and in bold face typed reading "POWDER-ACTUATED TOOL IN USE" must be placed conspicuously when the tool is being used. All powder-actuated tools must be left unloaded until they are actually ready to be used. Each day before using, each powder-actuated tool must be inspected for obstructions or defects. The powder- actuated tool operators must have and must use appropriate personal protective equipment such as hard hats, safety goggles, safety shoes and ear protectors whenever they are using the machines.

Machine Guarding

The following general rules apply to machine operation: Before operating any machine, every employee must have completed a training program on safe methods of machine operations. It is the primary purpose of supervision to ensure that employees are following safe machine operating procedures. There will be a regular program of safety inspection of machinery and equipment. All machinery and equipment must be kept clean and properly maintained. There must be sufficient clearance provided around and between machines to allow for safe operations, set up, servicing, material handling and waste removal. The supervisor will instruct every employee in the work area on the methods provided to protect the operator and other employees in the machine area from hazards created by the operation of a machine, such as nip points, rotating parts, flying chips and sparks. The machinery guards must be secure and arranged so they do not present a hazard. All special hand tools used for placing and removing material must protect the operator's hands. All revolving drums, barrels and containers should be guarded by an enclosure that is interlocked with the drive mechanisms, so that revolution cannot occur unless the guard enclosure is in place. All arbors and mandrels must have firm and secure bearings and be free of play. Machines should be constructed so as to be free from excessive vibration when the size tool is mounted and run at full speed. If the machinery is cleaned with compressed air, the air must be pressure controlled and personal protective equipment or other safeguards used to protect operators and other workers from eye and bodily injury. Saws used for ripping equipment must be installed with anti-kickback devices and spreaders. All radial arm saws must be arranged so that the cutting head will gently return to the back of the table when released.

Welding, Cutting & Brazing

Only authorized and trained personnel are permitted to use welding, cutting or brazing equipment. All operators must have a copy of the appropriate operating instructions and are directed to follow them. Compressed gas cylinders should be regularly examined for obvious signs of defects, deep rusting, or leakage. Use care in handling and storing cylinders, safety valves, relief valves and the like, to prevent damage. Precaution must be taken to prevent mixture of air or oxygen with flammable gases, except at a burner or in a standard torch. Only approved apparatus (torches, regulators, pressure-reducing valves, acetylene generators, manifolds) may be used. Cylinders must be kept away from sources of heat. It is prohibited to use cylinders as rollers or supports. Empty cylinders must be appropriately marked, their valves closed and valve-protection caps on. Signs reading: DANGER-NO SMOKING, MATCHES, OR OPEN LIGHTS, or equivalent must be posted. Cylinders, cylinder valves, couplings, regulators, hoses and apparatus must be kept free of oily or greasy substances. Care must be taken not to drop or strike cylinders. Unless secured on special trucks, all regulators must be removed and valve-protection caps put in place before moving cylinders. All cylinders without fixed hand wheels must have keys, handles, or non-adjustable wrenches on stem valves when in service. Liquefied gases must be stored and shipped valve-end up with valve covers in place. Before a regulator is removed, the valve must be closed and gas released from the regulator. All employees are instructed never to crack a fuel-gas cylinder valve near sources of ignition. Red is used to identify the acetylene (and other fuel-gas) hose, green for oxygen hose, and black for inert gas and air hose. All pressure- reducing regulators must be used only for the gas and pressures for which they are intended. The open circuit (No Load) voltage of arc welding and cutting machines must be as low as possible and not in excess of the recommended limits. Under wet conditions, automatic controls for reducing no-load voltage must be used. Grounding of the machine frame and safety ground connections of portable machines must be checked periodically. Electrodes must be removed from the holders when not in use. All electric power to the welder must be shut off when no one is in attendance. Suitable fire extinguishing equipment must be available for immediate use before starting to ignite the welding torch. The welder is strictly forbidden to coil or loop welding electrode cable around his/her body. All wet welding machines must be thoroughly dried and tested before being used. All work and electrode lead cables must be frequently inspected for wear and damage, and replaced when needed. All connecting cable lengths must have adequate insulation. When the object to be welded cannot be moved and fire hazards cannot be removed, shields must be used to confine heat, sparks and slag. Fire watchers will be assigned when welding or cutting is performed in locations where a serious fire might develop. All combustible floors must be kept wet, covered by damp sand, or protected by fire-resistant shields. When floors are wet down, personnel should be protected from possible electrical shock. When welding is done on metal walls, precautions must be taken to protect combustibles on the other side. Before hot work is begun, used drums, barrels, tanks and other containers must be so thoroughly cleaned that no substances remain that could explode, ignite or produce toxic vapors. It is required that eye protection helmets, hand shields and goggles meet appropriate standards. Employees exposed to the hazards created by welding, cutting or brazing operations must be protected with personal protective equipment and clothing. Check for adequate ventilation where welding or cutting is performed. When working in confined spaces, environmental monitoring tests should be taken and means provided for quick removal of welders in case of emergency.

Compressors & Compressed Air

All compressors must be equipped with pressure relief valves and pressure gauges. All compressor air intakes must be installed and equipped to ensure that only clean, uncontaminated air enters the compressor. Every air receiver must be provided with a drain pipe and valve at the lowest point for the removal of accumulated oil and water. Compressed air receivers must be periodically drained of moisture and oil. All safety valves shall be tested frequently and at regular intervals to determine whether they are in good operating condition. A current operating permit issued by the Division of Occupational Safety and Health shall be maintained. The inlet of air receivers and piping systems must be kept free of accumulated oil and carbonaceous materials.

Compressed Gas & Cylinders

Cylinders with a water weight capacity over 30 pounds must be equipped with means for connecting a valve protector device, or with a collar or recess to protect the valve. Cylinders must be legibly marked to identify clearly the gas contained. Compressed gas cylinders should be stored only in areas which are protected from external heat sources such as flame impingement, intense radiant heat, electric arcs or high temperature lines. Cylinders must not be located or stored in areas where they will be damaged by passing or falling objects, or subject to tampering by unauthorized persons. Cylinders must be stored or transported in a manner to prevent them from creating a hazard by tipping, falling or rolling. All cylinders containing liquefied fuel gas must be stored or transported in a position so that the safety relief device is always in direct contact with the vapor space in the cylinder. Valve protectors must always be placed on cylinders when the cylinders are not in use or connected for use. All valves must be closed off before a cylinder is moved, when the cylinder is empty, and at the completion of each job. Low pressure fuel-gas cylinders must be checked periodically for corrosion, general distortion, cracks, or any other defect that might indicate a weakness or render them unfit for service. The periodic check of low pressure fuel-gas cylinders includes a close inspection of the cylinder's bottom.

Hoists & Auxiliary Equipment

The operator should avoid carrying loads over people. Only employees who have been trained in the proper use of hoists are allowed to operate them.

Industrial Trucks/Forklifts

Singleton Tower, LLC does not currently own industrial trucks/forklifts. However, if they are used at Singleton Tower, LLC in future operations, the following rules and procedures will apply: Only trained personnel should be allowed to operate industrial trucks. Lift Truck Operating rules must be posted and will be strictly enforced. When operating any industrial truck, substantial overhead protective equipment will be provided on high lift rider equipment. Directional lighting will also be provided on each industrial truck that operates in an area with less than 2 foot candles per square foot of general lighting. Each industrial truck must have a warning horn, whistle, gong or other device which can be clearly heard above the normal noise in the area where it operated. Before using a forklift, check that the brakes on each industrial truck are capable of bringing the vehicle to a complete and safe stop when fully loaded. The parking brake must effectively prevent the vehicle from moving when unattended. When motorized hand and hand/rider trucks are operated, and when the operator releases the steering mechanism, make sure that both the brakes are applied and power to the motor shut off. Maintenance records will be available so that a driver can check on the servicing of the truck in case of questions. When an industrial truck operates in areas where flammable gases, vapors, combustible dust, or ignitable fibers may be present in the atmosphere, the vehicle must be approved for such locations with a tag showing such approval posted on the vehicle itself. Industrial trucks with internal combustion engines, operated in buildings or enclosed areas, should be carefully checked to ensure that the operation of the vehicle does not cause harmful concentration of dangerous gases or fumes.

Spraying Operations

In any spraying operation there should be adequate ventilation before starting any spraying job. As to the conditions of the area where the spray job is to be done, consideration should be taken before beginning work. If the area is enclosed, does it require mechanical ventilation? Before working, make sure that the area is free of combustible materials, and that there are "No Smoking" signs adequately posted and easily seen. If mechanical ventilation is provided when spraying in enclosed areas, air should not be recirculated so as to avoid contamination. There should be adequate space and ventilation for all drying areas. Also in an enclosed area, spray operations must be at least 20 feet from flames, sparks, operating electrical motors and other ignition sources. The spray area should be free of any hot surfaces. Any solvent used in the cleaning process should not have a flash point of 100 degrees or less. If portable lamps are used to illuminate the spray areas they must be approved for the location and must be suitable for use in a hazardous area. Approved respiratory equipment will be provided and must be used when appropriate during spraying operations. If a sprinkler system is within the confines of the spraying area operation, it should be in

working order and will be inspected semi-annually to make sure that it is in operating condition. If a spraying booth is used for the spraying operation, it must be made of metal, masonry or other noncombustible material. Make sure that "NO SMOKING" signs are posted in spray areas, paint rooms, paint booths and paint storage areas. The spray booth must be completely ventilated. Booth floors and baffles must be easily cleaned and noncombustible. Ducts and access doors must be easily cleaned. Lighting fixtures for both outside and inside the spray booth must be enclosed in clear see-through sealed panels. Electric motors for exhaust fans must be placed outside the booth. Belts and pulleys must be completely enclosed. Drying apparatus should be located in a well ventilated area in the booth and properly grounded. Infrared drying apparatus must be kept out of the spray area during a spraying operation.

Confined Spaces

Before entry into a confined space, all impellers, agitators, or other moving equipment contained in the confined space must be locked-out. Ventilation must be either natural or mechanically provided into the confined space. All hazardous or corrosive substances that contain inert, toxic, flammable or corrosive materials must be valved off, blanked, disconnected and separated. Atmospheric tests should be performed to check for oxygen content, toxicity and explosive concentration. Atmospheric tests must be performed on a regular basis in a confined area where entry is required. The area must also be checked for decaying vegetation or animal matter that could produce methane. Adequate lighting must be provided within the space. If the confined area is located below the ground or near where motor vehicles are operating, care must be taken that vehicle exhaust or carbon monoxide does not enter the space. When personnel enter a confined area, assigned safety standby employees who are alert to the work being done, are able to sound an alarm if necessary and to render assistance, must be in the area. These standby employees must be trained to assist in handling lifelines, respiratory equipment, CPR, first aid, and be able to employ rescue equipment that will remove the individual from the confined area. Standby personnel should be in teams of two during such an operation or else within the vicinity if working separately. There must also be an effective communication system utilized while the operation is occurring. When equipment which utilizes oxygen, such as salamanders, torches or furnaces, is used in a confined space, adequate ventilation must be provided to guarantee oxygen content and combustion for the equipment. When this equipment is used, adequate measures must be taken to assure that exhaust gases are vented outside the enclosure. When gas welding or burning is used, hoses must be checked for leaks. Compressed bottled gas must be outside the area and torches must be lit outside the area also. The atmosphere must be tested each time before lighting a torch.

Environmental Controls

Singleton Tower, LLC currently uses no dangerous chemicals in the scope of our work. However, if the use of chemicals becomes necessary, all employees must be aware of the hazards involved when working with chemicals and the remedies that need to be used when an accident does occur. A training program will give instructions on how to handle the chemical being used and first aid to be applied to victims of chemical exposure. First aid and caution signs will be conspicuously posted so as to alert individuals on a constant basis. Charts identifying the chemicals utilized in the workplace, their symptoms and effects must also be posted. The workers must know what the acceptable level of exposure to a chemical is and what safety systems must be in place when working with a chemical. Staff should also be aware of new chemical products which may be available that are less harmful, and they must ensure that facilities are adequately ventilated when using chemicals on the premises. Spray painting operations done in spray rooms or booths must be equipped with an appropriate exhaust system. Periodic inspections must be made of the booth and noted on an inspection tag posted on the booth. If welding is done, the welder should be certified. In the area of operation where the welding is taking place, the welder must be aware of ventilation available, the type of respirator that can be used in the area, and if exposure time or other means will suffice as a safe and adequate measure when welding as to the fumes that will be emitted. Welders should also be supplied with protective clothing and a flash shield during welding operations. When forklifts and other vehicles are used in buildings or other enclosed areas, carbon monoxide levels must be kept below maximum acceptable concentration. Noise levels also present a potential hazard. Noise levels within a facility must be at acceptable levels and if not, steps must be taken to reduce the level using recommended engineering controls. When fibrous materials such as asbestos are being handled, the necessary precautions must be taken to protect the employee from the material. The material must be labeled, along with signs conspicuously posted that these materials are being

used in the area. Employees should be aware of effective methods used to prevent emission of airborne asbestos fibers, silica dust and other similar hazardous materials. Some of the recommended methods of controlling the emission of these materials are by using water and vacuuming, rather than blowing and sweeping, the materials. Machinery such as grinders, saws and other tools that produce a fine airborne dust must be vented to an industrial collector or central exhaust system. In any ventilation system the system should be designed and operated at an airflow and volume necessary for proper application and effectiveness. In the design of the ventilation system the ducts and belts must be free of obstructions and slippage. As with all operations, there must be written standards on the procedures for the equipment, description of the job task, usage of the protective equipment provided, such as the selection and use of respirators, and when they are needed. Any water that is provided to an employee throughout the facility should be clearly identified as to whether it is for drinking, washing or cooking. All restrooms must be kept clean and sanitary. Employees should be screened before taking positions that may expose them to hazards they are not physically capable of handling. An employee who takes an assignment which requires physical labor must be trained to lift heavy loads properly so as not to damage themselves physically. If the work assignment involves dealing with equipment that produces ultra-violet radiation, the employee must be properly protected or given the correct protective clothing. An employee posted to an assignment on a roadway where there is heavy traffic must be given the designated protective clothing (bright colored traffic orange warning vest) and safety training regarding the hazards of this job.

Hazardous Substances Communication

When hazardous substances are used in the workplace, a hazard communication program dealing with Material Safety Data Sheets (MSDS), labeling and employee training will be in operation. MSDS materials will be readily available for each hazardous substance used. A training program plus regular question and answer sessions on dealing with hazardous materials will be given to keep employees informed. The program will include an explanation of what an MSDS is and how to use and obtain one; MSDS contents for each hazardous substance or class of substances; explanation of the "Right to Know"; identification of where employees can see the employer's written hazard communication program and where hazardous substances are present in their work area; the health hazards of substances in the work area, how to detect their presence, and specific protective measures to be used; as well as informing them of hazards of non-routine tasks and unlabeled pipes.

Electrical

The workplace will be aware of the OSHA Electrical Safety Orders and will comply with the same. Employees will be required to report any hazard to life or property that is observed in connection with a job, electrical equipment or lines. Employees will be expected to make preliminary inspections or appropriate tests to determine conditions before starting work. When equipment or lines are to be serviced, maintained or adjusted, employees must be aware of open switches. Lockouts must be tagged whenever possible. Equipment such as electrical tools or appliance must be grounded or of the double insulated type. Extension cords being used must have a grounding conductor. The workplace supervisor must be aware if multiple plug adaptors are prohibited. If ground-fault circuit interrupters are installed on each temporary 15 or 20 ampere, 120 volt AC circuit at locations where construction, demolition, modifications, alterations or excavations are being performed, temporary circuits must be protected by suitable disconnecting switches or plug connectors with permanent wiring at the junction. Electricians must be aware of the following:

* Exposed wiring and cords with frayed or deteriorated insulation must be repaired or replaced.
* Flexible cords and cables must be free of splices or taps.
* Clamps or other securing means must be provided on flexible cords or cables at plugs, receptacles, tools, equipment.
* The cord jacket must be held securely in place.
* All cord, cable and raceway connections must be intact and secure.
* In wet or damp locations, electrical tools and equipment must be appropriate for the use or location, or otherwise protected.

* The location of electrical power lines and cables (overhead, underground, under floor, other side of walls) must be determined before digging, drilling or similar work is begun.
* All metal measuring tapes, ropes, hand lines or similar devices with metallic thread woven into the fabric are prohibited for use where they could come in contact with energized parts of equipment or circuit conductors.
* The use of metal ladders is prohibited in areas where the ladder or the person using the ladder could come in contact with energized parts of equipment, fixtures or conductors.
* All disconnecting switches and circuit breakers must be labeled to indicate their use or equipment served.
* A means for disconnecting equipment must always be opened before fuses are replaced.
* All interior wiring systems must include provisions for grounding metal parts or electrical raceways, equipment and enclosures.
* All electrical raceways and enclosures must be fastened securely in place.
* All energized parts of electrical circuits and equipment must be guarded against accidental contact by approved cabinets or enclosures.
* Sufficient access and working space will be provided and maintained around all electrical equipment to permit ready and safe operations and maintenance.
* All unused openings (including conduit knockouts) in electrical enclosures and fittings must be closed with appropriate covers, plugs or plates.
* Electrical enclosures such as switches, receptacles, and junction boxes must be provided with tight-fitting covers or plates.
* Disconnecting switches for electrical motors in excess of two horsepower must be capable of opening the circuit when the motor is in a stalled condition without exploding. (Switches must be horsepower rated equal to or in excess of the motor HP rating.)
* Low voltage protection must be provided in the control device of motor driven machines or equipment which could cause injury from inadvertent starting.
* A motor disconnecting switch or circuit breaker must be located within sight of the motor control device.
* Motors:
    a) must be located within sight of their controller;
    b) must have their controller disconnecting means capable of being locked in the open position;
    c) or must have separate disconnecting means installed in the circuit within sight of the motor.
* A controller for a motor in excess of two horsepower must be rated equal to but not in excess of the motor it services. Employees who regularly work on or around energized electrical equipment or lines will be instructed in cardiopulmonary resuscitation (CPR) methods. Employees will be trained on how to work on energized lines or equipment over 600 volts.

Noise Engineering controls will be used to reduce excessive noise levels. When engineering controls are not feasible, administrative controls (i.e, worker rotation) will be used to minimize individual employee exposure to noise. An ongoing preventive health program will be utilized to educate employees in safe levels of noise, exposure, effects of noise on their health, and use of personal protection. Approved hearing protective equipment (noise attenuating devices) will be available to every employee working in areas where continuous noise levels exceed 85 dB. To be effective, ear protectors must be properly fitted and employees will be instructed in their use and care.

Fueling Where flammable liquids are used, employees will be trained to deal with spillage during fueling operations, how it is to be cleaned, the types and designs of fueling hoses and the specific types of fuel it can handle, whether fueling

is being done with a nozzle that is a gravity flow system or self-closing, how to avoid spills and recognition that if a spill does occur, the safety of restarting an engine. Employees must be aware that an open flame or light near any fuel is prohibited when fueling or the transfer of fuel is occurring. "NO SMOKING" signs will be posted conspicuously.

Piping Systems

Substances that are transported through piping need to be identified by color or labeling. Signs must be posted identifying the substance being transported through the pipes as to whether it is hazardous and where turn-off valves, connections and outlets are located. All tags used for labeling will be of a durable material with distinguishable and clearly written print. When non-potable water is piped through a facility, outlets or taps, notices will be posted to alert employees that it is unsafe and not to be used for drinking, washing or personal use. When pipelines are heated by electricity, steam or other external sources, warning signs or tags placed at unions, valves, or other serviceable parts will be part of the system.

Material Handling

In the handling of materials, employees must know the following: There must be safe clearance for equipment through aisles and doorways. Aisle ways must be designated, permanently marked, and kept clear to allow unhindered passage. Motorized vehicles and mechanized equipment will be inspected daily or prior to use. Vehicles must be shut off and brakes must be set prior to loading or unloading. Containers of combustibles or flammables, when stacked while being moved, must be separated by dunnage sufficient to provide stability. If dock boards (bridge plates) are used when loading or unloading operations are taking place between vehicles and docks, precautions must be observed. Trucks and trailers will be secured from movement during loading and unloading operations. Dock plates and loading ramps will be constructed and maintained with sufficient strength to support imposed loading. Hand trucks must be maintained in safe operating condition. Chutes must be equipped with sideboards of sufficient height to prevent the handled materials from falling off. At the delivery end of rollers or chutes, provisions must be made to break the movement of the handled materials. Pallets must be inspected before being loaded or moved. Hooks with safety latches or other arrangements will be used when hoisting materials, so that slings or load attachments won't accidentally slip off the hoist hooks. Securing chains, ropes, chockers or slings must be adequate for the job to be performed. When hoisting material or equipment, provisions must be made to assure no one will be passing under the suspended loads. Material Safety Data Sheets will be available to employees handling hazardous substances.

Transporting Employees & Materials

When employees are transporting either employees or materials, they must have an operator's license for that classification of vehicle and be certified or trained in the operation of that vehicle. For a safety program to be effective, they must also have knowledge of First Aid courses and safety equipment, as well as the vehicle and how it operates. As employees are transported by truck, provisions must be provided to prevent their falling from the vehicle. Vehicles should be in good working condition, inspected on a regular basis and must be equipped with lamps, brakes, horns, mirrors, windshields and turn signals in good working order. If the vehicle transports numerous individuals it must be equipped with handrails, steps, stirrups or similar devices, placed and arranged so that employees can safely mount or dismount. Safety measures to ensure passenger safety should be observed. When cutting tools with sharp edges are carried in the passenger compartment, they must be placed in closed boxes or secured containers. Carrying flares and two reflective type flares and a fire extinguisher must be part of the standard emergency equipment carried in the vehicle at all times.

Ventilation

In the operation of any facility ventilation system, there needs to be a design to integrate several systems of control which will expel contaminates and provide clean air. The systems must take into consideration the volume and velocity that will be needed to successfully remove contaminants. The system must not fail in the case of an emergency situation where two contaminants are exposed to each other when a fire or explosion occurs. In the design of the system, clean-out ports or doors that are provided at intervals will not exceed 12 feet in all horizontal runs of exhaust ducts. The system must be operational so that it will not offset the functions of other operations.

Crane Checklist

Singleton Tower, LLC does not currently own any cranes. However, if cranes are used by Singleton Tower, LLC employees, the following guidelines will apply: With the operation of cranes there are several functional areas to be considered. Cranes should be inspected on a biannual basis with the inspection certificate available when a question arises. The crane must be utilized in an operation which does not violate OSHA regulations. Cranes will be visually inspected for defective components prior to any work shift. Electrically operated cranes will be effectively grounded, preventive maintenance established, have a clearly visible load; operating controls clearly identified; a fire extinguisher provided at the operator's station; rated capacity visibly marked; an audible warning device mounted on the crane, and sufficient illumination. Crane design shall be such that the boom will not fall over backwards when equipped with boom stops.

Safety Posters

Singleton Tower, LLC is required to post certain employment related information. The required information is maintained on the bulletin board where employees can find the following required posters: Various state and federal orders regulating the Wages, Hours and Working Conditions in certain industries. Pay Day Notice Anti-Discrimination Poster Equal Employment Opportunity is the Law (EEOC form) OSHA Safety and Health Protection on the Job Notice of Workers Compensation Carrier Notice to Employees: Unemployment Insurance and Disability Insurance Notice: Employee Polygraph Protection Act (form WH 1462) Access to Medical and Exposure Records Notice to Employees: Time Off to Vote In addition to the above listed notices, a copy of this injury prevention program, a log and summary of Occupational Injuries and Illnesses, a copy of Singleton Tower, LLC's code of Safe Work Practices and a Fire Prevention and Evacuation Plan will be posted. When employees are required to work on the premises of any other employer, such as a service call or installation situation, the job site will maintain a collection of Material Data Safety Sheets that describe any hazards unique to that site. Check with the other employer's job site coordinator or supervisor for the exact location of the MSDS information. In addition to these required safety postings, emergency numbers are maintained on the bulletin board. In the case of a real emergency, call 911. State your name, the nature of the emergency, and exact location of the injury. Answer all questions completely. Do NOT use 911 for routine calls to police or fire departments.

Licenses and Permits

In addition to other postings required by law, Singleton Tower, LLC maintains a copy of all necessary business licenses, permits, and notices required by the National Labor Relations Board or other governmental bodies, notices of citations during abatement periods, and other required information which are posted during the appropriate times on the bulletin board.

Personal Protective Equipment Clothing

1. Where there is a danger of flying particles or corrosive materials, employees must wear protective goggles and/or face shields provided [or approved] by Singleton Tower, LLC.
2. Employees are required to wear safety glasses at all times in areas where there is a risk of eye injuries such as punctures, contusions or burns.
3. Employees who need corrective lenses are required to wear only approved safety glasses, protective goggles, or other medically approved precautionary procedures when working in areas with harmful exposures, or risk of eye injury.
4. Employees are required to wear protective gloves, aprons, shields and other means provided in areas where they may be subject to cuts, corrosive liquids and/or harmful chemicals.
5. Hard hats must be worn in areas subject to falling objects, and at all times while at construction sites.
6. Appropriate footwear including steel toed shoes must be worn in an area where there is any risk of foot injuries from hot, corrosive, poisonous substances, falling objects, crushing or penetrating action.

7. When necessary employees must use the approved respirators which are provided for regular and emergency use.
8. All safety equipment must be maintained in sanitary condition and ready for use. Report any defective equipment immediately.
9. If any irritant gets into an employee's eyes, call for medical assistance immediately and flush the eye out with clean water.
10. An emergency shower may be provided for emergencies. Ask your supervisor for more details on use of this facility.
11. Food may not be eaten in work areas, or in places where there is any danger of exposure to toxic materials or other health hazards. Ask your supervisor to identify safe eating places.
12. In cases where the noise level exceeds certain levels, ear protection is required.
13. In cases of cleaning toxic or hazardous materials, protective clothing provided must be worn.

Hardhats

In Singleton Tower, LLC, hardhats are required [at all times, in designated areas, when appropriate]. Hardhats are common in our industry. There was a time, about one hundred years ago, when no one wore a hardhat. But, over time, the value of hardhats to save lives was firmly proven, so that the entire industry now accepts this safety device as a natural article of clothing, like a football player wearing a helmet during a game. Sometimes a person fails to wear a hardhat, either through forgetfulness or through underestimating the risk of head injury which can be prevented by wearing one. Remember that all it takes is a carelessly dropped tool or piece of material coming down on your head to cause severe injury or even death. There are a number of workers disabled with various types of head injuries and vision problems because they didn't wear a hardhat. When you wear a hardhat, wear it right. Keep it squarely on your head with the inside band properly adjusted. See your supervisor if you're having trouble adjusting the hardhat.

Work Environment

Work sites must be clean and orderly. Work surfaces must be kept dry or appropriate means taken to assure the surfaces are slip-resistant. Spills must be cleaned up immediately. All combustible scrap, debris and waste must be stored safely and removed promptly. Combustible dust must be cleaned up with a vacuum system to prevent the dust from going into suspension. The accumulated combustible dust must be removed routinely. Metallic or conductive dust must be prevented from entering or accumulating on or around electrical enclosures or equipment. Waste containers must be covered. Oily and paint soaked rags are combustible and should be discarded in sealable metal containers only. Paint spray booths, dip tanks and paint areas must be cleaned regularly. All oil and gas fired devices should be equipped with flame failure controls that will prevent flow of fuel if pilots or main burners are not working. Ask your supervisor where these controls are located. Make sure all pits and floor openings are either covered or otherwise guarded.

Walkways

All aisles and passageways must be kept clear. Also, aisles and passageways should be clearly marked. Wet surfaces must be covered with non-slip material and all holes properly covered or marked with warning guards. All spills must be cleaned up immediately, and a caution sign placed on all wet or drying surfaces. In cases of passageways used by forklifts, trucks or other machinery, use a separate aisle for walking, if available. If no separately marked aisle is available, use extreme caution. Remember, walking in a passageway used by machinery is like walking in the middle of a street used by cars: You may have the right of way, but the heavier vehicle can't always see you and can't always stop in time. The key to moving around in such circumstances is to stop, look and listen and then to move when there is no danger. Make eye contact with the drivers of moving vehicles so that you know that they know you are there. Equipment must be properly stored so that sharp edges do not protrude into walkways. Changes in elevations must be clearly marked, as must passageways near dangerous operations like welding, machinery operation or painting. If there is a low ceiling, a warning sign must be posted. If the walkway or stairway is more than thirty inches above the floor or ground, it must have a guardrail. If an employee is aware of any breach of these standards, please inform the workplace supervisor.

Floor and Wall Openings

Be careful when working near floor and wall openings. All floor openings (holes)

should be guarded by a cover, guardrail or equivalent barrier on all sides except at the entrance to stairways and ladders. Toe boards must be installed around the edges of a permanent floor opening. Skylights must be able to withstand at least 200 pounds pressure. Glass used in windows, doors, and walls (including glass block) must be able to withstand a human impact, and if required by code, be shatterproof "safety glass." Before beginning work at a new location, inspect it to ensure that all floor openings which must remain open, such as floor drains, are covered with grates or similar covers. In roadways and driveways, covers with capacity to carry a truck rear axle load of at least 20,000 pounds must protect all manholes and trenches. In office buildings, fire resistive construction requires that the doors and hallway closures be properly rated and be equipped with self-closing features. Be sure that there are at least two fire emergency exits accessible from your location at all times.

Work Area Fire extinguishers must remain accessible at all times. Means of egress should be kept unblocked, well-lighted and unlocked during work hours. Excessive combustibles (paper) may not be stored in work areas. Aisles and hallways must be kept clear at all times. Designated employees have been trained to respond to a fire or other emergency. Workplaces are to be kept free of debris, floor storage and electrical cords. Adequate aisle space is to be maintained. File cabinet drawers should be opened one at a time and closed when work is finished. Proper lifting techniques are to be used by employees to avoid overexertion and strain when carrying loads. No alcohol or any intoxicating substance may be consumed prior to or during work.

Driving Drive safely. If vehicles are used during the work day, seat belts and shoulder harnesses are to be worn at all times. Vehicles must be locked when unattended to avoid criminal misconduct. Do not exceed the speed limit. Vehicles must be parked in legal spaces and must not obstruct traffic. Defensive driving must be practiced by all employees. Employees should park their vehicles in well-lighted areas at/or near entrances to avoid criminal misconduct. Smoking is not allowed in Singleton Tower, LLC vehicles.

Vehicle Maintenance Work safely when repairing vehicles. Where tires are mounted and/or inflated on drop center wheels, a safe practice procedure must be posted and enforced. Where tires are mounted and/or inflated on wheels with split rims and/or retainer rings, a safe practice procedure must be posted and enforced. Each tire inflation hose must have a clip-on chuck with at least 24 inches of hose between the chuck and an in-line hand valve and gauge. The tire inflation control valve should automatically shut off the air flow when the valve is released. A tire restraining device such as a cage, rack or other effective means must be used while inflating tires mounted on split rims, or rims using retainer rings. Employees are strictly forbidden from taking a position directly over or in front of a tire while it's being inflated. Proper lifting techniques must be used by employees to avoid overexertion when lifting packages.

Cleanliness All work sites must be clean and orderly. All work surfaces must be kept dry or appropriate means taken to assure that surfaces are slip-resistant. All spill materials or liquids should be cleaned up immediately and combustible scrap, debris and waste stored safely and removed from the work site promptly. Any accumulations of combustible dust must be routinely removed from elevated surfaces including the overhead structure of buildings. Combustible dust should be cleaned up with a vacuum system to prevent the dust going into suspension. Metallic or conductive dust must be prevented from entering or accumulating on or around electrical enclosures or equipment. Ask your supervisor about the proper disposal of oily and paint-soaked waste. All oil and gas fired devices must be equipped with flame failure controls that will prevent flow of fuel if pilots or main burners are not working. Paint spray booths, dip tanks, etc., must be cleaned regularly. Washing facilities are provided, so wash your hands after handling materials.

Tool Maintenance Faulty or improperly used hand tools are a safety hazard. All employees shall be responsible for ensuring that tools and equipment (both company and employee-owned) used by them or other employees at their

workplace are in good condition. Hand tools such as chisels, punches, etc., which develop mushroom heads during use, must be reconditioned or replaced as necessary. Broken or fractured handles on hammers, axes and similar equipment must be replaced promptly. Worn or bent wrenches should be replaced regularly. Appropriate handles must be used on files and similar tools. Appropriate safety glasses, face shields, etc., must be worn while using hand tools or equipment which might produce flying materials or be subject to breakage. Eye and face protection must be worn when driving in tempered spuds or nails. Check your tools often for wear or defects. Jacks must be checked periodically to assure they are in good operating condition. Tool handles must be wedged tightly into the heads of tools. Tool cutting edges should be kept sharp enough so the tool will move smoothly without binding or skipping. When not in use, tools should be stored in a dry, secure location.

Ladders

Check ladders each and every time before you climb. Ladders should be maintained in good condition: joints between steps and side rails should be tight; hardware and fittings securely attached; and movable parts operating freely without binding or undue play. Non-slip safety feet are provided on each ladder. Ladder rungs and steps should be free of grease and oil. Employees are prohibited from using ladders that are broken, missing steps, rungs, or cleats, or that have broken side rails or other faulty equipment. It is prohibited to place a ladder in front of doors opening toward the ladder except when the door is blocked open, locked or guarded. It is prohibited to place ladders on boxes, barrels, or other unstable bases to obtain additional height. Face the ladder when ascending or descending. Be careful when you climb a ladder. Do not use the top step of ordinary step ladders as a step. When portable rung ladders are used to gain access to elevated platforms, roofs, etc., the ladder must always extend at least 3 feet above the elevated surface. It is required that when portable rung or cleat type ladders are used, the base must be so placed that slipping will not occur, unless it is lashed or otherwise held in place. All portable metal ladders must be legibly marked with signs reading "CAUTION" - "Do Not Use Around Electrical Equipment." Employees are prohibited from using ladders as guys, braces, skids, gin poles, or for other than their intended purposes. Only adjust extension ladders while standing at a base (not while standing on the ladder or from a position above the ladder). Metal ladders should be inspected for tears and signs of corrosion. Rungs of ladders should be uniformly spaced at 12 inches, center to center.

Combustible Materials

All combustible scrap, debris and waste materials (oily rags, etc.) must be stored in covered metal receptacles and removed from the work site promptly. Proper storage to minimize the risk of fire, including spontaneous combustion must be practiced. Only approved containers and tanks are to be used for the storage and handling of flammable and combustible liquids. All connections on drums and combustible liquid piping, vapor and liquid must be kept tight. All flammable liquids should be kept in closed containers when not in use (e.g., parts-cleaning tanks, pans, etc.). Bulk drums of flammable liquids must be grounded and bonded to containers during dispensing. Storage rooms for flammable and combustible liquids must have explosion-proof lights. Storage rooms for flammable and combustible liquids should have mechanical or gravity ventilation. Liquefied petroleum gas must be stored, handled, and used in accordance with safe practices and standards. No smoking signs must be posted on liquefied petroleum gas tanks. Liquefied petroleum storage tanks should be guarded to prevent damage from vehicles. All solvent wastes and flammable liquids should be kept in fire-resistant, covered containers until they are removed from the work site. Vacuuming should be used whenever possible rather than blowing or sweeping combustible dust. Fire separators should be placed between containers of combustibles or flammables when stacked one upon another to assure their support and stability. Fuel gas cylinders and oxygen cylinders must be separated by distance, fire resistant barriers, etc., while in storage. Fire extinguishers are selected for the types of materials and placed in areas where they are to be used. These fire extinguishers are classified as follows: Class A - Ordinary combustible materials fires. Class B - Flammable liquid, gas or grease fires. Class C - Energized-electrical equipment fires. Appropriate fire extinguishers must be mounted within 75 ft. of outside areas containing flammable liquids, and within 10 ft. of any inside storage area for such materials. All extinguishers must be serviced, maintained and tagged at intervals not to exceed one year. Extinguishers should be placed free from obstructions or blockage. All extinguishers must be fully charged and in their designated places unless in use. Where sprinkler systems are permanently installed, are the nozzle heads arranged so that water will not be sprayed into operating

electrical switch boards and equipment? Check to see that heads have not been bent or twisted from their original position. "NO SMOKING" rules will be enforced in areas involving storage and use of hazardous materials. "NO SMOKING" signs have been posted where appropriate in areas where flammable or combustible materials are used and/or stored. Safety cans must be used for dispensing flammable or combustible liquids at point of use. All spills of flammable or combustible liquids must be cleaned up promptly. Storage tanks should be adequately vented to prevent the development of excessive vacuum or pressure as a result of filling, emptying, or atmosphere temperature changes. Storage tanks are equipped with emergency venting that will relieve excessive internal pressure caused by fire exposure.

First Aid Kits

First-aid kits and required contents are maintained in a serviceable condition. Unit-type kits have all items in the first-aid kit individually wrapped, sealed, and packaged in comparable sized packages. The commercial or cabinet- type kits do not require all items to be individually wrapped and sealed, but only those which must be kept sterile. Items such as scissors, tweezers, tubes of ointments with caps, or rolls of adhesive tape, need not be individually wrapped, sealed, or disposed of after a single use or application. Individual packaging and sealing shall be required only for those items which must be kept sterile in a first-aid kit. First-aid kits shall contain at least the following items:
10 Package Kit: 1 Pkg. Adhesive bandages, 1" (16 per pkg.) 1 Pkg. Bandage compress, 4" (1 per pkg.) 1 Pkg. Scissors and tweezers (1 each per pkg. 1 Pkg. Triangular bandage, 40" (1 per pkg.) 1 Pkg. Antiseptic soap or pads (3 per pkg.) 5 Pkgs. of consulting physician's choice

16 Package Kit: 1 Pkg. Absorbent gauze, 24" x 72" (1 per pkg.) 1 Pkg. Adhesive bandages, 1" (16 per pkg.) 2 Pkgs. Bandage compresses, 4" (1 per pkg.) 1 Pkg. Eye dressing (1 per pkg.) 1 Pkg. Scissors, and tweezers (1 each per pkg.) 2 Pkgs. Triangular bandages, 40" (1 per pkg.) 1 Pkg. Antiseptic soap or pads (3 per pkg.) 7 Pkgs. of consulting physician's choice

24 Package Kit: 2 Pkgs. Absorbent gauze, 24" x 72" (1 per pkg.) 2 Pkgs. Adhesive bandages, 1" (16 per pkg.) 2 Pkgs. Bandage compresses, 4" (1 per pkg.) 1 Pkg. Eye dressing (1 per pkg.) 1 Pkg. Scissors and tweezers (1 each per pkg.) 6 Pkgs. Triangular bandages (1 per pkg.) 1 Pkg. Antiseptic soap or pads (3 per pkg.) 9 Pkgs. of consulting physician's choice

36 Package Kit: 4 Pkgs. Absorbent gauze, 24" x 72" (1 per pkg.) 2 Pkgs. Adhesive bandages, 1" (16 per pkg.) 5 Pkgs. Bandage compresses, 4" (1 per pkg.) 2 Pkgs. Eye dressing (1 per pkg.) 1 Pkg. Scissors and tweezers (1 each per pkg.) 8 Pkgs. Triangular bandages, 40" (1 per pkg.) 1 Pkg. Antiseptic soap or pads (3 per pkg.) 13 Pkgs. of consulting physician's choice.

Scissors shall be capable of cutting 2 layers of 15 oz. cotton cloth or its equivalent. The first-aid kits are maintained at the ten, sixteen, twenty-four or thirty-six package level. Where the eyes or body of any person may be exposed to injurious chemicals and/or materials, suitable facilities for quick drenching or flushing of the eyes and body are provided, within the work area, for immediate emergency use. A poster shall be fastened and maintained either on or in the cover of each first-aid kit and at or near all phones plainly stating the phone numbers of available doctors, hospitals, and ambulance services within the district of the work site.

First Aid Station

If a fixed establishment employs more than 200 employees at one central location, First-aid stations shall be located as close as practicable to the highest concentration of personnel. First-aid stations shall be well marked and available to personnel during all working hours. One person holding a valid first-aid certificate shall be responsible for the proper use and maintenance of the first-aid station. First-aid stations shall be equipped with a minimum of two first-aid kits, the size of which shall be dependent upon the number of personnel normally employed at the work site. One first-aid kit may be a permanent wall-mounted kit, but in all cases the station shall be equipped with at least one portable first-aid kit. When required by the circumstances, the station shall be equipped with two wool blankets and a stretcher in addition to first-aid kits. A roster, denoting the telephone numbers and addresses of doctors, hospitals and ambulance services available to the work site, shall be posted at each first-aid station.

Chapter 3 Chemical Safety

Introduction

The objective of this chapter is to provide guidance to all Singleton Tower, LLC employees and participating guests who use hazardous materials so that they may perform their work safely. Singleton Tower, LLC does not currently use or store hazardous chemicals; however, if the use of such hazardous chemicals is necessary in future Company projects, the following guidelines may then be implemented to deal with these substances. Many of these materials are specifically explosive, corrosive, flammable, or toxic; they may have properties that combine these hazards. Many chemicals are relatively non-hazardous by themselves but become dangerous when they interact with other substances, either in planned experiments or by accidental contact. To avoid injury and/or property damage, persons who handle chemicals in any area of the Company must understand the hazardous properties of the chemicals with which they will be working. Before using a specific chemical, safe handling methods must always be reviewed. Supervisors are responsible for ensuring that the equipment needed to work safely with chemicals is provided. The cost of this equipment is borne by the Company.

Hazcom Plan

On May 25, 1986 the Occupational Safety and Health Administration (OSHA) placed in effect the requirements of a new standard called Hazard Communication (29 CFR 1910.1200). This standard establishes requirements to ensure that chemical hazards in the workplace are identified and that this information, along with information on protective measures, is transmitted to all affected employees. This section describes how Singleton Tower, LLC employees are informed of the potential chemical hazards in their work area so they can avoid harmful exposures and safeguard their health. Components of this program include labeling, preparing a material safety data sheet (MSDS), and training. With regard to MSDS, Singleton Tower, LLC has limited coverage under the OSHA Hazard Communication Standard. The Company is required to maintain only those sheets that are received with incoming shipments for the following reasons: the Company commonly uses small quantities of many different hazardous materials for short periods of time; that the hazards change, often unpredictably; many materials are of unknown composition and most workers are highly trained. Responsibilities of Supervisors/Management Identify hazards for respective work areas. Ensure hazards are properly labeled. Obtain/maintain copies of material safety data sheets, as required, of each hazardous material used in the work area and make them accessible to employees during each work shift. Have the written Hazard Communication Program available to all employees. Provide hazard-specific training for employees. Identify hazardous materials in the hazard review section of the Singleton Tower, LLC purchase requisition form. Employees must: Attend safety training meetings. Perform operations in safe manner. Notify management immediately of any safety hazards or injuries. When ordering materials, identify hazardous chemicals in the hazard review section of the Singleton Tower, LLC purchase requisition form. The Responsible Safety Officer must: Develop a written Hazard Communication Program. Maintain a central file of material safety data sheets. Review and update Singleton Tower, LLC stock safety labels. Provide generic training programs. Assist supervisors in developing hazard-specific training programs. Oversee the Hazard Communication Standard written policy and implementation plans. Alert on-site contractors to hazardous materials in work areas. Alert on-site contractors that they must provide to their employees information on hazardous materials they bring to the work site. The number of hazardous chemicals and the number of reactions between them is so large that prior knowledge of all potential hazards cannot be assumed. Therefore, when the chemical properties of a material are not fully known, it should be assumed hazardous and used in as small quantities as possible to minimize exposure and thus reduce the magnitude of unexpected events. The following general safety precautions should be observed when working with chemicals: Keep the work area clean and orderly. Use the necessary safety equipment. Carefully label every container with

the identity of its contents and appropriate hazard warnings. Store incompatible chemicals in separate areas. Substitute less toxic materials whenever possible. Limit the volume of volatile or flammable material to the minimum needed for short operation periods. Provide means of containing the material if equipment or containers should break or spill their contents. Follow the requirements of this manual, if systems that can generate pressure or are operated under pressure are involved. Provide a back-up method of shutting off power to a heat source if any hazard is involved. Obtain and read the Material Safety Data Sheets.

Task Evaluation

Each task that requires the use of chemicals must be evaluated to determine the potential hazards associated with the work. This hazard evaluation must include the chemical or combination of chemicals that will be used in the work, as well as other materials that will be used near the work. If a malfunction during the operation has the potential to cause serious injury or property damage, an Operational Safety Procedure (OSP) must be prepared and followed. Operations must be planned to minimize the generation of hazardous wastes. Additionally, unused chemicals should be recycled.

Supervisor Responsibility

Supervisors are responsible for establishing safe procedures and for ensuring that the protective equipment needed to work with the chemicals is available. Supervisors must instruct their workers about possible hazards, safety precautions that must be observed, possible consequences of an accident, and procedures to follow if an accident does occur. The supervisor is required to enforce the proper use of protective equipment and the established safety practices. It is the responsibility of employees and all who use Singleton Tower, LLC facilities to understand the properties of the chemicals with which they will work and to follow all precautions that apply to each specific task. When faced with an unexpected threat of malfunction, injury, or damage, employees are expected to choose a course of action that provides the most protection to themselves and to others in the area. Every employee is expected to report to the supervisor any unsafe condition seen in the area that would not permit him/her to work safely. The Responsible Safety Officer assists employees and supervisors to work safely by providing information on the hazardous properties of materials, recommending methods for controlling the hazards of specific operations, and by monitoring the work environment. Supervisors must instruct their personnel about the potential hazards involved in the work, proper safety precautions to follow, and emergency procedures to use if an accident should occur. To supplement the supervisor's training, the Responsible Safety Officer will conduct training courses and materials on selected topics. In addition, material safety data sheets and safety information, including hazards, health effects, potential routes of exposure, proper handling precautions, and emergency procedures on specific chemicals, are available through the Responsible Safety Officer's office.

Effects on Reproduction

Both men and women may be exposed to hazardous agents that can cause infertility or result in genetic damage that is passed on to offspring. These agents include ionizing radiation, alcohol, cigarette smoke, pharmaceuticals, and some of the thousands of different chemicals that are used in the home or workplace. Although many of these have been tested to determine whether they cause acute (immediate) effects on the body, few have been studied to see if they cause cancer (carcinogens), birth defects (teratogens), or genetic defects (mutagens). Even fewer have been studied to see if they can cause infertility, menstrual disorders, or other disorders relating to reproduction. The primary path for hazardous substances to reach an unborn child is through the placenta. Scientists now believe that most chemical substances or drugs can cross this barrier with varying degrees of ease and enter the system of the developing fetus. Thus, many chemicals and drugs that enter a pregnant woman's body (through breathing, swallowing, absorption through the skin, etc.) will eventually enter the mother's blood circulation and find their way into the unborn child. In general, the important questions of exactly how much of the toxic substance that enters the mother's body will reach the fetus or what concentration the fetus can tolerate without harmful effects are not yet answered. The fetus may be most vulnerable in the early weeks of pregnancy, but it is also at risk later in pregnancy. In light of the potential harm of workplace exposures to both a pregnant woman and her developing fetus, it is very important and required by Singleton Tower, LLC policy for the

woman to inform the Responsible Safety Officer of her pregnancy immediately.

Airborne Contaminants

Exposures by inhalation of airborne contaminants (gases, vapors, fumes, dusts, and mists) must not exceed the levels listed in the latest edition of Threshold Limit Values of Airborne Contaminants (TLV) published by the American Conference of Governmental Industrial Hygienists. These TLV levels refer to airborne concentrations of substances and represent conditions under which it is believed that workers may be repeatedly exposed without adverse effect. In all cases of potentially harmful exposure, feasible engineering or administrative controls must first be established. In cases where respiratory protective equipment, alone or with other control measures, is required to protect the employee, the protective equipment must be approved by the Responsible Safety Officer, for each specific use.

Safety Equipment

Eyewash fountains are required if the substance in use presents an eye hazard. The eyewash fountain must provide a soft stream or spray of aerated water. In areas where a corrosive chemical or rapid fire hazard exists, safety showers must be provided for immediate first aid treatment of chemical splashes and for extinguishing clothing fires. The shower must be capable of drenching the victim immediately in the event of an emergency. Eyewash fountains and safety showers should be located close to each other so that, if necessary, the eyes can be washed while the body is showered. Access to these facilities must always remain open. In case of accident, flush the affected part for at least 15 minutes. Report the accident to the Responsible Safety Officer immediately. A special first aid treatment kit for fluorine and hydrofluoric acid burns is prepared by the Medical Services Department. The kit is obtained by contacting the Responsible Safety Officer. Safety shields must be used for protection against possible explosions or splash hazards. Company equipment must be shielded on all sides so that there is no line-of- sight exposure of personnel. The sash on a chemical fume hood is a readily available partial shield. However, a portable shield must also be used, particularly with hoods that have vertical-rising sashes rather than horizontal- sliding sashes.

Labels

All containers (including glassware, safety cans, plastic squeeze bottles) must have labels that identify their chemical contents. Labels should also contain information on the hazards associated with the use of the chemical. Precautionary labels are available from Singleton Tower, LLC stock room for most of the common chemicals.

Chemical Storage

The separation of chemicals (solids or liquids) during storage is necessary to reduce the possibility of unwanted chemical reactions caused by accidental mixing. Explosives such as picric acid should be stored separately outdoors. Use either distance or barriers (e.g., trays) to isolate chemicals into the following groups: Flammable liquids (e.g., acetone, benzene, ethers, alcohols). Place in approved fire lockers. Other liquids (e.g., chloroform, trichloroethane). Acids (e.g., nitric, sulfuric, hydrochloric, perchloric). * Treat acetic acid as a flammable liquid. Bases (e.g., sodium hydroxide, ammonium hydroxide). Lips, strips, or bars should be installed across the width of reagent shelves to restrain the chemicals in case of earthquake. Chemicals must not be stored in the same refrigerator used for food storage. Refrigerators used for storing chemicals must be appropriately identified by placing a label on the door (labels may be obtained from a Responsible Safety Officer).

Emergencies

In case of an emergency, consider any of the following actions if appropriate: Evacuate people from the area. Isolate the area. If the material is flammable, turn off ignition and heat sources. Call the Fire Department or 911 for assistance. Wear appropriate personal protective equipment. Pour Sorb-all or appropriate neutralizing agent on spill. Clean up; place waste in plastic bags for disposal. Chemical spill cleanup materials are available from stores as listed below: Flammable solvent spill kit Flammable solvent absorbent Acid spill kit Acid spill absorbent Caustic (base) spill kit Caustic (base) absorbent Safety equipment kit (contains scoops, sponge, safety glasses, disposal bags, etc.) Cabinet to hold kits

Disposal of Chemicals

All Singleton Tower, LLC employees, participating guests, and visitors using

hazardous chemicals are responsible for disposing of these chemicals safely. Federal and state regulations mandate strict disposal procedures for chemicals. To comply with these regulations all persons using Company facilities must observe these procedures. Routine Disposal of Chemicals In general the disposal of hazardous chemicals to the sanitary sewer is not permitted. The Responsible Safety Officer will advise on the proper disposal of chemical wastes. In using chemical waste storage containers, certain procedures must be observed, as listed below:

* Incompatible chemicals must not be mixed in the same container (e.g., acids should not be mixed with bases; organic liquids should not be mixed with strong oxidizing agents).
* Waste oils must be collected in 55-gallon drums.
* Disposal solids, and explosive materials must be stored in separate containers. The following requirements must be met as a condition for pickup and disposal of chemicals by the Responsible Safety Officer:
* Chemicals must be separated into compatible groups.
* Leaking containers of any sort will not be accepted.
* Dry materials (gloves, wipes, pipettes, etc.) must be securely contained in plastic bags and over packed in a cardboard box. Packages that are wet or have sharp protruding objects will not be accepted for pick up.
* Unknown chemicals will require special handling.
* The responsible department must make every effort to identify the material that is to be disposed of. If all the user's attempts to identify the waste chemicals have failed, the Responsible Safety Officer will accept the waste and analyze the material. For more information call the Responsible Safety Officer.
* Each breakable container must be properly boxed. Place all bottles in plastic bags, then place in a sturdy container and use an absorbent cushioning material that is compatible with the chemicals.
* Each primary container must be labeled with content, amount, physical state, and the percentage breakdown of a mixture. * Each box must have a complete list of contents or description written on an official Responsible Safety Officer hazardous materials packing list. Blank packing lists are available from the Responsible Safety Officer.
* For safety purposes, boxes must be of a size and weight so that one person can handle them. Boxes that exceed 45 pounds or 18 inches on a side cannot be safely handled by one person and will not be acceptable for pick up. General Housekeeping Rules:
* Maintain the smallest possible inventory of chemicals to meet your immediate needs.
* Periodically review your stock of chemicals on hand.
* Ensure that storage areas, or equipment containing large quantities of chemicals, are secure from accidental spills.
* Rinse emptied bottles that contain acids or inflammable solvents before disposal.
* Recycle unused laboratory chemicals wherever possible.
* DO NOT:

Place hazardous chemicals in salvage or garbage receptacles. Pour chemicals onto the ground. Dispose of chemicals through the storm drain system. Dispose of highly toxic, malodorous, or lachrymatory chemicals down sinks or sewer drains.

Chapter 4 Confined Spaces

Definitions

A confined space is defined as any structure that must be entered and that has or may contain dangerous concentrations of hazardous gases or vapors or an oxygen deficient atmosphere. Entry to these spaces must be rigorously controlled to prevent serious injury or death.

Hazardous Conditions

Hazardous conditions include, but are not limited, to the following: An atmosphere containing less than 19.5% oxygen (normal air contains 20.9% oxygen). This is usually the result of oxygen displacement by inert gases such as nitrogen, argon, helium, or sulfur hexafluoride. Flammable gases and vapors (e.g., methane, ethane, propane, gasoline, methyl-ethyl ketone, alcohol). Toxic gases and vapors (e.g., hydrogen sulfide, nitrogen dioxide, 1,1,1 trichloroethane, perchloroethane, methylene chloride).

Hazard Prevention

The primary objective is to prevent oxygen deficiency or other hazardous condition. This must be accomplished by accepted engineering control measures, such as general and local ventilation and substitution of materials. Only when such controls are not possible should respiratory protection be used. Written operating procedures governing the identification, testing, and entry into a confined space with a potential for oxygen deficiency must be established by the operating personnel and approved by the Responsible Safety Officer. Monitoring devices, audible alarms, warning lights, and instructional signs should be installed where there is a potentially oxygen-deficient atmosphere. These installations must be approved by the Responsible Safety Officer. Before entering a confined space, the steps below must be followed: An entry permit must be issued to the worker by the responsible supervisor and reviewed by the Responsible Safety Officer. Air quality must be tested to determine the level of oxygen and toxic or flammable air contaminants. Air purging and ventilation must be provided whenever possible. The confined space must be isolated from supply lines capable of creating hazardous conditions. Lock-out procedures must be used to secure electrical systems, pressure systems, piping, machinery, or moving equipment. If a person must enter a confined space containing hazardous gases, the procedures below must be followed: Protective equipment must be worn, including air supply respirator plus harness and lifeline. At least one person must be stationed outside the confined space, with suitable respirator. Communication with personnel in the confined space must always be maintained.

Chapter 5 Electrical Safety

Policy It is the policy of Singleton Tower, LLC to take every reasonable precaution in the performance of work to protect the health and safety of employees and the public and to minimize the probability of damage to property. The electrical safety requirements contained in this chapter are regulations set forth by Singleton Tower, LLC.

Employee Responsibility All Singleton Tower, LLC personnel are responsible for all aspects of safety within their own groups. The Responsible Safety Officer is responsible for providing information, instruction, and assistance, as appropriate, concerning Singleton Tower, LLC electrical safety requirements and procedures. Individual employees are responsible for their own and their co-workers' safety. This means: Become acquainted with all potential hazards in the area in which they work. Learn and follow the appropriate standards, procedures, and hazard-control methods. Never undertake a potentially hazardous operation without consulting with appropriate supervision. Stop any operation you believe to be hazardous. Notify a supervisor of any condition or behavior that poses a potential hazard. Wear and use appropriate protective equipment. Immediately report any occupational injury or illness to the Responsible Safety Officer, any on site Medical Services Department and the appropriate supervisor. Each employee acting in a supervisory capacity has specific safety responsibilities. These include:
Developing an attitude and awareness of safety in the people supervised and seeing that individual safety responsibilities are fully carried out.
Maintaining a safe work environment and taking corrective action on any potentially hazardous operation or condition.
Ensuring that the personnel he/she directs are knowledgeable and trained in the tasks they are asked to perform.
Ensuring that safe conditions prevail in the area and that everyone is properly informed of the area's safety regulations and procedures.
Ensuring that contract personnel are properly protected by means of instructions, signs, barriers, or other appropriate resources.
Ensuring that no employee assigned to potentially hazardous work appears to be fatigued, ill, emotionally disturbed, or under the influence of alcohol or drugs (prescription, over the county medicinal or otherwise).
Management at every level has the responsibility for maintaining the work environment at a minimal level of risk throughout all areas of control. Each manager: Is responsible for being aware of all potentially hazardous activities within the area of responsibility. May assign responsibility or delegate authority for performance of any function, but - Remains accountable to higher management for any oversight or error that leads to injury, illness, or damage to property.

Procedures It is the policy of Singleton Tower, LLC to follow the fundamental principles of safety, which are described below. A clear understanding of these principles will improve the safety of working with or around electrical equipment.

Practice proper housekeeping and cleanliness: Poor housekeeping is a major factor in many accidents. A cluttered area is likely to be both unsafe and inefficient. Every employee is responsible for keeping a clean area and every supervisor is responsible for ensuring that his or her areas of responsibility remain clean. Identify hazards and anticipate problems: Think through what might go wrong and what the consequences would be. Do not hesitate to discuss any situation or question with your supervisor and coworkers.

Resist "hurry-up" pressure: Program pressures should not cause you to bypass thoughtful consideration and planned procedures.

Design for safety: Consider safety to be an integral part of the design process. Protective devices, warning signs, and administrative procedures are supplements to good design but can never fully compensate for its absence. Completed

designs should include provisions for safe maintenance.

Maintain for safety: Good maintenance is essential to safe operations. Maintenance procedures and schedules for servicing and maintaining equipment and facilities, including documentation of repairs, removals, replacements, and disposals, should be established.

Document your work: An up-to-date set of documentation adequate for operation, maintenance, testing, and safety should be available to anyone working on potentially hazardous equipment. Keep drawings and prints up to date. Dispose of obsolete drawings and be certain that active file drawings have the latest corrections. Have designs reviewed: All systems and modifications to systems performing a safety function or controlling a potentially hazardous operation must be reviewed and approved at the level of project engineer or above.

Have designs and operations verified: All systems performing safety functions or controlling a potentially hazardous operation must be periodically validated by actual test procedures at least once a year, and both the procedures and actual tests must be documented.

Test equipment safety: Tests should be made when the electrical equipment is de-energized, or, at most, energized with reduced hazard. Know emergency procedures: All persons working in areas of high hazard (with high-voltage power supplies, capacitor banks, etc.) must be trained in emergency response procedures, including cardiopulmonary resuscitation (CPR) certification.

Working with Energized Equipment

This section contains safety requirements that must be met in constructing electrical equipment and in working on energized electrical equipment. Special emphasis is placed on problems associated with personnel working on hazardous electrical equipment in an energized condition. Such work is permissible, but only after extensive effort to perform the necessary tasks with the equipment in a securely de-energized condition has proven unsuccessful, or if the equipment is so enclosed and protected that contact with hazardous voltages is essentially impossible. Definitions: The following definitions are used in this discussion of electrical safety.

- Authorized Person: An individual recognized by management as having the responsibility for and expertise to perform electrical procedures in the course of normal duties. Such individuals are normally members of electronic or electrical groups.
- Backup Protection: A secondary, redundant, protective system provided to de-energize a device, system, or facility to permit safe phy Companion: A co-worker who is cognizant of potential danger and occasionally checks the other worker.
- Electrical Hazard: A potential source of personnel injury involving, either directly or indirectly, the use of electricity.
- Direct Electrical Hazard: A potential source of personnel injury resulting from the flow of electrical energy through a person (electrical shocks and burns).
- Indirect Electrical Hazard: A potential source of personnel injury resulting from electrical energy that is transformed into other forms of energy (e.g., radiant energy, such as light, heat, or energetic particles; magnetic fields; chemical reactions, such as fire, explosions, the production of noxious gases and compounds; and involuntary muscular reactions).
- First Line Protection: The primary protective system and/or operational procedure provided to prevent physical contact with energized equipment.
- General Supervision: The condition that exists when an individual works under a supervisor's direction but not necessarily in the continuous presence of the supervisor.
- Grounding Point: The most direct connection to the source of a potential electrical hazard such as the terminals of a capacitor. Such a point must be indicated by a yellow circular marker.
- Grounds, Electrical: Any designated point with adequate capacity to carry any potential currents to earth. Designated points may be building columns or specially designed ground-network cabling, rack, or chassis ground. Cold water pipes, wire ways, and conduits must not be considered electrical grounds.

- Grounds, Massive: Large areas of metal, concrete, or wet ground that make electrical isolation difficult or impossible.
- Implied Approval: Approval is implied when a supervisor, knowing the qualifications of an individual, assigns that individual a task, or responsibility for, a device, system, or project.
- Qualified Person: An individual recognized by management as having sufficient understanding of a device, system, or facility to be able to positively control any hazards it may present.
- Must, Should, and May: Must indicates a mandatory requirement. “Should” indicates a recommended action. “May” indicates an optional or permissive action, not a requirement or recommendation.
- Safety Watch: An individual whose sole task is to observe the operator and to quickly de-energize the equipment, using a crash button or circuit breaker control in case of an emergency, and to alert emergency personnel. This person should have basic CPR training.

Type of Hazards

The degree of hazard associated with electrical shock is a function of the duration, magnitude, and frequency of the current passed by the portion of the body incorporated in the circuit. The current that can flow through the human body with contacts at the extremities, such as between the hand or head and one or both feet, depends largely on the voltage. Body circuit resistance, even with liquid contacts (barring broken skin) will probably be not less than 500 ohms. The current flow at this resistance at 120 volts is 240 milliamperes. Recognition of the hazards associated with various types of electrical equipment is of paramount importance in developing and applying safety guidelines for working on energized equipment. Three classes (in order of increasing severity) of electrical hazards have evolved.

Class A Hazard

Class A electrical hazard exists when all the following conditions prevail: The primary AC potential does not exceed 130 volts rms. The available primary AC current is limited to 30 amperes rms. The stored energy available in a capacitor or inductor is less than 5 joules (J=CV2/2=LI2/2). The DC or secondary AC potentials are less than 50 volts line-to-line and/or to ground or the DC or secondary AC power is 150 volt-amperes (V-A) or less. Although the voltages and currents may be considered nominal, a "Class A" electrical hazard is potentially lethal. This class is particularly dangerous because of everyday familiarity with such sources, an assumed ability to cope with them, and their common occurrence in less guarded exposures.

Class B Hazard

A Class B electrical hazard has the same conditions as a Class A hazard except that the primary AC potential is greater than 130 volts rms, but does not exceed 300 volts rms.

Class C Hazard

Class C electrical hazard classifications prevail for all situations when one or more of the limitations set in Class B is exceeded.

Employee Attitude

The attitudes and habits of personnel and the precautions they routinely take when working on energized equipment are extremely important. There are three modes of working on electrical equipment.

Mode 1: Turn Off the Power

All operations are to be conducted with the equipment in a positively de-energized state. All external sources of electrical energy must be disconnected by some positive action (e.g., locked-out breaker) and with all internal energy sources rendered safe. "Mode 1" is a minimum hazard situation.

Mode 2: Latent Danger

All manipulative operations (such as making connections or alterations to or near normally energized components) are to be conducted with the equipment in the positively de-energized state. Measurements and observations of equipment functions may then be conducted with the equipment energized and with

normal protective barriers removed. "Mode 2" is a moderate-to-severe hazard situation, depending on the operating voltages and energy capabilities of the equipment.

Mode 3: Hot Wiring

"Mode 3" exists when manipulative, measurement, and observational operations are to be conducted with the equipment fully energized and with the normal protective barriers removed. "Mode 3" is a severe hazard situation that should be permitted only when fully justified and should be conducted under the closest supervision and control. One knowledgeable person should be involved in addition to the worker(s). Written permission may be required. Work on Class B or Class C energized circuits must only be done when it is absolutely necessary.

Safety Glasses

Either safety glasses or a face shield must be worn when working on electrical equipment.

Personal Protective Devices

For work on any energized circuitry with a Class B or Class C hazard, the use of personal protective devices (e.g., face shields, blast jackets, gloves, and insulated floor mats) is encouraged, even if not required.

Elevated Locations

Any person working on electrical equipment on a crane or other elevated location must take necessary precautions to prevent a fall from reaction to electrical shock or other causes. A second person, knowledgeable as a safety watch, must assume the best possible position to assist the worker in case of an accident.

Chain of Command

The supervisory chain must be identified for normal operation and development, servicing, or testing of hazardous equipment. An up-to-date set of instructions for operation, maintenance, testing, and safety should be provided and made readily available to anyone working on hazardous equipment. As many tests as practicable should be made on any type of electrical equipment in the unenergized condition, or at most, energized with reduced hazard. All covering, clothing, and jewelry that might cause hazardous involvement must be removed. Adequate and workable lock-out/tag-out procedures must be employed. A person in a hazardous position who appears to be fatigued, ill, emotionally disturbed, or under the influence of alcohol and/or drugs (medicinal, or otherwise) must be replaced by a competent backup person, or the hazardous work must be terminated. Supervisors and workers must be encouraged to make the conservative choice when they are in doubt about a situation regarding safety. Training sessions and drills must be conducted periodically to help prevent accidents and to train personnel to cope with any accidents that may occur. CPR instruction must be included. An emergency-OFF switch, clearly identified and within easy reach of all high-hazard equipment, should be provided. Also, this switch may be used to initiate a call for help. Resetting an Emergency-OFF switch must not be automatic but must require an easily understandable overt act. Automatic safety interlocks must be provided for all access to high-hazard equipment. Any bypass of such an interlock should have an automatic reset, display conspicuously the condition of the interlocks, and ensure that barriers cannot be closed without enabling the interlock. All equipment should have convenient, comfortable, and dry access. Communication equipment (e.g., fire alarm box, telephone) should be provided near any hazardous equipment. Its location should be clearly marked to ensure that the person requesting assistance can direct the people responding to a call for help to the emergency site quickly. Any component that in its common use is non- hazardous, but in its actual use may be hazardous, must be distinctively colored and/or labeled. (An example might be a copper pipe carrying high voltage or high current.) Periodic tests of interlocks to ensure operability must be performed and documented at least yearly.

Protective Systems

Equipment must be designed and constructed to provide personnel protection. First-line and backup safeguards should be provided to prevent personnel access to energized circuits. Periodic tests must be established

to verify that these protective systems are operative.

Safety Practices Additional safety practices are described below:

- Cable Clamping: A suitable mechanical-strain-relief device such as a cord grip, cable clamp, or plug must be used for any wire or cable penetrating an enclosure where external movement or force can exert stress on the internal connection. Grommets, adlets, or similar devices must not be used as strain relief.
- Emergency Lighting: There must be an emergency lighting system that activates when normal power fails in Class C conditions.
- Flammable and Toxic Material Control: The use of flammable or toxic material must be kept to a minimum. When components with such fluids are used, a catch basin or other approved method must be provided to prevent the spread of these materials should the normal component case fail.
- Isolation: All sources of dangerous voltage and current must be isolated by covers and enclosures. Access to lethal circuits must be either via screw-on panels, each containing no less than four screws or bolts, or by interlocked doors. The frame or chassis of the enclosure must be connected to a good electrical ground with a conductor capable of handling any potential fault current.
- Lighting: Adequate lighting must be provided for easy visual inspection.
- Overload Protection: Overload protection and well marked disconnects must be provided. Local "off" controls must be provided on remote-controlled equipment. All disconnects and breakers should be clearly labeled as to which loads they control.
- Power: All ac and dc power cabling to equipment not having a separate external ground but having wire-to-wire or wire-to-ground voltage of 50 volts or more must carry a ground conductor unless cabling is inside an interlocked enclosure, rack, grounded wire way, or conduit, or feeds a commercial double-insulated or UL-approved device. This requirement will ensure that loads such as portable test equipment, temporary or experimental, is grounded. UL-approved devices such as coffee pots, timers, etc., used per the manufacturer's original intent are permissible.
- Rating: All conductors, switches, resistors, etc., should be operated within their design capabilities. Pulsed equipment must not exceed either the average, the rms, or the peak rating of components. The equipment should be derated as necessary for the environment and the application of the components.
- Safety Grounding : Automatic discharge devices must be used on equipment with stored energy of 5 joules or more. Suitable and visible manual grounding devices must also be provided to short-to-ground all dangerous equipment while work is being performed.

Safety Practices The following checklist must be used as a guide for circuits operating at 130 volts or more or storing more than 5 joules. An enclosure may be a room, a barricaded area, or an equipment cabinet.

- Access: Easily opened doors, panels, etc., must be interlocked so that the act of opening de-energizes the circuit. Automatic discharge of stored-energy devices must be provided. Doors should be key-locked, with the same required key being also used for the locks in the control-circuit-interlock chain. This key must be removable from the door only when the door is closed and locked.
- Heat: Heat-generating components, such as resistors, must be mounted so that heat is safely dissipated and does not affect adjacent components.
- Isolation: The enclosure must physically prevent contact with live circuits. The enclosure can be constructed of conductive or non-conductive material. If conductive, the material must be electrically interconnected and connected to a good electrical ground. These connections must be adequate to carry all potential fault currents.
- Seismic Safety: All racks, cabinets, chassis, and auxiliary equipment must be secured against movement during earthquakes. Strength: Enclosures must be strong enough to contain flying debris due to component failure.
- Temporary Enclosure: Temporary enclosures (less than 6-month duration) not conforming to the normal

requirements must be considered Class C hazards.

- Ventilation: Ventilation must be adequate to prevent overheating of equipment and to purge toxic fumes produced by a fault.
- Visibility: Enclosures large enough to be occupied by personnel must allow exterior observation of equipment and personnel working inside the enclosure.
- Warning Indicators: When systems other than conventional facilities represent Class C hazards, the systems should be provided with one of the following two safety measures:
    - (1) A conspicuous visual indicator that is clearly visible from any point where a person might make hazardous contact or entry; and
    - (2) A clearly visible primary circuit breaker or "OFF" control button on the front of the enclosure.

Safety Practices

Because a wide range of power supplies exist, no one set of considerations can be applied to all cases. The following classification scheme may be helpful in assessing power-supply hazards.

- Power supplies of 50 volts or less with high current capability too often are not considered a shock hazard, although these voltages are capable of producing fatal shocks. Since they are not "high voltage," such power sources frequently are not treated with proper respect. In addition to the obvious shock and burn hazards, there is also the likelihood of injuries incurred in trying to get away from the source of a shock. Cuts or bruises, and even serious and sometimes fatal falls, have resulted from otherwise insignificant shocks.
- Power supplies of 300 volts or more, with lethal current capability, have the same hazards to an even greater degree. Because supplies in this category are considered Class C hazards, they must be treated accordingly.
- High-voltage supplies that do not have dangerous current capabilities are not serious shock or burn hazards in themselves and are therefore often treated in a casual manner. However, they are frequently used adjacent to lower-voltage lethal circuits, and a minor shock could cause a rebound into such a circuit. Also, an involuntary reaction to a minor shock could cause a serious fall (for example, from a ladder or from experimental apparatus).

The following are additional safety considerations for power supplies.

- Primary disconnect: A means of positively disconnecting the input must be provided. This disconnect must be clearly marked and located where the workmen can easily lock or tag it out while servicing the power supply. If provided with a lockout device, the key must not be removable unless the switch or breaker is in the "off" position.
- Overload Protection: Overload protection must be provided on the input and should be provided on the output.

Danger with Large Capacitors

This section describes the hazards associated with capacitors capable of storing more than 5 joules of energy. Capacitors may store hazardous energy even after the equipment has been de-energized and may build up a dangerous residual charge without an external source; "grounding" capacitors in series, for example, may transfer rather than discharge the stored energy. Another capacitor hazard exists when a capacitor is subjected to high currents that may cause heating and explosion. At one time, capacitors were called condensers and older capacitors may still bear this label in diagrams and notices. Capacitors may be used to store large amounts of energy. An internal failure of one capacitor in a bank frequently results in an explosion when all other capacitors in the bank discharge into the fault. Approximately 10 sup 4 joules is the threshold energy for explosive failure of metal cans. Because high-voltage cables have capacitance and thus can store energy, they should be treated as capacitors. The liquid dielectric in many capacitors, or its combustion products, may be toxic. Do not breathe the fumes from the oil in older capacitors. The following are safety practices for capacitors:

- Automatic Discharge: Permanently connected bleeder resistors should be used when practical. Capacitors in series should have separ personnel to gain access to the voltage terminals -- never longer than 5 minutes. In the case of Class C equipment with stored energy in excess of 5 joules, an automatic, mechanical discharging device must be provided that functions when normal access ports are opened. This device must be contained locally

within the protective barrier to ensure wiring integrity and should be in plain view of the person entering the protective barrier so that the individual can verify its proper functioning. Protection also must be provided against the hazard of the discharge itself.

- Safety Grounding: Fully visible, manual-grounding devices must be provided to render the capacitors safe while they are being worked on. Grounding points must be clearly marked, and caution must be used to prevent transferring charges to other capacitors.
- Ground Hooks: All ground hooks must:
    - Have conductors crimped and soldered.
    - Be connected such that impedance is less than 0.1 ohms to ground.
    - Have the cable conductor clearly visible through its insulation.
    - Have a cable conductor size of at least #2 extra flexible, or in special conditions a conductor capable of carrying any potential current.
    - Be in sufficient numbers to ground conveniently and adequately ALL designated points.
    - Be grounded and located at the normal entry way when stored, in such a manner to ensure that they are used.
    - In Class C equipment with stored energy in excess of 5 joules, a discharge point with an impedance capable of limiting the current to 500 amperes or less should be provided. This discharge point must be identified with a yellow circular marker with a red slash and must be labeled "HI Z PT" in large readable letters.
    - A properly installed grounding hook must first be connected to the current-limiting discharge point and then to a low-impedance discharge point (less than 0.1 ohm) that is identified by a yellow circular marker.
    - The grounding hooks must be left on all of these low impedance points during the time of safe access.
    - The low-impedance points must be provided, whether or not the HI-Z current- limiting points are needed.
    - Voltage indicators that are visible from all normal entry points should also be provided.
- Fusing: Capacitors used in parallel should be individually fused when possible to prevent the stored energy from dumping into a faulted capacitor. Care must be taken in placement of automatic-discharge safety devices with respect to fuses. If the discharge will flow through the fuses, a prominent warning sign must be placed at each entry indicating that each capacitor must be manually grounded before work can begin. Special knowledge is required for high-voltage and high-energy fusing.
- Unused Terminal Shorting: Terminals of all unused capacitors representing a Class C hazard or capable of storing 5 joules or more must be visibly shorted.

Danger with Large Magnets

This section describes inductors and magnets that can store more than 5 joules of energy or that operate at 130 volts or more. The following are some hazards peculiar to inductors and magnets:

* The ability of an inductor to release stored energy at a much higher voltage than that used to charge it.
* Stray magnetic fields that attract magnetic materials.
* Time-varying stray fields that induce eddy currents in conductive material thereby causing heating and mechanical stress.
* Time-varying magnetic fields that may induce unwanted voltages at inductor or magnet terminals.

The following are safety practices for inductive circuits:

- Automatic Discharge: Freewheeling diodes, varistors, thyrites, or other automatic shorting devices must be used to provide a current p Connections: Particular attention should be given to connections in the current path of inductive circuits. Poor connections may cause destructive arcing.
- Cooling: Many inductors and magnets are liquid cooled. The unit should be protected by thermal interlocks on the

outlet of each parallel coolant path, and a flow interlock should be included for each device.

- Eddy Currents: Units with pulsed or varying fields should have a minimum of eddy-current circuits. If large eddy-current circuits are unavoidable, they should be mechanically secure and able to safely dissipate any heat produced.
- Grounding: The frames and cores of magnets, transformers, and inductors should be grounded.
- Rotating Electrical Machinery: Beware of the hazard due to residual voltages that exists until rotating electrical equipment comes to a full stop.

Safety Design

Proper philosophy is vital to the safe design of most control applications. The following checklist should be used as a guide.

- Checkout: Interlock chains must be checked for proper operation after installation, after any modifications, and during periodic routine testing.
- Fail-safe design: All control circuits must be designed to be "fail-safe." Starting with a breaker or fuse, the circuit should go through all the interlocks in series to momentary on-off switches that energize and "seal in" a control relay. Any open circuit or short circuit will de-energize the control circuit and must be reset by overt act. Interlock
- Bypass Safeguards: A systematic procedure for temporarily bypassing interlocks must be established. Follow-up procedures should be included to ensure removal of the bypass as soon as possible. When many control- circuit points are available at one location, the bypassing should be made through the normally open contacts of relays provided for this purpose. In an emergency, these relays can be opened from a remote control area.
- Isolation: Control power must be isolated from higher power circuits by transformers, contactors, or other means. Control power should be not more than 120 volts, ac, or dc. All circuits should use the same phase or polarity so that no additive voltages (Class B or Class C hazard) are present between control circuits or in any interconnect system. Control-circuit currents should not exceed 5 amperes.
- Lock-out: A keyed switch should be used in interlock chains to provide positive control of circuit use. To ensure power removal before anyone enters the enclosure, this same key should also be used to gain access to the controlled equipment. Motor Control Circuits (Class B or Class C Hazards). All Class B or Class C motor circuits must have a positive disconnect within view of the motor or, if this is not practical, a disconnect that can be locked open by the person working on these motor circuits is acceptable. Overvoltage Protection: Control and instrumentation circuits used with high-voltage equipment must have provision for shorting fault-induced high voltages to ground. High-voltage fuses with a high-current, low-voltage spark gap downstream from the high-voltage source are recommended. This also applies to all circuits penetrating high-voltage enclosures.
- Voltage Divider Protection: The output of voltage dividers used with high voltages must be protected from overvoltage-to-ground within the high-voltage area by spark gaps, neon bulbs, or other appropriate means. Current Monitors: Currents should be measured with a shunt that has one side grounded or with current transformers that must be either loaded or shorted at all times.
- Instrument Accuracy: Instrumentation should be checked for function and calibration on a routine basis.

More than 300 Volts

To work on systems with voltages greater than 300 volts (CLASS B OR C HAZARD): Open the feeder breaker, roll out if possible, tag out, and lock if in enclosure. If work is on circuits of 600 V or more, positive grounding cables should be attached to all three phases. Tag should contain who, why, and when information, and it is of vital importance because a person's life may depend on it. "Vital" in this case means that the presence and status of the tag are inviolate, and the tag must not be altered or removed except by the person who attached it.

Less than 300 Volts

To work on systems with voltages less than 300 volts (CLASS A HAZARD): Turn-off and tag the feeder breaker. Tag is inviolate except on projects where established circuit checkout procedure allows a qualified person to remove it and energize circuit after checkout is complete.

Motor Generator Systems

For motor or generator work, primary feeder breaker must be opened, tagged, and locked out if possible. For generator-load work, motor-start permissive key must be removed by the person doing work and restored when work is complete.

High Voltage

To work on high voltage power supplies and enclosures use Class B or Class C hazard procedure specified in the safety requirements. Access should always be by a permissive key that interrupts input power when the key is removed from the control panel. Grounding of power supply output must occur either automatically when the key is removed from the control panel or manually before the access door can be opened.

High Current

To work on high current power supplies (normally for magnets), treat the system as a high voltage power supply, if energy storage is 5 joules or more when the system is off. If not, then requirements for working on a magnet are as follows: If power supply is equipped with Kirk (trademark) or equivalent interlock, turn key and remove. This locks the input breaker in "off" position until the key is reinserted and turned. If power supply is not equipped with a Kirk (trademark) or equivalent interlock, turn off and tag input circuit breaker.

Working on Power Supplies

The minimum requirements for working on any power supply is to turn the power off and properly tag feeder circuit breakers external to the power supply.

Electrical Lock-out/Tag-out Procedures

When you have to do maintenance work on a machine, take these four steps to protect yourself and your co-workers from injury:

1. De-energize the machine if possible. Positively disconnect the machine from the power source. If there is more than one source of power, then disconnect them all.
2. If possible, lock out all disconnect switches. You must be given a lock and a key for each disconnect before you begin working on the machine.
3. Tag all disconnect switches. Use the yellow or Red safety tags which state in large letters -- "Danger...Do Not Operate," or "Danger...Do Not Energize" and which give the name of the individual who locked out the equipment, date and time. The tag must also state "DO NOT REMOVE THIS TAG". (The person who placed the tag may remove it only after the machinery maintenance has been completed.)
4. Test the equipment to ensure it is de-energized before working on it. First, attempt to operate the equipment by turning it on normally. Next, check all electrical lines and exposed areas with test equipment or a "lamp". Finally, short to ground any exposed connections using insulated grounding sticks. This test must be done even if the electrical connection is physically broken, such as pulling out a plug, because of the chance of discharging components. A TAG OUT ONLY PROCEDURE MAY BE USED IF THE MACHINE CANNOT BE LOCKED OUT. IF THE MACHINE IS SUPPLIED ELECTRICAL POWER FROM A SINGLE SOURCE, WHICH IS UNDER THE EXCLUSIVE CONTROL OF A TRAINED AND QUALIFIED REPAIR PERSON AT ALL TIMES AND THERE ARE NOT ANY OTHER PERSONS IN THE REPAIR AREA WHO COULD BE HARMED BY THE ACCIDENTAL ENERGIZING OF THE MACHINERY, THEN TAG OUT MAY BE USED INSTEAD OF LOCK-OUT/TAG OUT. Be aware that many accidents occur at the moment of re-energizing. If the machinery is to be re-energized, all persons must be kept at a safe distance away from the machinery. The re-energization can be performed only by a person who either performed the lock-out/tag out, a person acting under the immediate and direct commands of the original lock-out/tag out person, or in the event of a shift change, or other unavailability of the original person, then the original shall, before leaving, appoint a surrogate original person and show him or her all steps taken to lock-out/tag out the equipment.

Chapter 6 Emergencies

Organization
Singleton Tower, LLC requires that during every emergency an organized effort be made to protect personnel from further injury and to minimize property damage. All of Singleton Tower, LLC's resources can be made available to respond to an emergency. Each supervisor must know what to do during an emergency in his or her area and must be certain that his or her employees understand their roles.

Building Emergency Plan
A specific emergency plan for each building or facility must be prepared under the direction of the Building Manager. A Building Manager and Deputy Manager must be appointed and oriented for each building or complex. Generally, the Building Manager is the person in charge of a building or facility. The Building Manager has specific responsibility for the preparation, updating, and implementation of the emergency plan for this area. This responsibility includes recommending personnel to attend indoctrination and training programs. Specifically, each plan must contain the following information and procedures as appropriate for each building:
* The names of the Building Manager, Deputy Manager, and Assistant Manager(s).
* A list of people with specific duties during an emergency and a description of their duties. For example, specific people should be assigned to supervise evacuation and to carry out a rapid search of the area (assuming this can be done safely).
*Floor plans showing evacuation routes, the location of shutoff switches and valves for the utility systems (water, gas, electricity), and the locations of emergency equipment and supplies (including medical).
*Indications on the floor plans of areas where specific hazards (i.e., toxic, flammable, and/or radioactive materials) exist.
*Location and description of special hazards or hazardous devices should be included in the text together with shutdown procedures if applicable.
* Designation of a primary assembly point for evacuees, well away from the building. An alternate site should also be designated in case the first choice cannot be used.
* Reentry procedures. No one should reenter an evacuated building or area without specific instructions from the Building Manager or other person in charge.
* Department Head and Supervisor responsibilities regarding emergency preparedness and action procedures.
* Emergency plans for facilities or equipment requiring an Operational Safety Procedure (OSP).

Operational Safety Procedures
OSP's for individual facilities or pieces of equipment must include emergency plans for the facilities or equipment.

Supervisors Responsibilities
During an emergency, the supervisor must:
*Ensure that those under his or her supervision are familiar with the plan for the building, particularly the recommended exit routes and how to report an emergency.
*Render assistance to the person in charge during an emergency, as required.
*Maintain familiarity with the shutdown procedures for all equipment used by those under his or her supervision.
*Know the location and use of all safety equipment on his or her floor.
*Keep employees from reentering an evacuated area until reentry is safe.

No Loitering Policy
Employees not involved in the emergency must stay away from the scene and follow the

instructions issued over the public address system or directly from the person in charge. The sounding of a fire bell means immediate evacuation by the nearest exit. Employees must not reenter an area that they have evacuated until notified that it is safe to return.

Employee Responsibilities

Employees, other than emergency-response groups, involved in any emergency greater than a minor incident are expected to act as follows:

*If there is threat of further injury or further exposure to hazardous material, remove all injured persons, if possible, and leave the immediate vicinity.

*If there is no threat of further injury or exposure, leave seriously injured personnel where they are.

*Report the emergency immediately by phone. State what happened, the specific location, whether anyone was injured, and your name and phone number.

*Proceed with first aid or attempt to control the incident only if you can do so safely and have been trained in first aid or the emergency response necessary to control the incident.

*Show the ranking emergency-response officer where the incident occurred, inform him or her of the hazards associated with the area, provide any other information that will help avoid injuries, and do as he or she requests.

Chapter 7 Building Management and Construction

Introduction

Singleton Tower, LLC's buildings and equipment must equal or exceed existing legal standards for safety, fire prevention, sanitation, architectural barriers, health protection, and resistance to seismic forces. Safeguards must provide built-in protection against injury to personnel or damage to property and include methods for limiting the consequences of accidents. Protection systems must permit the most effective work conditions consistent with effective safeguards. Since physical plant facilities are the responsibility of the Engineering Department, the following matters related to engineering and construction must be referred to the Engineering Department: New construction or alteration of buildings, building facilities, fixed equipment, outside utilities such as cooling towers, electrical substations, underground pipes, conduits, or vaults, roadways, parking lots, walkways, landscaping, sewers, and drainage systems. Plans under consideration that will affect any structure or physical plant facility because of the size of the project, loads, vibration, temperature requirements, humidity control, radiation background, or ventilation requirements, or any code-related feature of the facility.

General Requirements

The following general requirements apply to all buildings:

(1) Construction should be of non-combustible or fire-rated materials as much as possible.

(2) Building Manager must ensure that the floors of traffic corridors are unobstructed and meet code requirements.

All work areas should have the following:

(1) At least two unobstructed exits if total floor area is over 250 sq ft.

(2) A smooth wall finish and smooth, impermeable work surfaces. Automatic fire detection and suppression systems.

(3) Adequate ventilation.

Additional requirements for manufacturing, industrial or production areas are as follows:

(1) Safety enclosures or barriers for high energy systems.

(2) Warning signals and safety interlocks for high energy systems or equipment.

(3) Adequate grounding devices for electrical systems as required by the National Electric Code and this manual.

(4) Proper design of pressurized gas systems in accordance with this manual.

Additional requirements for chemical handling areas are as follows:

(1) Process and special ventilation in accordance with the ACGIH standards and recommendations.

(2) Safety storage arrangements for chemicals.

(3) Emergency eyewash and shower facilities.

Contractors

In addition to the full- and part-time employees on the Singleton Tower, LLC payroll, important work is performed by personnel through contract arrangements. These non-Singleton Tower, LLC persons are sometimes referred to as contract or subcontract personnel. Nevertheless, the safety obligations of subcontractor personnel are the same as those of the Singleton Tower, LLC employees. Those Singleton Tower, LLC supervisors assigned to direct work of contractor and/or subcontractor employees must instruct and otherwise provide safety equipment and conditions equivalent to those provided to payroll employees. This is to ensure that Singleton Tower, LLC property is protected from damage and that all employees, payroll or non-payroll, are protected from work injury and illness. Singleton Tower, LLC is required by law to make its facilities as safe as possible for the protection of the employees of its contractors and

subcontractors, as well as any other visitor.

Construction Safety

Construction safety is closely monitored by the various on-site construction supervisors, job site coordinators, superintendents, architects, engineers, government and private inspectors, contractor's and subcontractor's safety officials and Singleton Tower, LLC's Responsible Safety Officer, all of whom must work closely together. Each contractor and subcontractor must supply the name of its designated safety official for that job site to Singleton Tower, LLC's Responsible Safety Officer before being allowed to commence work on the site. In addition, the following definitions and procedures formalize the safety responsibilities and duties of all those persons involved with construction site management.

Construction Leadership

The following definitions describe personnel referred to in these procedures:

- Construction Inspector. The person assigned by Singleton Tower, LLC to monitor subcontractor activities for construction compliance with the subcontract specifications and drawings.
- Responsible Safety Officer. The person assigned to monitor construction safety.
- Architect/Engineer (A/E). The person assigned by Singleton Tower, LLC to ensure that a construction project is built according to contract documents and design intent may also be called Project Architect, Project Engineer, or Project Manager.
- Subcontractor. Firm responsible for actual construction and compliance with all safety regulations.

OSHA Regulations and Building Owner

Responsible Safety Officer has been given the responsibility by Singleton Tower, LLC and OSHA for monitoring the safety of construction site activities and enforcing all OSHA regulations. The extent of monitoring will vary depending upon the type of activity the subcontractor is engaged in. The Responsible Safety Officer role after visiting a construction site is to advise the Construction Inspector and the Architect/Engineer wherever the subcontractor is in violation of a safe practice or an unsafe condition exists. After notification by the Responsible Safety Officer, the Construction Inspector and the Architect/Engineer are responsible for notifying the Subcontractor to take corrective action. The responsibility for correction of the problems rests with the Subcontractor. The Responsible Safety Officer will follow up to ensure that corrective action is being taken or had been taken by the Subcontractor. A record will be maintained by the Responsible Safety Officer giving the date, discrepancies noted, notifications given, and actions taken by the Subcontractor.

Subcontractor Safety

The Responsible Safety Officer is responsible for monitoring the safety performance of the Subcontractor. He/she will usually coordinate visits with the Construction Inspector, or if the Construction Inspector is not available, will carry on the monitoring activities. The Subcontractor's safety performance must be logged by the Responsible Safety Officer, and if necessary referred in writing to the Construction Inspector and the Architect/Engineer for notification to the Subcontractor and subsequent action as appropriate by the Subcontractor.

Sub-Contractor Employees

Except when responding to an emergency, personnel entering a construction site must:

* Identify themselves to the Construction Inspector and/or Architect/Engineer upon arrival.
* State the purpose of their visit and the area to be visited.
* Obey the on-the-job instructions, wear appropriate protective equipment, and follow any special instructions given by the Construction Inspector.
* Communicate with the Subcontractor only through the Construction Inspector and the Architect/Engineer.
* Notify the Construction Inspector when their visit is terminated. The Responsible Safety Officer visits to construction

sites will normally be limited. Instructions and/or recommendations from the Responsible Safety Officer must be directed to the Subcontractor in the presence of the Construction Inspector. In cases of imminent threat to life safety or severe hazard of injury, the Responsible Safety Officer Inspector may contact the Subcontractor without the presence of the Construction Inspector. Operational problems relating to the safety will be coordinated by the Responsible Safety Officer and discussed directly with the Construction Inspector and/or with the Architect/Engineer. The Construction Inspector and the Architect/Engineer will notify the Subcontractor of the need to fulfill his responsibilities.

Subcontractors Project Safety Program

The Subcontractor must submit a project safety program for review and acceptance before any on-site activities. The Safety Program must be acceptable to the Responsible Safety Officer, with copies of the accepted program going to the Construction Inspector, the Architect/Engineer, and the Contract Administrator. The subcontractor must comply with all rules and the construction industry safety orders by OSHA.

Pre-Job Construction Conferences

The Construction Inspector must notify the Responsible Safety Officer of the subcontractor's on-site start date and discuss any unusual safety problems with the Responsible Safety Officer and the Architect/Engineer. In addition, the Responsible Safety Officer and the Architect/Engineer will discuss any unusual safety problems at a construction pre-start meeting with the Subcontractor.

Fire Inspections

Construction site fire safety inspections may be made at any time by any authorized representative. All discrepancies or problems observed must be in writing and addressed to the Construction Inspector and the Architect/Engineer.

Stop Work Orders

The Singleton Tower, LLC stop work procedure applies to all construction subcontractor activities. It must be used only where life-safety or hazard of severe injury situations exist, or where significant damage to equipment or property could occur if the operation continued. The Construction Inspector or Architect/Engineer of a construction project is responsible for directing the Subcontractor to stop an operation whenever he/she has reason to believe that continuing will lead to injury or damage to Singleton Tower, LLC or Subcontractor employees or property. The Responsible Safety Officer is authorized to request the Construction Inspector to have the Subcontractor stop any operation they believe will lead to injury of Singleton Tower, LLC or Subcontractor personnel or damage to Singleton Tower, LLC or Subcontractor property. All work stoppages must be in writing to the Subcontractor and must reference Safety and Health or the Subcontract's General Conditions, and, if known, the appropriate OSHA regulation. A safety memorandum must be issued by the Responsible Safety Officer after each instance of stopping work, with copies to the Construction Inspector, the Architect/Engineer, and the Contract Administrator. Work must not resume until authorized by Singleton Tower, LLC management. An example of a work stoppage situation would be having people working next to an upper-level edge not provided with edge barriers. A stop work notice would be issued and work would not resume until Singleton Tower, LLC management was satisfied that proper barriers were in place. When issuing a stop work order, only those areas of the construction project immediately involved in the hazardous situation are included in the order. Differences of opinion between the Responsible Safety Officer and the Construction Inspector or Architect/Engineer concerning a stop work order must be immediately referred to their supervisors or department heads. The Responsible Safety Officer's recommendations must be followed until the supervisors/department heads make a decision. In the absence of the Construction Inspector, the Responsible Safety Officer must direct the Subcontractor to stop an operation that the Responsible Safety Officer considers perilous to personnel or property. The Responsible Safety Officer must locate the Construction Inspector, the Architect/Engineer, or the department head and notify them of the action taken.

Serious Accidents On Site

In the event of a serious accident on a construction site, the Construction Inspector, Architect/Engineer, or Responsible Safety Officer will determine if all work is to be immediately stopped. If work is stopped, all workmen in the immediate area are to be assembled by the Subcontractor until the Responsible Safety

Officer has conducted an initial investigation, collected applicable information from witnesses, and determined whether work may resume. The person stopping work must initiate notification of Responsible Safety Officer and Singleton Tower, LLC's legal Counsel.

Excavation and Shoring

Job orders, purchase orders, and subcontracts for excavations that are 5 or more feet deep or are in unstable earth and in which people will work, must specify that shoring is required that is in compliance with 29 CFR 1926, Subpart P, Excavation, which is available from Engineering Department or the Responsible Safety Officer. If it is necessary to deviate from the requirements, a civil engineer registered by the State must submit detailed data to the Responsible Safety Officer for alternative effective shoring and sloping systems. These data shall include soil evaluations, slope stability, and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used. When sheet piling is to be used, full loading due to the ground water table must be assumed unless prevented by weep holes and drains or other means. Additional stringers, uprights, and bracing must be provided to allow for any necessary temporary removal of individual supports. Excavated material must be located at least 2 ft back from the edge of excavations of 5-ft or greater depth and 1 ft back from the edge for excavations less than 5-ft deep. Sloping. Instead of a shoring system, the sides or walls of an excavation may be sloped, if this provides equivalent protection. The degree of sloping is dependent on the type of soil and the depth of excavation. Sloping requirements are shown in 29 CFR 1926, Subpart P, Appendix B. Supervision. Excavation work must always be under the immediate supervision of someone with authority and qualifications to modify the shoring system or work methods as necessary to provide greater safety. A ladder projecting 36 in. above ground surface must be provided for access and exit. Travel distance to the ladder must not exceed 25 ft.

Chapter 8 Fire Safety

Introduction
Policy and planning for fire safety at Singleton Tower, LLC takes into account the special fire hazards for specific operating areas, the protection of high-value property, and the safety of employees. These ends are met by:
* Non-combustible or fire-rated materials and construction practices suitable to the assigned uses of buildings and facilities.
* Alarm systems and automatic extinguishing systems.
* Availability of suitable hand extinguishers and local hose lines for use before firefighters arrive.
* Access to professional fire departments, always staffed and trained in the control of emergencies that could occur at the Company. (The Fire Department makes the initial response to all requests for emergency aid received on the emergency telephone number, 911.)

This chapter covers the fire safety responsibilities of employees and supervisors and sets forth the fire safety rules and procedures.

Fire Department
The Community Fire Department is responsible for protecting people and property from fires, explosions, and other hazards through prevention and expeditious control of such events. In addition, the Fire Department provides first- response rescue and transportation services in medical emergencies. The Fire Department's inspection staff is responsible for ensuring company-wide compliance with fire safety and protection requirements and for reviewing all plans and procedures for compliance with these requirements; for inspecting and testing automatic fire protection and alarm systems and ensuring their maintenance and repair; for conducting fire safety and protection inspections; and for providing fire prevention recommendations. Other responsibilities include training employees in fire safety equipment, practices, and procedures. All these fire protection and response functions are performed in conformance with OSHA regulations, State law, Singleton Tower, LLC policies, and nationally recognized standards and guidelines for fire and life safety. The Fire Chief and the Fire Marshall have the authority to enforce applicable requirements of the Uniform Building Code; the Uniform Fire Code; National Fire Protection Association Codes (including the Life Safety Code), Standards, and Recommended Practices; and the fire protection provisions of OSHA Orders. All employees must immediately report fires, smoke, or potential fire hazards to the Fire Department (dial 911). All employees must conduct their operations in such a way as to minimize the possibility of fire. This means applying rules such as keeping combustibles separated from ignition sources, being careful about smoking, and avoiding needless accumulations of combustible materials. Supervisors are responsible for keeping their operating areas safe from fire. The Responsible Safety Officer and the Fire Department will provide guidance and construction criteria with respect to fire and life safety as well as inspections. The provision and maintenance of fire detection systems and both automatic and manual fire extinguishing equipment is the responsibility of the Responsible Safety Officer. But the supervisor, who best knows the day-to-day nature of his/her operations, is responsible for notifying the Responsible Safety Officer of operations that change the degree of fire risk and will therefore require a change in the planned fire protection provisions.

Supervisor Responsibilities
Supervisors must ensure that their personnel are properly instructed regarding potential fire hazards involved in their work and around their workplaces, the proper precautions to minimize fires, and the procedures in case of fire. The local Fire Department and the Responsible Safety Officer also offer formal courses and training materials on the following topics in fire prevention and response:
* Fire Safety
* Fire-Extinguisher Operation
* Self-Contained Breathing Apparatus

Class A Combustibles

Class A combustibles are common materials such as wood, paper, cloth, rubber, plastics, etc. Fires in any of these fuels can be extinguished with water as well as other agents specified for Class A fires. They are the most common fuels to be found in non-specialized operating areas of the workplace such as offices. Safe handling of Class A combustibles means:

* Disposing of waste daily.
* Keeping the work area clean and free of fuel paths, which can spread a fire, once started.
* Keeping combustibles away from accidental ignition sources such as hot plates, soldering irons, or other heat or spark-producing devices.
* Keeping all rubbish, trash, or other waste in metal or metal-lined receptacles with tight-fitting covers when in or adjacent to buildings. (Exception: wastebaskets of metal or of other material and design approved for such use, which are emptied
* Using safe ashtrays for disposal of smoking materials and making sure that the contents are extinguished and cold to the touch before emptying them into a safe receptacle.
* Planning the use of combustibles in any operation so that excessive amounts need not be stored.
* Storing paper stock in metal cabinets and rags in metal bins with automatically closing lids.
* Making frequent inspections and checks for noncompliance with these rules in order to catch fires in the potential stage.

Class B Combustibles

Class B combustibles are flammable and combustible liquids (including oils, greases, tars, oil-based paints, lacquers) and flammable gases. Flammable aerosols (spray cans) are treated here. Cryogenic and pressurized flammable gases are treated elsewhere in this manual. The use of water to extinguish Class B fires (by other than trained firefighters) can cause the burning liquid to spread carrying the fire with it. Flammable-liquid fires are usually best extinguished by excluding the air around the burning liquid. Generally, this is accomplished by using one of several approved types of fire-extinguishing agents, such as the following: Carbon dioxide ABC, multipurpose dry chemical Halon 1301 (used in built-in, total-flood systems), Halon 1211 (used in portable extinguishers). Fires involving flammable gases are usually controlled by eliminating the source of fuel, i.e., closing a valve. Technically, flammable and combustible liquids do not burn. However, under appropriate conditions, they generate sufficient quantities of vapors to form ignitable vapor-air mixtures. As a general rule, the lower the flash point of a liquid, the greater the fire and explosion hazard. It should be noted that many flammable and combustible liquids also pose health hazards. NOTE: The flash point of a liquid is the minimum temperature at which it gives off sufficient vapor to form an ignitable mixture with the air near the surface of the liquid or within the vessel used. It is the responsibility of the user to ensure that all Class B combustibles are properly identified, labeled, handled, and stored. If assistance is required, contact the Responsible Safety Officer. Safe handling of Class B combustibles means:

* Using only approved containers, tanks, equipment, and apparatus for the storage, handling, and use of Class B combustibles.
* Making sure that all containers are conspicuously and accurately labeled as to their contents.
* Dispensing liquids from tanks, drums, barrels, or similar containers only through approved pumps taking suction from the top or through approved self-closing valves or faucets.
* Storing, handling, and using Class B combustibles only in approved locations, where vapors cannot reach any source of ignition, including heating equipment, electrical equipment, oven flame, mechanical or electrical sparks, etc.
* Never cleaning with flammable liquids within a building except in a closed machine approved for the purpose.
* Never storing, handling, or using Class B combustibles in or near exists, stairways, or other areas normally used for egress.
* In rooms or buildings, storing flammable liquids in excess of 10 gallons in approved storage cabinets or special rooms approved for the purpose.
* Knowing the locations of the nearest portable fire extinguishers rated for Class B fires and how to use them.
* Never smoking, welding, cutting, grinding, using an open flame or unsafe electrical appliances or equipment, or

otherwise creating heat that could ignite vapors near any Class B combustibles.

Electrical Fires

There are many combustible materials, including electrical equipment, oxidizing chemicals, fast-reacting or explosive compounds, and flammable metals, which present specialized fire safety and extinguishing problems. Refer to other appropriate chapters of this manual for safe handling advice. If in doubt, request advice from the Responsible Safety Officer.

Welding and Other Permits

As part of the local Fire Department's program to control and reduce fire hazards, a permit system is in effect to cover welding, burning, or other operations with a high fire hazard. Typically, operations that require a permit are:

* Welding (arc, oxyacetylene, or heliarc)
* Soldering (which requires an open flame)
* Use of a torch (for cutting, bending, forming, etc.)
* Use of tar pots (for road work or roofing, etc.)
* Open fires for any purpose
* Spray painting
* To obtain additional information or to request a permit for these operations, call the Fire Department on its business line, not the emergency 911 number.

Portable Heaters

The use of these devices, whether privately or company owned, is allowed only where there is no chance of causing injury to personnel or of creating a fire hazard. This provision obviously requires common sense in safely locating such devices and ensuring that they do not operate when they are unattended. These devices may not be used in locations where:

* Flammable or explosive vapors or dusts may be present.
* Smoking, eating, or drinking are prohibited because toxic or radioactive materials may be present.
* The area has been designated as unsafe for such devices. The following practices should be carried out when operating portable heating appliances:
* Do not place the appliance on unstable or readily combustible materials.
* Maintain a clearance of at least 12 inches between the appliance and combustible materials.
* Ensure that the appliance is approved by either Underwriters Laboratories, Inc., or Factory Mutual Research Corporation.
* Connect the appliance directly to a proper electrical outlet using only the cord with which it was originally equipped.
* Do not use extension cords in lieu of permanent wiring.
* Do not operate appliances during off hours if they are unattended unless they are controlled by a timer installed by a Singleton Tower, LLC electrician. The timer will automatically de-energize the appliance during off hours and energize it not more than 30 minutes before the arrival of personnel. If 24 hour operation is desirable, the proposed operation and arrangement must be reviewed by the local Fire Department and a permit obtained. This permit must be posted near the operating appliance for the information of off-shift personnel who may be checking the area.

Fire Fighting Equipment

This section describes the fixed and portable equipment that may be provided in working areas for fire protection. The fixed equipment includes automatic sprinklers, detectors and alarms, fire doors, etc. The portable equipment consists of fire extinguishers and hoses to be operated by employees before the arrival of the local Fire Department.

Fire Detectors

Several types of automatic fire detectors may be used throughout Singleton Tower, LLC, according to particular needs and purposes. All of them will detect fire (by one of several means) and transmit an alarm. In the buildings equipped with evacuation alarm bells, the automatic detectors will activate those alarms, as will the manual pull

boxes. In some cases, automatic extinguishing systems will be activated by automatic detectors. The Fire Department always dispatches firefighters and apparatus to the scene of any automatically actuated alarm.

Sprinkler Systems

Buildings may be provided with automatic sprinkler systems. The sprinkler heads will contain a fusible element (most commonly fused at 212 degrees F) which, on melting, opens the head and starts a spray of water. The resulting flow of water in the piping will activate an alarm at the fire station, and firefighters will be dispatched. Automatic sprinkler heads can be damaged if they are subjected to mechanical abuse. A protective cage should be installed where such damage is possible. Heat inadvertently applied to the sprinkler head can also activate the sprinkler when no actual fire is present. Normal heat sources should therefore be kept away from sprinkler heads. To avoid decreasing the flow or spread of water or altering the spray pattern, do not allow material or furniture to be located too near the sprinkler head. Allow at least 18 inches of clearance around sprinkler heads. Sprinkler system control valves must be kept accessible for Fire Department use. Allow at least 3 feet of clearance (enough for a man to pass through easily) around such valves.

Alarm System

In some buildings, evacuation alarm bells may be automatically activated when fire is detected. They may also be activated manually at strategically located pull boxes. The emergency actions of personnel and the evacuation procedures for each building or operating area are usually set forth in the Operational Safety Procedures for each building and posted near the main entrance or fire exit or elevator. Never use the elevator in case of a fire.

Fire Doors

Automatic fire doors and dampers may be provided at strategic points to close and block the spread of smoke and fire when these are sensed by automatic detectors. Automatic fire doors must never be blocked or left in disrepair so that they cannot close and latch automatically as intended in the event of a fire. Self-closing fire doors are those doors designed and installed to close each time after being opened. They too must never be blocked, wedged, or tied open. If such doors must be kept open, the self-closers must be replaced with approved automatic smoke- activated release hold-open devices.

Fire Exits

Exit corridors must not be used for storage. The Life Safety Code, NFPA 101, requires that buildings designed for human occupancy must have continuous and unobstructed exits to permit prompt evacuation of the occupants and allow necessary access for responding emergency personnel. The intent of the Code is to keep exits free from obstructions and clear of combustible materials. Attention to housekeeping, therefore, is very important. "Temporary" storage of furniture, equipment, supplies, or anything else is not permitted in exit ways. Combustibles, including recyclable waste paper, are not permitted in exit ways. Metal lockers with ends and tops ferried to the walls and that do not interfere with minimum exit width requirements may be installed in exit corridors when approved by the Fire Department and the Responsible Safety Officer. The following requirements must be met for storage locker/cabinets:

* Cabinets will be permitted on one side of the corridor only.
* Cabinets must end at least 6 ft from the corridor exit door.
* Cabinet ends must be at least 12 in. from the edge of the doorway on the latch side and from the edge of the door leaf when fully opened into the corridor.
* The cabinets must not be more than 20 in. deep by 37 in. wide by 72-3/4 in. high.
* The cabinets must be all metal construction with positive latches to prevent spillage of contents in the event of an earthquake.
* All doors must return automatically to the closed position when not held open manually.
* A 45 degree-angle fairing must be provided from the wall to the corridor corner of the cabinet. Fairing must be provided at both ends of the cabinet or bank of cabinets. A 45 degree-angle fairing must be provided at the top of the cabinets from the outside corridor edge of cabinet to the wall. All cabinets must be anchored to the wall firmly enough to withstand 0.5g of lateral acceleration (or a lateral load equal to 1/2 the total dead weight of the cabinet and its contents) in the event of an earthquake.

* Liquids and chemicals are not to be stored in corridor lockers.
* All cabinets must be kept locked, with one key being retained by the Building Manager.
* All cabinets must be labeled with the contents and the name, address, and telephone number of the assigned user.
* Any deviation from the above requirements must be approved by a Responsible Safety Officer.

Mechanical Equipment Rooms

Mechanical equipment rooms contain boilers, blowers, compressors, filters, electrical equipment, etc. Such rooms must be separated from other areas of a building by fire-resistant walls and doors. To maintain the integrity of these separations, the fire doors must never be left open. Fan rooms house ventilation equipment which often includes automatic shut down and dampers activated by interlocking with the building smoke and fire detectors. Fire dampers and other automatic shut-down provisions must not be disabled without Fire Department approval (as for temporary maintenance procedures). Mechanical equipment rooms and fan rooms must not be used for storage of any kind.

Construction Areas

Construction areas under control of either Singleton Tower, LLC or outside contractors must be maintained in a fire-safe condition and accessible to emergency response forces.

Life Safety Code

The Life Safety Code of the National Fire Protection Association, NFPA 101, requires that emergency lighting be provided for means of egress in certain areas. The Code states emergency lighting is required in exit corridors in any office-type building where the building is two or more stories in height above the level of exit discharge. In industrial occupancies such as laboratories and shops, the Code requires emergency lighting in all exit aisles, corridors, and passageways. Emergency lighting may be installed in areas where not required by the Code when such areas present an egress hazard during a power failure. Although elevators are not considered a means of egress within the jurisdiction of the Life Safety Code, they do require emergency lighting. (Titles 8 and 24 require that emergency lighting be maintained in an elevator for a period of at least four hours.) Two types of emergency lights that satisfy the specifications of the Life Safety Code are: * Battery Type - Only rechargeable batteries may be used. The rating of the battery must be such that it provides power for illumination for one and one-half hours in the event of a failure of normal lighting. * Generator Type - When emergency lighting is provided by an electric generator, a delay of not more than 10 seconds is permitted. Exit sign lights, when burned out, should be reported to Maintenance for service.

Exit Corridors

Exit corridors must not be used for storage. The Life Safety Code, NFPA 101, requires that buildings designed for human occupancy must have continuous and unobstructed exits to permit prompt evacuation of the occupants and allow necessary access for responding emergency personnel. The intent of the Code is to keep exits free from obstructions and clear of combustible materials. Attention to housekeeping, therefore, is very important. "Temporary" storage of furniture, equipment, supplies, or anything else is not permitted in exit ways. Combustibles, including recyclable waste paper, are not permitted in exit ways. Metal lockers with ends and tops ferried to the walls and that do not interfere with minimum exit width requirements may be installed in exit corridors when approved by the Fire Department and the Responsible Safety Officer. The following requirements must be met for storage locker/cabinets:
* Cabinets will be permitted on one side of the corridor only.
* Cabinets must end at least 6 ft from the corridor exit door.
* Cabinet ends must be at least 12 in. from the edge of the doorway on the latch side and from the edge of the door leaf when fully opened into the corridor.
* The cabinets must not be more than 20 in. deep by 37 in. wide by 72-3/4 in. high.
* The cabinets must be all metal construction with positive latches to prevent spillage of contents in the event of an earthquake.
* All doors must return automatically to the closed position when not held open manually.
* A 45 degree-angle fairing must be provided from the wall to the corridor corner of the cabinet.

* Fairing must be provided at both ends of the cabinet or bank of cabinets.
* A 45 degree-angle fairing must be provided at the top of the cabinets from the outside corridor edge of cabinet to the wall.
* All cabinets must be anchored to the wall firmly enough to withstand 0.5g of lateral acceleration (or a lateral load equal to 1/2 the total dead weight of the cabinet and its contents) in the event of an earthquake.
* Liquids and chemicals are not to be stored in corridor lockers.
* All cabinets must be kept locked, with one key being retained by the Building Manager.
* All cabinets must be labeled with the contents and the name, address, and telephone number of the assigned user.
* Any deviation from the above requirements must be approved by a Responsible Safety Officer.

No Smoking

Smoking is forbidden in certain areas for fire safety reasons. Such areas include the following:

* Where flammable gases or liquids are stored, handled, or used.
* Where significant quantities of combustible materials, such as paper, wood, cardboard, or plastics are stored, handled, or used.
* Where liquid- or gaseous-oxygen is stored, handled, or used.
* Within 20 ft of a smoke detector.
* In tape and record storage vaults and computer equipment areas .
* Areas that are designated "No Smoking" areas for fire safety reasons are indicated by large rectangular signs consisting of white backgrounds with red letters stating "NO SMOKING."

Chapter 9
Gases

Introduction
This chapter contains guidelines and requirements for the safe use of flammable and/or compressed gases. It covers the use of flammable-gas piping systems, high-pressure gas cylinders, manifolded cylinders, and compressed air.

Hazards
All gases must be used in a manner that will not endanger personnel or property in routine shop use or experimental operations. Hazards associated with handling and use of flammable and/or high-pressure gases include the following:
* Injuries caused by flying objects accelerated by an explosion or pressure release;
* Almost certain death if a flammable mixture is inhaled and then ignited;
* Asphyxiation;
* Secondary accidents such as falls or electrical shocks;
* Fire caused by ignition of flammable gases;

Relief Valves Required
All systems, system components, and piping subject to over-pressures must be equipped with relief devices.

Operational Safety Procedures
Equipment containing highly toxic gases requires an Operational Safety Procedure (OSP) and must comply with the requirements described in the chapters on chemical safety. If you are in doubt as to the hazards, toxicity, or safe operating practices for any gases, consult the Responsible Safety Officer.

Fire Risk
Fire requires three elements: fuel, oxygen, and ignition. Any experiment or routine operation that places a flammable gas in the presence of an oxidant (air, oxygen) and an ignition source (spark, flame, high temperature) is extremely dangerous. To reduce the risk of fire, eliminate two of these three elements. Thus, when using flammable gases:
(1) eliminate ignition sources and
(2) prevent mixing of fuel with air or oxygen. Contain or vent fuel. Pyrophoric substances, which are materials that ignite spontaneously when exposed to air, require even more care. Minimize the use of oxygen in high concentration. Materials not normally considered combustible burn violently in high-oxygen atmospheres. Therefore, special precautions must be taken when working with high-oxygen concentrations.

Guidelines
All personnel authorized to work with flammable gases must be familiar with the hazards and emergency measures that might be required in the event of an accident. For safe operation the following safety guidelines must be observed:

- A piping (schematic) diagram of the apparatus and an operating procedure that includes safety considerations and emergency instructions must be developed, and the installed piping must be inspected to ensure that it is installed as shown on the piping diagram.
- Only personnel authorized to work on the experiment are allowed in the operations area.
- Appropriate warning devices and signs, such as "Danger-Hydrogen" and "No Smoking and Open Flames," must be posted on or near the work area and at the doors to the operating area.

- Flammable gas shutoff valves must be located outside flammable gas operating areas.
- Good housekeeping practices must be observed; unnecessary combustible material must be kept out of flammable gas operating areas.
- Only the flammable gas cylinders actually required for the experiment are allowed in the operating area. Extra cylinders must be stored in an approved area outside the building or work area.
- When two or more cylinders containing flammable gas are used inside a room or other confined area, and are connected to a common manifold, the regulators must be modified.
- The existing relief valves on the regulator must be replaced with two special relief valves connected to a metal vent line that terminates outside and above the building. Likewise, when the building occupancy is rated H7, as defined in the Uniform Building Code, all flammable gas regulators must have their relief valves vented to a vent line that terminates outside and above the building. All ignition sources, e.g., welding torches, lit cigarettes, electric arcs, electrostatic charges, and pilot lights, must be kept away from flammable gases at all times. Ventilation must be provided to prevent entrapment of flammable gases in closed areas. If the gas is lighter than air, overhead ventilation is required. Gases denser than air must be prevented from entering trenches and manholes where they can collect and form explosive mixtures with air. Cracking a hydrogen gas cylinder valve before attaching the regulator is not recommended since the gas may be ignited by static charge or friction heating. Closing the valve stops the flame immediately. Never use a flame to detect flammable gas leaks. Use soapy water or use other approved methods. If a flammable gas cylinder is discovered with a small leak and the gas has not ignited, the cylinder must be moved carefully to a safe outside area. If the leak is serious or the gas has ignited, evacuate the area and call the local Fire Department immediately.

Hydrogen

Hydrogen is a colorless, odorless, non-toxic, and highly flammable gas. It is the lightest gas, being only 0.07 times the density of air and having a rate of diffusion 3.8 times faster that air, which allows it to fill a confined space rapidly. The danger hydrogen poses is evident from its wide range of flammable mixtures: 4% to 75% in air and 4% to 94% in oxygen. Hydrogen-air mixtures can be ignited by an extremely low energy input, 0.02 millijoules, which is only 10% of the energy required to ignite a gasoline-air mixture. High pressure hydrogen leaks will usually ignite as a result of the static electricity generated by the escaping gas. The ignition temperature of hydrogen is 932 degrees F, its flame velocity is 270 cm/sec (almost 10 times the velocity of a natural-gas flame), and it burns with a virtually colorless (invisible) flame at 3713 degrees F. If ignited, unconfined hydrogen and air mixtures will burn or explode depending upon how close the mixture is to being stoichiometric. Confined mixtures may detonate (burn at sonic velocity) depending upon the mixture and the geometry of the confined space. Hydrogen is not toxic but can cause asphyxiation. See NFPA 50A, Standard for Gaseous Hydrogen Systems at Consumer Sites

Oxygen

Oxygen supports combustion but is itself nonflammable. Oxygen lowers the ignition point (in air) of flammable substances and causes them to burn more vigorously. Materials such as oil and grease burn with nearly explosive violence in oxygen, even in minute quantities. Therefore, oxygen cylinders must not be handled with greasy or oily hands or gloves and must not be stored near highly combustible materials such as oil, grease, or reserve acetylene. Oxygen must never be used to purge lines, to operate pneumatic tools, or to dust clothing - cloth, plastics, etc., saturated with oxygen burn explosively. Accordingly, oxygen cylinders must never be used as hat racks, clothes hangers, etc., since leaky fittings can result in accumulations of gas in the covering material. Insects in oxygen "pigtails" can ignite spontaneously and may cause sufficient heat and over-pressure to burst the pigtail, valve, or manifold: don't leave pigtails disconnected for more than a few minutes. Do not use white lead, oil, grease, or any other non-approved joint compound for sealing oxygen-system fittings. Threaded connections in oxygen piping must be sealed with joint compounds or Teflon tape approved for oxygen service. Litharge and water is recommended for service pressures above 300 psig (2.0 MPa). Gaskets must be made of non-combustible materials. When high pressure oxygen cylinders are stored inside a building, they must be separated from flammable gas cylinders by at least 20 feet or by a fire-resistive partition.

Acetylene

Acetylene is used principally with welding and cutting torches. Commercial acetylene gas is colorless and highly flammable with a distinctive garlic-like odor. Acetylene, in its free state under pressure, may decompose violently - the higher the pressure, the smaller the initial force required to cause an explosion. Therefore, acetylene is stored in acetone, which dissolves 300 times its volume of acetylene. Acetylene cylinders are filled with a porous filler material that holds the acetone. The combination of filler and acetone allows acetylene to be contained in cylinders at moderate pressures without danger of explosive decomposition. Full cylinder pressure is 250 psig at 70 degrees F. CAUTION: when acetylene is withdrawn from its cylinder too rapidly, the gas cannot come out of solution fast enough, the downstream pressure drops, and liquid acetone is thrown out of the cylinder and may limit the flow of the pressure-reducing regulator. The following precautions are recommended when working with acetylene: To prevent flashbacks check valves are required in welding gas lines and at the welding/cutting torch. If the acetylene pressure drops, the oxygen pressure at the torch can push oxygen back up the acetylene line, where it can mix with acetylene and cause a flashback. Copper must not be used in acetylene piping - copper forms an impact-sensitive copper acetylide. NEVER use free acetylene gas outside the cylinder at pressures over 15 psig (30 psia) -- it can decompose violently. Acetylene cylinders should be used or stored only in an upright position to avoid the possibility of acetone leaking from the cylinder. If an acetylene cylinder has been stored horizontally, the cylinder should be put upright and left in that position for about 30 minutes before being used. When cylinders are empty of acetylene, valves must be closed to prevent evaporation of the acetone. Acetylene cylinders may be filled only by the supplier.

Magic Gas

The Magic Gas mixture is denser than air and consists of the following: Isobutane - 23.52%; Methylal (dimethoxy- methane) - 4.00%; (nominal) Freon 13-B1- 0.48%; Argon -72.00%. This gas is purchased premixed in Matheson 1F (Fat Boy) cylinders pressurized to 35 psig. The flammable limits of this gas are about 1.8% to 7% in air. Singleton Tower, LLC safety rules for high pressure cylinders and flammable gases apply to all uses of Magic Gas.

Cylinders

Only cylinders meeting Department of Transportation (DOT) regulations may be used for transporting compressed gases. Each cylinder must bear the required DOT label for the compressed gas contained, except under certain specified conditions set forth in DOT regulations. It is illegal to remove or to change the prescribed numbers or other markings on cylinders - do not deface, cover, or remove any markings, labels, decals, or tags applied or attached to the cylinder by the supplier. Each cylinder in use at Singleton Tower, LLC must carry a legible label or stencil identifying the contents. Do not repaint cylinders unless authorized by the owner. Compressed-gas containers must not contain gases capable of combining chemically, nor should the gas service be changed without approval by the Responsible Safety Officer. The cylinder-valve outlet connections on cylinders containing gas mixtures are provided by the gas supplier, based on the physical and chemical characteristics of the gases. Gas mixtures having a flammable component must have a cylinder-valve outlet connection with left-handed threads, even though the gas mixture is nonflammable, unless the Responsible Safety Officer has authorized otherwise. Regulators, gauges, hoses, and other appliances provided for use with a particular gas or group of gases must not be used on cylinders containing gases having different chemical properties unless information obtained from the supplier indicates that this is safe. Gases must not be mixed at Singleton Tower, LLC sites in commercial DOT cylinders and must not be transferred from one DOT cylinder to another. Gases mixed at Singleton Tower, LLC must never be put into a Singleton Tower, LLC- or vendor-owned compressed gas cylinder. Vendor-owned cylinders must not be used for any purpose other than as a source of vendor-supplied gas. Only the vendor may pressurize these cylinders. It is illegal to transport a leaking cylinder (charged or partially charged) by a common or contract carrier.

Compressed Gases

Compressed gases (over 150 psig) are usually stored in steel cylinders manufactured according to DOT specifications. When the DOT was formed in 1969, it acquired responsibility for cylinder specifications, formerly issued by ICC. DOT regulations require the following markings on all cylinders: Type of cylinder and pressure

rating Serial number Inspection date. For example: DOT 3AA2065 973487 6/70 DOT 3AA indicates DOT specification 3AA, which is a seamless alloy-steel cylinder of definite prescribed steel, not over 1000-lb water capacity, with at least 150-psi service pressure; 2065 is the service pressure at 70 degrees F. and the maximum refill pressure; 973487 is the manufacturer's serial number; and 6/70 is the date of the initial qualifying test. Old cylinders (made before 1970) will have "ICC" in the markings, whereas cylinders manufactured after 1970 will be marked "DOT." The other identification markings are unchanged. Singleton Tower, LLC owns cylinders for most of the common industrial gases and may use its own content identification color code. For non-Company-owned cylinders, which may, or may not, have a non-Company color code, the name of the gas painted on each cylinder, rather than the color code, should be used to identify the contents. Mixed-gas cylinders must be marked with an adhesive label placed on the shoulder of the cylinder. The label must contain a RED diamond for flammable gas or a GREEN diamond for nonflammable gas. The percentage of each gas component must be marked on the label and on a tag attached to the valve by the supplier. In addition, a circumferential white stripe must be painted near the shoulder of the cylinder to indicate mixed gas.

Inspections

All compressed gas cylinders, hoses, tubing, and manifolds must be inspected frequently to ensure that they are free of defects that could cause a failure. Cylinders must be considered defective and rejected (or removed from service) if a valve is stiff, or a fitting leaks, or if they contain dents, cuts, gouges, digs over 3 inches long, leaks (of any size), fire damage, or valve damage. All defective cylinders (Singleton Tower, LLC- or vendor-owned) must be sent back to the manufacturer or vendor for test and repair. Hoses and fittings that appear worn must be replaced before the equipment is put to further use. All standard size single compressed gas cylinders (200 scf) that are used only at Singleton Tower, LLC, such as in fixed tube banks, must be pressure tested to 5/3 (1.67) of their DOT service pressure every 6 years.

Cylinder Handling

Compressed gases should be handled only by experienced and properly instructed personnel. When in doubt about the proper handling of a compressed gas cylinder or its contents, consult the Responsible Safety Officer. Compressed gas cylinders are dangerous when handled incorrectly. Always assume that a cylinder is pressurized. Handle it carefully. Never throw, bang, tilt, drag, slide, roll, or drop a cylinder from a truck bed or other raised surface. If a cylinder must be lifted manually, at least two people must do the lifting. Because of their shape, smooth surface, and weight, gas cylinders are difficult to move by hand. A truck or an approved cylinder handcart must always be used to move a cylinder. Cylinders must be fastened in metal cradles or skid boxes before they are raised with cranes, forklifts, or hoists. Rope or chain lifting slings alone must not be used. Cylinders, even empty ones, must never be used as rollers for moving materials, as work supports, etc. If damaged, a cylinder can cause severe injuries, including lung damage from inhalation of toxic contents and physical trauma from explosion. A pressurized gas cylinder can become a dangerous projectile if its valve is broken off. When a cylinder is not connected to a pressure regulator or a manifold, or is otherwise not in use, it is extremely important that the cylinder valve be kept closed and the safety cap be kept in place -- the cap protects the cylinder valve (do not lift cylinders by their caps). Notify the Responsible Safety Officer, giving details and cylinder serial number, if you believe that a foreign substance may have entered the cylinder or valve. Cylinders containing compressed gases should not be subjected to a temperature above 125 degrees Fahrenheit. Flames, sparks, molten metal, or slag must never come in contact with any part of a compressed gas cylinder, pressure apparatus, hoses, etc. Do not place cylinders where they might become part of an electric circuit. When cylinders are used in conjunction with electric welding, ensure that the cylinders cannot be accidentally grounded and burned by the electric welding arc. Cylinders must not be subjected to artificially low temperatures. Many ferrous metals become extremely brittle at low temperatures. The loss of ductility and thermal stress at low temperature may cause a steel cylinder to rupture. Never attempt to repair, alter, or tamper with cylinders, valves, or safety relief devices.

Working With Gases

Always identify the contents of a gas cylinder before using it. If a cylinder is not clearly labeled, return it to the Responsible Safety Officer. Before using a cylinder, be sure it is properly supported with two metal

chains or the equivalent to prevent it from falling. Contamination of compressed gas cylinders by feedback of process materials must always be prevented by installation of suitable traps or check valves. Suitable pressure-regulating devices and relief devices must always be used when gas is admitted to systems having pressure limitations lower than the cylinder pressure. Gas cylinder valves can be "cracked" (opened slightly) momentarily before regulators are attached to blow dirt off the valve seats, but the valve outlet should always be pointed away from people or equipment. (Cracking the valve is not recommended with hydrogen because it can be ignited by static charge or friction.) After the regulator is securely attached to the cylinder valve, fully release (turn counter-clockwise) the pressure-adjusting screw of the regulator before opening the cylinder valve. Open gas cylinder high pressure valves slowly; this gives compression heat time to dissipate and prevents "bumping" the gauges. Never use a wrench on any cylinder-valve hand wheel. Keep removable keys or handles on valve spindles or stems while cylinders are in service. Never leave pressure in a system that is not being used. To shut down a system, close the cylinder valve and vent the pressure from the entire system. Equipment must not be disassembled while it is under pressure. Be aware that any valved-off portion of the system may still be under pressure; bleed the hose, line, or vessel before disassembly to ensure that there is not enough pressure energy stored in the trapped gas or in piping distortion to propel loose objects. Connections to piping, regulators, and other appliances should always be kept tight to prevent leakage. Where hose is used, it should be kept in good condition. Manifold pigtails should not be left disconnected for more than a few minutes. Certain insects are attracted to pure gases and will quickly clog these lines. Never use compressed gas to dust off clothing; this may cause serious injury or create a fire hazard. About 30 psi gauge pressure (0.2 MPa) must be left in "empty" cylinders to prevent air from entering the cylinder and contaminating it; air contamination in a hydrogen cylinder is extremely dangerous. Before a regulator is removed from a cylinder, close the cylinder valve and release all pressure from the regulator. Before returning an empty cylinder, close the valve and replace the cylinder-valve protective cap and outlet cap or plug, if used.

Cylinder Storage

Cylinders not actively in use inside of buildings must be stored outside in areas approved by the Responsible Safety Officer and must be fastened - with two metal chains or bars or in a fixture - to prevent them from falling if they are bumped or shaken, as during an earthquake. When gases of different types are stored at the same location, cylinders must be grouped by types of gas, and the groups must be arranged in accordance with the gases contained, e.g., flammable gases must not be stored near oxygen. Charged cylinders and empty cylinders should be stored separately in an arrangement that permits removal of "old stock" (cylinders in storage the longest) with minimum handling of other cylinders. Storage rooms or areas should be dry, cool, well ventilated, and, where practical, fire resistant; must have solid, level floors or storage surfaces; and must be away from traffic. Storage in subsurface locations should be avoided. Cylinders must not be stored at temperatures above 125 degrees F. or near radiators or other sources of heat, near sparking devices, or near salt or other corrosive chemicals. If stored outside, cylinders must be protected from continuous direct sunlight, extreme weather, or moisture.

Supervisor Responsibilities

Supervisors must make periodic surveys of regulators in their areas. Damaged, unreliable, or otherwise defective regulators must be replaced immediately. All surplus regulators must be inspected, cleaned, adjusted, and repaired, as required. Immediately after its removal from a flammable, toxic, and/or radioactive system, the entire regulator must be safely vented and purged. If in doubt about the hazard call the Responsible Safety Officer. Use only regulators of the approved type and design for the specific gas-and-cylinder combination to be employed. Ensure that threads and nipples (e.g. round, flat, conical) on regulators correspond to those on the cylinder-valve outlet (never force connections). Regulators with green-face gauges must be used only with oxygen. Regulators designed for use on gas lines must not be used on gas cylinders; single-stage regulators are for use only up to 150 psig (1.0 MPa) and must be used only for in-line installation. Two-stage regulators for inert gases are equipped with two relief valves that protect the regulator diaphragms and gauges from excessive over-pressure. Relief valves on regulators for use with flammable, toxic, and/or radioactive gases must be vented to a safe location. The second stage of a two-stage regulator will normally be adjusted so that the low-pressure output cannot exceed 67% of the highest reading on the low-pressure output gauge; the low pressure output relief valve will be set to open at (or under) the highest reading on the low-pressure output gauge.

Users are cautioned that additional pressure-relief valves may be required to protect downstream equipment. Single-stage cylinder regulators (except acetylene regulators) are equipped with a single relief device that is set to open at (or under) the highest reading on the output gauge. These regulators will be adjusted to limit the output pressure to 67% of the highest reading of the output gauge. If piping and associated apparatus connected to the regulator discharge are rated at a pressure lower than the lowest possible setting of the low-pressure output relief valve on the regulator and, therefore, a leak in the regulator valve seat could cause damage to the connected apparatus, a separate relief valve must be installed in the downstream equipment to protect it from damage caused by over-pressurization.

Diaphragm Failure

Diaphragm failure permits the cylinder gas to escape to the surrounding atmosphere through holes in the regulator body. To reduce the probability of diaphragm failure, high-pressure regulators are equipped with stainless steel diaphragms. Regulators for use with flammable and/or toxic gases can be obtained with a bonnet fitting which allows the regulator to be vented.

Regulators, Vacuum Service

If piping on the high-pressure side of a regulator is to be evacuated through the regulator, it must be modified for vacuum service to prevent damage to the diaphragms and pressure gauges. Regulators modified for vacuum service must be so labeled.

Compressed Air

Compressed air for general shop or laboratory use must be restricted to 30-psig (207-kPa) maximum pressure by restricting nozzles. Compressed air at pressures up to 100-psig (700-kPa) may be used to operate pneumatic tools, certain control instruments, and research equipment with properly designed over-pressure relief devices. Use of air- pressurized research equipment must be approved by the Responsible Safety Officer. Building compressed air (house air) may be used to dry parts and to help accomplish many other jobs in the shop or laboratory, but always ensure that no one is in line with the air stream and always wear goggles or a face shield. Compressed air must not be used for breathing unless it has been especially installed for this purpose and such use has been approved by the Responsible Safety Officer. Never apply air pressure to the body or use compressed air to clean clothing. Compressed air injected into the body openings can be fatal. Compressed air used to clean clothing drives particles into the fabric, where they can cause skin irritation and infections. Use a clothes brush instead to clean clothing. Compressed air must not be used to transfer liquids from containers of unknown safe working pressure. A pressurized commercial drum of unknown pressure rating is a hazardous device; for example, a 55-gal (200 liter) drum pressurized to 14.5 psig (100 kPa) has a force on the drum head of about 3 tons. To transfer liquids use a pump or a siphon with a bulk aspirator. The transfer pressure for commercial-type liquid nitrogen dewars must be less that 14.5 psig. For most laboratory-type liquid nitrogen systems, transfer pressures of less than 5 psig are adequate. Compressed air must never be used for transferring liquid hydrogen or liquid helium. When an automatic shut-off coupling is not used on air-operated tools, a short metal chain (or its equivalent) should be attached to the hose to prevent it from whipping in case it separates from the tool. When using an air-operated tool, shut off the compressed air and vent the hose before changing nozzles or fittings.

Chapter 10 Mechanical Guarding

Introduction and Standards

Mechanical guarding must encompass both the power transmission parts of all mechanical equipment and the points of operation on production machines. Guards must be provided where rotational motion, nip points, and cutting, shearing, punching, and forming mechanisms can cause injury to personnel or damage to tools and equipment. Mechanical guards must be designed or otherwise procured to meet the following specifications:

* The guard must provide positive protection equal to that specified in ANSI B15.1.
* The guard must be considered a permanent part of the machine or equipment, capable of being easily or quickly removed or replaced.
* The guard must not interfere with efficient operation or maintenance of the machine or give discomfort to the operator. * The guard must not weaken the machine structure.
* The guard must be designed for a specific job and a specific machine.
* The guard must be durable, resistant to fire and corrosion, and easily repaired.
* The guard must not present hazards, such as rough edges, splinters, pinch points, shear points, or sharp corners.

Methods of guarding that must be considered include the following:

* Enclosing the operation (preferred)
* Interlocking devices
* Moving barriers
* Removal devices
* Remote control
* Two-handed tripping devices
* Electronic safety devices
* Machines designed for fixed locations must be securely anchored to the floor or bench to prevent walking or tipping.

Employees may operate machinery only when properly trained and authorized to do so. Proper clothing and protective devices must be worn when specified by the supervisor or shop foreman.

ELECTRICAL TAG OUT PROCEDURE: When you have to do maintenance work on a machine, take these four steps to protect yourself and your co-workers from injury:

1. De-energize the machine if possible. Positively disconnect the machine from the power source. If there is more than one source of power, then disconnect them all.
2. If possible, lock out all disconnect switches. You must be given a lock and a key for each disconnect before you begin working on the machine.
3. Tag all disconnect switches. Use the yellow or Red safety tags which state in large letters -- "Danger..Do Not Operate," or "Danger--Do Not Energize" and give the name of the individual who locked out the equipment, date and time. The tag must also state "DO NOT REMOVE THIS TAG" (except the person who placed the tag may remove it only after the machinery maintenance has been completed.
4. Test the equipment to ensure it is de-energized before working on it. First, attempt to operate the equipment by turning on normally. Next check all electrical lines and exposed areas with test equipment or a "lamp". Finally, short to ground any exposed connections using insulated grounding sticks. This test must be done even if the electrical connection is phys A TAG OUT ONLY PROCEDURE MAY BE USED IF THE MACHINE CAN NOT BE LOCKED OUT. IF THE MACHINE IS SUPPLIED ELECTRICAL POWER FROM A SINGLE SOURCE, WHICH IS UNDER THE EXCLUSIVE CONTROL OF A TRAINED AND QUALIFIED REPAIR PERSON AT ALL TIMES AND THERE ARE

NOT ANY OTHER PERSONS IN THE REPAIR AREA WHO COULD BE HARMED BY THE ACCIDENTAL ENERGIZING OF THE MACHINERY, THEN TAG OUT MAY BE USED INSTEAD OF LOCK OUT/TAG OUT.

RE-ENERGIZING: Many accidents occur at the moment of re-energizing. If the machinery is to be re-energized, all persons must be kept at a safe distance away from the machinery. The re-energization can be performed only by a person who either performed the lock-out/tag out, a person acting under the immediate and direct commands of the original lock-out/tag out person, or, in the event of a shift change ,or other unavailability of the original person, then the original shall, before leaving, appoint a surrogate original person and show him or her all steps taken to lock-out/tag out the equipment.

Chapter 11 Materials Handling

Introduction

Singleton Tower, LLC requires that safety planning and practices for commonplace tasks be as thorough as for operations with unusual hazards. Commonplace tasks make up the greater part of the daily activities of most employees and, not unexpectedly, offer more potential sources of accidents with injuries and property damage. Every operation or work assignment begins and ends with handling of materials. Whether the material is a sheet of paper (paper cuts are painful) or a cylinder of toxic gas, accident risks can be reduced with thorough planning. Identifying obvious and hidden hazards should be the first step in planning work methods and job practices. Thorough planning should include all the steps associated with good management from job conception through crew and equipment decommissioning. Most of the material presented in this chapter is related to the commonplace and obvious. Nevertheless, a majority of the incidents leading to injury, occupational illness, and property damage stem from failure to observe the principles associated with safe materials handling and storage. A less obvious hazard is potential failure of used or excessive motorized handling or lifting equipment. The Responsible Safety Officer must be notified whenever it is desired to acquire a crane, forklift truck, or other motorized handling or lifting equipment from excessed sources.

Lifting and Moving

Lifting and moving of objects must be done by mechanical devices rather than by manual effort whenever this is practical. The equipment used must be appropriate for the lifting or moving task. Lifting and moving devices must be operated only by personnel trained and authorized to operate them. Employees must not be required to lift heavy or bulky objects that overtax their physical condition or capability.

Rigging

Planning for safe rigging and lifting must begin at the design stage, and lifting procedures must be developed for assembly and installation. The lifting procedure should be developed and discussed with the rigging crew fore person. Responsibility for all rigging jobs is shared between the rigging crew and the customer. The customer is responsible for defining and requesting the move, for providing technical information on relevant characteristics of the apparatus, including special lifting fixtures when required, for providing suggestions on rigging and moving, and for assigning someone to represent them both in planning and while the job is being carried out. The riggers are responsible for final rigging and for carrying out whatever moves have been designated. Before any movement takes place, however, each representative must approve the rigging and other procedures associated with the intended move. Each must respect the responsibility and authority of the other to prevent or terminate any action he or she judges to be unsafe or otherwise improper. The supervisor must make certain that personnel know how to move objects safely by hand or with mechanical devices in the operations normal to the area and must permit only those employees who are formally qualified by training and certification to operate a fork truck, crane, or hoist. The supervisor must enforce the use of safe lifting techniques and maintain lifting equipment in good mechanical condition. Employees are required to observe all established safety regulations relating to safe lifting techniques. The Responsible Safety Officer provides training programs followed by certification for employees who have demonstrated the ability to operate fork trucks of up to 4-ton capacity and for incidental crane operations that require no special rigging.

Manual Lifting Rules

Manual lifting and handling of material must be done by methods that ensure the safety of both the employee and the material. It is Singleton Tower, LLC policy that employees whose work assignments require heavy lifting be properly trained and physically qualified, by medical examination if deemed necessary. The following are rules for manual lifting:

* Inspect the load to be lifted for sharp edges, slivers, and wet or greasy spots.

* Wear gloves when lifting or handling objects with sharp or splintered edges. These gloves must be free of oil, grease, or other agents that may cause a poor grip.
* Inspect the route over which the load is to be carried. It should be in plain view and free of obstructions or spillage that could cause tripping or slipping.
* Consider the distance the load is to be carried. Recognize the fact your gripping power may weaken over long distances.
* Size up the load and make a preliminary "heft" to be sure the load is easily within your lifting capacity. If it is not, get help.
* If team lifting is required, personnel should be similar in size and physique. One person should act as a leader and give the commands to lift, lower, etc. Two persons carrying a long object such as a piece of pipe or lumber should carry it on the same shoulder and walk in step. Shoulder pads should be used to prevent cutting shoulders and help reduce fatigue.

To lift an object off the ground, the following are manual lifting steps:
* Make sure of good footing and set your feet about 10 to 15 inches apart. It may help to set one foot forward or the other.
* Assume a knee-bend or squatting position, keeping your back straight and upright.
* Get a firm grip and lift the object by straightening your knees - not your back.
* Carry the load close to your body (not on extended arms). To turn or change your position, shift your feet - don't twist your back.
* The steps for setting an object on the ground are the same as above, but in reverse.

Mechanical Lifting

Mechanical devices must be used for lifting and moving objects that are too heavy or bulky for safe manual handling by employees. Employees who have not been trained must not operate power-driven mechanical devices to lift or move objects of any weight. Heavy objects that require special handling or rigging must be moved only by riggers or under the guidance of employees specifically trained and certified to move heavy objects.

Inspections

Each mechanical lifting or moving device must be inspected periodically. Each lifting device must also be inspected before lifting a load near its rated capacity. Defective equipment must be repaired before it is used. The rated load capacity of lifting equipment must not be exceeded. Material moving equipment must be driven forward going up a ramp and driven backward going down a ramp. Traffic must not be allowed to pass under a raised load. The floor- loading limit must be checked before mobile lifting equipment enters an area. Passengers must not be carried on lifting equipment unless it is specifically equipped to carry passengers.

Load Path Safety

Loads moved with any material handling equipment must not pass over any personnel. The load path must be selected and controlled to eliminate the possibility of injury to employees should the material handling equipment fail. Equipment worked on while supported by material handling equipment must have a redundant supporting system capable of supporting all loads that could be imposed by failure of the mechanical handling equipment. A suspended load must never be left unattended but must be lowered to the working surface and the material handling equipment secured before leaving the load unattended.

Truck Loading

All objects loaded on trucks must be secured to the truck to prevent any shifting of the load in transit. The wheels of trucks being loaded or unloaded at a loading dock must be chocked to prevent movement.

Clean Work Areas

All areas controlled by Singleton Tower, LLC must be kept in orderly and clean condition and used only for activities or operations for which they have been approved. The following specific rules must also be followed:
* Keep stairs, corridors, and aisles clear.

* Traffic lanes and loading areas must be kept clear and marked appropriately.
* Store materials in work rooms or designated storage areas only. Do not use hallways, fan lofts, or boiler and equipment rooms as storage areas. Do not allow exits, passageways, or access to equipment to become obstructed by either stored materials or materials and equipment that is being used.
* Arrange stored materials safely to prevent tipping, falling, collapsing, rolling, or spreading - that is, any undesired and unsafe motion.
* Do not exceed the rated floor capacity of stored material for the area. The load limit and the maximum height to which material may be stacked must be posted.
* Place materials such as cartons, boxes, drums, lumber, pipe, and bar stock in racks or in stable piles as appropriate for the type of material.
* Store materials that are radioactive, fissile, flammable, explosive, oxidizing, corrosive, or pyrophoric only under conditions approved for the specific use by the Responsible Safety Officer. Segregate and store incompatible materials in separate locations.
* Remove items that will not be required for extended periods from work areas and put them in warehouse storage.

Temporary equipment required for special projects or support activities must be installed so that it will not constitute a hazard. A minimum clearance of 36 inches must be maintained around electrical power panels. Wiring and cables must be installed in a safe and orderly manner, preferably in cable trays. Machinery and possible contact points with electrical power must have appropriate guarding. The controls for temporary equipment must be located to prevent inadvertent actuation or awkward manipulation. When heat-producing equipment must be installed, avoid accidental ignition of combustible materials or touching of surfaces above 60 degrees C (140 F). Every work location must be provided with illumination that meets OSHA requirements. Evaluation of illumination quality and requirements is made by the Responsible Safety Officer, but the supervisor of an area is responsible for obtaining and maintaining suitable illumination. Areas without natural lighting and areas where hazardous operations are conducted must be provided with enough automatically activated emergency lighting to permit exit or entry of personnel if the primary lighting fails.

Cranes

There are two types of heavy duty cranes that may be used at Singleton Tower, LLC. Bridge cranes are classified as cab-operated or pendant-operated. Mobile cranes consist of a boom and controls mounted on a truck chassis. Bridge and mobile cranes must be operated only by trained operators designated by the supervisor in charge of the facility. The supervisor is also responsible for ensuring that operators are trained, carrying out the inspections and following the safe operating rules explained in the Operator/Rigger Training Program. The Operator/Rigger Training Program is administered by the Responsible Safety Officer. The training staff consists of a qualified crane consultant, professional riggers, and the Responsible Safety Officer. There are two levels of required training and performance:
(1)Professional Operator/Rigger: Person whose principal assignment includes crane operation and rigging functions. The chief operator/rigger must ensure that those professional operators/riggers under his/her supervision maintain the necessary qualifications.
(2) Incidental Operator/Rigger: Person who performs operating/rigging functions as an incidental part of his/her normal work assignment. Persons in this category are restricted to lower load limits and rigging of specific types of hardware. Incident supervisors must arrange for the employee to receive incidental crane-operator training on the appropriate crane. Successful completion of the training must include an oral or written examination on the safety aspects of crane operation and a satisfactory demonstration of operational skills. The supervisor must determine that the applicant does not have any disqualifying medical or physical disabilities based on established requirements.

Crane Inspections Required

The following crane inspections are required:

* All crane functional operating mechanisms must be inspected for maladjustment interfering with proper operation and for excessive wear of components. On days the crane is used, inspection is required by a crane operator.

* Inspect the crane for deterioration or leakage in lines, tanks, valves, drain pumps, and other parts of air or hydraulic systems. On days the crane is used, inspection is required by a crane operator.
* Hook inspection: On days used visual inspection by a crane operator is required. Annual inspections must have signed reports by Singleton Tower, LLC or an outside Engineer. Hooks with cracks or having deformation more than 15% in excess of normal throat opening or more than 10 degrees twist from the plane of the unbent hook must be discarded.
* Inspection of wire-rope slings, including end connections, for excessive wear, broken wires, stretch, kinking, or twisting. Visual inspection is required by the crane operator on days used. The Responsible Safety Officer, the primary user or the Building Manager must ensure that an annual inspection with a signed report is made. Singleton Tower, LLC or an outside Engineer must inspect rope reeving for noncompliance with manufacturer's recommendations before first use and annually thereafter.

Running Ropes Inspections

Running ropes must be thoroughly inspected at least once a year during the structural inspection of the crane, and a full, written, dated, and signed report of rope conditions must be kept on file.

OSHA Crane Standards

Routine maintenance, adjustments, and repairs must be performed by a qualified mechanic and reported to the Responsible Safety Officer according to each machine's established schedule and according to OSHA requirements.

OSHA Standards for Forklifts

Forklift users must familiarize themselves with and comply with OSHA Standard 29 CFR 1910.178 and ANSI B56.1. Modifications and additions must not be performed by the customer or user without manufacturer's prior authorization or qualified engineering analysis. Where such authorization is granted, capacity, operation and maintenance instruction plates, tags, or decals must be changed accordingly. If the forklift truck is equipped with front end attachments other than factory installed attachments, the user must ensure that the truck is marked with a card or plate that identifies the current attachments, shows the approximate weight of the truck with current attachments and shows the lifting capacity of the truck with current attachments at maximum lift elevation with load laterally centered. The user must see that all nameplates, caution and instruction markings are in place and legible. The user must consider that changes in load dimension may affect truck capacities.

Forklift Maintenance

Because forklift trucks may become hazardous if maintenance is neglected or incomplete, procedures for maintenance must comply with ANSI B56.1 Section 7 and OSHA Standard 29 CFR 1919.178 g.

Forklift Extension

Maximum efficiency, reliability, and safety require that the use of fork extensions be guided by principles of proper application, design, fabrication, use, inspection, and maintenance. The user must notify the Responsible Safety Officer before purchasing extensions or having them fabricated. Fork extensions are only appropriate for occasional use. When longer forks are needed on a regular basis, the truck should be equipped with standard forks of a longer length. Routine on-the-job inspections of the fork extension must be made by the forklift operator before each use unless, in the judgment of the supervisor, less frequent inspections are reasonable because of his or her knowledge of its use since the last inspection. Extensions must be inspected for evidence of bending, overload, excess corrosion, cracks, and any other deterioration likely to affect their safe use. All fork extensions must be proof load tested to establish or verify their rated capacities, whether they were supplied commercially or fabricated at Singleton Tower, LLC. A load equal to the rated capacity of the pair at a particular load center multiplied by 1.15, must be placed on each fork extension pair and fork assembly and supported for a period of five minutes without any significant deformation. Rated capacity must be determined at significant load centers, including the midpoint of the extension and at the tip. Once determined, the rated capacity and load center information must be shown by stamping or tagging the extensions in a protected location of low stress. The proof load test must be witnessed by a mechanical engineer or designer. Whenever evidence of deterioration is

detected or whenever the extensions have been overloaded, magnetic particle inspection must be performed.

Crane Loads When equipment is designed to be crane lifted at a single point with a single-bolt pickup device, the vertical lifting load through the screw thread of the bolt must be in line with the axis of the bolt so that the load will remain level when it is lifted. With this bolt alignment the lift will be through the center of gravity and will be safer since the load will not tilt or kick out when it is lifted. A single-bolt pickup device, such as a Safety Hoist Ring or equivalent carefully designed and maintained in-house device, must be used. When a load is to be crane-lifted by slings from a crane hook through 2, 3, or 4 single-load pickup points located at the corners of the load, and without the use of a spreader bar, the forces at the lift points will be nonvertical. In this case a single bolt pickup device, such as a safety hoist ring or equivalent carefully designed and maintained in-house device, must be used at each pickup point. The use of eye bolts with shoulders is permitted for lifting light incidental loads after receiving approval from the crane certified operator or supervisor and when the following conditions are met: The load is in line with the axis of the eye bolt and side loads are minimal (a spreader bar may be required). The average stress at the root area of the thread does not exceed 5000 psi. The thread engagement is at least two bolt diameters.

Chapter 12 Noise

Introduction
This chapter contains information on the effects, evaluation, and control of noise. For assistance in evaluating a noise problem, contact the Responsible Safety Officer.

Danger of Noise
Exposing the ear to high levels of noise may cause hearing loss. This loss can be temporary or permanent. Temporary hearing loss or auditory fatigue occurs after a few minutes exposure to an intense noise but is recoverable following a period of time away from the noise. If the noise exposure is repeated, there may be only a partial hearing recovery and the loss becomes permanent. Typically, significant hearing losses occur first in the frequency range of 3,000 to 6,000 hertz (Hz). Losses in this frequency range are not critical to speech perception, and the individual usually is completely unaware of this initial symptom. With longer exposures, the hearing loss spreads to lower frequencies, which will affect speech perception. Workers' Compensation laws regard hearing losses in the speech frequency range of 500 to 3,000 Hz as being compensable. The evaluation of hearing loss due to noise is complicated by the fact that hearing acuity normally decreases with increasing age. Further, the losses associated with age are quite similar to those caused by excessive noise since the hearing for high frequency sounds is most affected in both instances. Hearing impairment may also result from infections, tumors, and degenerative diseases.

ACGIH Standards
OSHA has prescribed the limits established by the American Conference of Governmental Industrial Hygienists as a standard for occupational noise exposure. Both the sound pressure level of the noise and the total duration of the noise exposure are considered to determine if these limits are exceeded. The sound pressure levels are expressed as dBA or decibels A-weighted. A-weighting filters are used when measuring sound levels to more accurately predict the response of the human ear to different frequencies. When the daily noise exposure is composed of two or more periods of noise of different levels, their combined effect must be considered rather than the individual effect of each. Exposure to continuous noise above 115 dBA is not permitted without ear protection. Personnel must not be exposed to impact noises exceeding 140 dBA. Impact noises occur at intervals of greater than one per second. (For example, the noise made by a metal shear.)

Reducing Noise Exposure
Noise exposure can be reduced by using engineering controls, administrative procedures, or personal protective devices. Engineering Controls include:
* Proper design of new machines
* Modification of present machines
* Proper repair and upkeep of equipment
* Use of appropriate mufflers
* Use of vibration dampeners on machines
* Reduction of noise transmission, including increasing distance between noise and personnel exposed; construction of barriers between noise source and personnel; and sound treatment of ceilings and walls.

Administrative Procedures include:
* Job schedule changes
* Personnel rotation

Personnel Protective Devices include:

* Ear plugs and earmuffs

Federal and state occupational safety and health regulations require that whenever employees are exposed to excessive noise levels, feasible engineering or administrative controls must be used to reduce these levels. When these control measures cannot be completely accomplished and/or while such controls are being initiated, personnel must be protected from the effects of excessive noise levels. Such protection can, in most cases, be provided by wearing suitable protective hearing devices. The appropriate Medical Services provider and/or the supervisor of the Department will supply ear plugs for employees upon request or before going into a high noise area. There is a need for medical supervision when ear plugs are used because their effectiveness depends on proper fitting. Only approved plugs should be used. Ear plugs should be cleaned daily to prevent ear infections. Protection greater than that provided by a single device can be obtained by wearing ear plugs under an earmuff. While the reduction provided by wearing both devices simultaneously is considerably less than the sum of the individual attenuations, it is still greater than when either device is worn separately.

Chapter 13
Protective Equipment

Introduction Singleton Tower, LLC will provide suitable equipment to protect employees from hazards in the workplace. The Responsible Safety Officer will advise on what protective equipment is required for the task, but the supervisor of the operation must obtain this equipment and see that it is used. Protective clothing is not a substitute for adequate engineering controls.

Protection Issued Protective clothing will be issued to employees who work with hazardous material for the purpose of protecting their health and safety. The Responsible Safety Officer is available for consultation as needed.

Protective Shoes Singleton Tower, LLC encourages the wearing of safety shoes. For certain types of work the wearing of safety shoes is required by Company policy or by federal regulations. Examples are when employees are exposed to foot injuries from hot, corrosive, or poisonous substances; in shops, in equipment handling, or in construction jobs where there is a danger of falling objects; or in abnormally wet locations.

Protective Gloves Singleton Tower, LLC provides proper hand protection to employees exposed to known hand hazards. The supervisor must obtain the suitable hand protection and ensure that it is used. The individual department must maintain a supply of special or infrequently used hand protection. Assistance in selecting the proper hand protection may be obtained by consulting the Responsible Safety Officer.

Head Protection Singleton Tower, LLC provides appropriate head protection devices for employees to protect them from head or other injuries that could result from their working environment. Some head protection devices are available from stock. The supervisor must also maintain sufficient supply of head protection devices for visitors in the area.

Eye Protection Singleton Tower, LLC provides appropriate eye protection devices for employees assigned to tasks in which an eye-injury hazard exists. The supervisor of the operation is responsible for determining the need for suitable eye- protection devices and for ensuring that the employees use them. The Responsible Safety Officer and appropriate Medical Services agency will assist the supervisor in defining eye-hazard operations and in selecting appropriate eye protection. An optometrist is available to issue, repair, adjust, and fit personal safety glasses and also for consultation regarding occupational eye protection. The standard sign: CAUTION, EYE HAZARD AREA, DO NOT ENTER WITHOUT EYE PROTECTION, must be posted in every area where eye protection is mandatory. All employees who work in such an area must wear the eye protection issued to them. Every visitor to the area must also be provided with suitable eye protection.

Respiratory Protection Any operation that generates harmful airborne levels of dusts, fumes, sprays, mists, fogs, smokes, vapors, or gases or that may involve oxygen-deficient atmospheres requires the use of effective safety controls. This must be accomplished, as much as feasible, by accepted engineering control measures (for example, enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials). When

effective engineering controls are not feasible, or while they are being instituted, appropriate respiratory protection must be used in accordance with Singleton Tower, LLC requirements as prescribed by OSHA in ANSI 288.2-1980, Standard Practices for Respiratory Protection.

Responsibilities

To ensure that the respiratory protection program is conducted in accordance with ANSI 288.2-1980, certain responsibilities are required of each employee, supervisor, Responsible Safety Officer, and the Medical Services Department.

Employees are responsible for:
* Wearing the respirator in accordance with the instructions and training received.
* Maintaining and storing the respirator in good condition.
* Returning the respirator at the end of the required use for overhaul, cleaning, and disinfection.

Supervisors are responsible for:
* Identifying those employees who may need to use respiratory protection.
* Ensuring that their employees have been properly trained and fitted.
* Ensuring that their employees use the respirators as required.

The Responsible Safety Officer is responsible for:
* Providing respiratory equipment.
* Maintaining the equipment in good condition.
* Fitting employees with proper respirators and providing training for their use.
* Evaluating employee exposures and work conditions, including inspection of respirator use.

The Medical Services Department is responsible for:
* Granting medical approval for each respirator user.

Chapter 14 Pressure Safety

Definitions

The following definitions apply in this chapter:

- Low Pressure: Gas Pressure less than 1 MPa gauge (150 psig) or liquid pressure less than 10 MPa (1500 psig).
- Intermediate Pressure: Gas pressure from 1 to 20 MPa gauge (150 to 3000 psig) and liquid pressure from 10 to 35 MPa gauge (1500 to 5000 psig).
- High Pressure: Gas pressure greater than 20 MPa gauge (3000 psig) and liquid pressure greater than 35 MPa gauge (5000 psig).
- Pressure Equipment: Any equipment, e.g., vessels, manifolds, piping, or other components, that operates above or below (in the case of vacuum equipment) atmospheric pressure.
- Pressure System: Any mechanical system comprising pressure equipment.
- Pressure Vessel: A relatively high-volume pressure component (such as a spherical or cylindrical container) with a cross section larger than the associated piping.
- Ductile Vessel: A pressure vessel fabricated from materials that yield extensively before failure when over stressed at any temperature within the vessel's operating range (generally, materials that exhibit greater than 5% plastic strain to rupture).
- Brittle Vessel: A pressure vessel fabricated from materials that do not yield extensively before failure when over stressed at any temperature within the vessel's operating range (generally, materials that exhibit less than 5% plastic strain to rupture).
- Research Pressure Equipment: Pressure equipment used for research, development, or for some other unique activity (such as special test equipment for shop use).
- Plant-Facility Pressure Equipment: Pressure vessels and pressurized utility equipment that is part of Singleton Tower, LLC buildings or physical-plant facilities.

Operational Safety Procedure:

The OSP is the document used to describe the controls necessary to ensure that the risks associated with a potentially hazardous research project or unique activity are at an acceptable level.

- Safety Note (SN): A Safety Note is generally used to document engineering calculations or tests of specific equipment or activities when there is a safety concern but the potential hazard is not high enough to require an OSP.
- Maximum Allowable Working Pressure (MAWP): The maximum differential pressure (at the specified operating temperature) at which equipment is designed to operate safely. The relief device must not be set higher than the MAWP.
- Operating Pressure (OP): The pressure at which equipment is normally operated - always less than the MAWP (also called working pressure).
- Pressure Test: A test to ensure than equipment will not fail or permanently deform - i.e., will operate reliably at the MAWP.
- Proof Test: A test in which equipment prototypes are pressurized to determine the actual yield or failure (burst) pressure (used to calculate the MAWP).
- Safety Factor (SF): The ratio of the ultimate (i.e., burst or failure) pressure (measured or calculated) to the MAWP. A SF related to something other than the failure pressure should be identified with an appropriate subscript, e.g., SF sub y (based on yield pressure) or SF sub u (based on ultimate strength).
- Leak Test: A pressure or vacuum test to determine the existence, rate, and/or location of a leak.

Standard Operating Procedures

Any Singleton Tower, LLC division involved in the construction and/or use of pressure equipment must ensure that such equipment is designed, installed, tested, and operated in accordance with the requirements of this chapter. The Responsible Safety Officer must make an evaluation to determine whether the potential hazard of the pressure equipment is high enough to require an OPS.

Pressure Installer

The Pressure Installer is a technician or mechanic certified to fabricate, assemble, install, and operate pressure equipment within a specified pressure range. Upon being assigned by his or her supervisor, the Pressure Installer is authorized to work directly for a supervisor or the Responsible Safety Officer.

Low and High Hazards

For convenience in describing the required controls, pressure equipment has been divided into two hazard categories:

- Low-Hazard pressure equipment - equipment with a low hazard level involving routine risks that are accepted without question by most users or equipment that is covered by existing industrial standards.
- High-Hazard pressure equipment - equipment for which operational risk is high enough to require a SN and may be high enough to require an OSP. Review and approval are required.

Low Hazards

The following systems are low hazard and do not normally require an SN or OSP.

* Air and inert-gas systems for working pressures up to 1 MPa gauge (150 psig) and inert-liquid systems for working pressures up to 10 MPa gauge (1500 psig), provided that the stored energy does not exceed 100 kJ(75,000 ft-lb).
* Utility systems for MAWPs up to 2.0 MPa gauge (300 psig), including cold-water, hot-water, low-conductivity- water, compressed-gas, natural-gas, butane and propane (LPG), and steam systems that strictly comply with applicable Engineering standards.
* Compressed-gas-cylinder manifolds assembled with compound-thread fittings in compliance with the chapter on GASES of this Manual.
* Manifolds on tube banks and tube trailers that consist of components rated at 20.7 MPa gauge (3000 psig) or higher and that are periodically retested.
* Unmodified pressure vessels designed in accordance with Refs. 1-3, ASME Boiler and Pressure Vessel Codes and ASME-code stamped.
* Refrigeration systems that comply with the ASME Boiler and Pressure Vessel Codes (Refs. 1 and 2) and applicable Air-Conditioning and Refrigeration Institute (ARI) standards (Ref. 4).
* Pressure vessels, stamped with a Department of Transportation (DOT) rating, used to supply and transport fluids. These vessels are subject to the retesting requirements of Ref. 5, Code of Federal Regulations, CFR 49, Transportation, Parts 100-199 (current issue).
* Air-pressure tanks, liquefied-petroleum-gas tanks, anhydrous-ammonia tanks, and fired-steam boilers inspected periodically in accordance with Ref. 6, "Unfired Pressure Vessel Safety Orders," or Ref. 7, "Boiler and Fired Pressure Vessel Safety Orders" of the State of California or other similar state requirements. The Responsible Designer must notify the Technicians Supervisor whenever such a vessel is to be installed.
* Unmodified, commercially manufactured hydraulic systems with a safety factor of 4 or higher for working pressures to 35 MPa (5075 psi) on hydraulic presses, motorized vehicles, and machine tools that are periodically inspected and maintained by the using organization.

Protective Containments

This section covers protective containment designed, specified, or used by Singleton Tower, LLC personnel to enclose gas-pressurized vessels (including those that contain toxic, radioactive, and/or flammable materials) to protect personnel from the pressure-vessel-failure hazards of blast pressure and flying fragments and to

prevent release to the atmosphere of any hazardous materials leaked from the pressure vessel. Containment vessels may be required to enclose research equipment during its development or to enclose vessels used to transport highly toxic and/or radioactive substances.

Transportation

Only containers approved by the Department of Transportation (DOT) or by OSHA may be used for off-site shipment of pressure vessels containing radioactive materials. Contact the Responsible Safety Officer for approval for transporting radioactive material on or off site.

Ductile Vessels

When the contained vessel is made of ductile material, the containment vessel must be designed with an ultimate (burst) safety factor of at least 4. When the contained vessel is made of brittle material, the containment vessel must be designed with an ultimate (burst) safety factor of at least 8.

Design Curtain

The following requirements apply to all gas-pressure containment vessels. Design the containment vessel using the appropriate safety factor specified in the above paragraph. Base the design upon the maximum equilibration pressure expected if the contained vessel fails and its contents enter the containment vessel heated to the highest temperature expected within the containment vessel or to 55 degrees C (130 degrees F), whichever is higher. Containment-vessel materials must have satisfactory fracture toughness at an operating temperature of -40 degrees C (-40 degrees F), unless a lower temperature is required and specified. If off-site transportation is to be permitted, design the containment vessel to withstand the normal conditions of transport, including heat, cold, pressure, vibration, water spray, free drop, corner drop, penetration, and compression. The contained vessel must be mounted securely inside the containment vessel. Include a compound pressure/vacuum gauge to allow monitoring of the internal pressure of the containment vessel. This gauge must be graduated to at least 120%, but not over 200%, of the highest credible equilibration pressure. Include two separate valves and gas lines for safely introducing, exhausting, and monitoring flushing gases. Include suitable covers and shields to protect all valves and gauges from damage. Cap or plug all terminal valve ports. Provide accommodations for locking or wiring valve handles closed, or have valve handles removed during shipment to prevent unauthorized operation or tampering.

Pressure Testing

Pressure test the containment vessel to at least 1.5 times the maximum possible equilibration pressure as defined above. No detectable plastic strain is permitted, as determined before and after testing by measurements made to within 0.025 mm (0.001 in.). After successful pressure testing, leak check the containment vessel at its maximum possible equilibration pressure with a leak detector capable of detecting leakage of 1 x 10 sup -8 atm cm sup 3/sec. No detectable leakage is permitted. The Responsible Safety Officer should specify contained-vessel rupture testing of the containment vessel if she or he deems it advisable. After a successful test, label the containment vessel with the working pressure that was the basis for the design calculations and for an operating-temperature range of -29 to +55 degrees C (-20 to +131 degrees F), unless a wider temperature range is required and specified.

MAWP Statements

The MAWP must be stated on all pressure-system (and pressure-vessel) assembly drawings.

Relief Valves Required

The following requirements (Relief Devices) apply in addition to all other sections of this manual. When evacuated vacuum vessels are raised to atmospheric pressure with a pressurized-gas source, a relief device must be installed between the gas source and vacuum vessel. Use ASME code-approved or Singleton Tower, LLC-stocked relief devices whenever possible. The use of any other non-ASME pressure-relief device on high-hazard pressure equipment must be specifically approved by the Responsible Safety Officer. Singleton Tower, LLC personnel are not permitted to set, seal, or stamp relief devices on utility water boilers, steam boilers, and compressed-air receivers that

are under the jurisdiction of the State. Only authorized Plant Maintenance Technicians, and other specifically authorized persons, are permitted to set and seal relief devices on non-coded pressure vessels and systems.

Piping Standards

The following requirements apply in addition to other sections of this manual on Pressurized Flammable-Fluid Piping, and Instruments. Use flexible nonmetallic hose only when it is impractical to use metal pipe or tubing. Any use of nonmetallic hose in pressure systems must be approved by the Responsible Safety Officer. Keep hose lengths as short as possible, protect them from mechanical damage, and anchor the ends to prevent whipping in case of a hose or hose-fitting failure. Avoid sharp hose bends, and do not bend hoses more sharply than recommended by the manufacturer. Replace or repair any hose showing leaks, burns, wear, or other defects. Do not use nonmetallic hose on flammable, toxic, and/or radioactive gas systems. (Gases tend to permeate nonmetallic hoses.) On liquefied-gas systems, ensure that all terminal-block (liquid-withdrawal) valves are rated above the vapor pressure of the liquefied gas at 38 degrees C (100 degrees F) or that a properly set relief valve is permanently installed on the outlet side of each terminal-block valve. All work on pressure equipment requiring an SN must be performed by trained personnel under the direction of an engineer or the Responsible Safety Officer. All systems must be securely fastened to resist seismic forces as specified in the chapter on Seismic Safety. For gas systems use gauges graduated to about twice the MAWP of the system; for liquid systems use gauges graduated to at least the test pressure. Calibrate pressure gauges, switches, and other devices through 120% of their maximum operating points. These devices must be capable of withstanding the operational, and emergency, temperatures of the system, and their material must be compatible with the system fluid. Use safety-type gauges (with shatterproof faces, solid fronts, and blow-out backs) or protect operators with a tested, Singleton Tower, LLC -approved gauge-safety shield. This applies to all gas-pressure gauges over 100 mm in diameter graduated to over 1.4 MPa (200 psi) and to all liquid-pressure gauges over 100 mm in diameter graduated to over 140 MPa (20,000 psi). Safety-type gauges may be required for other combinations of diameter and pressure. Protect a gauge subject to pressure surges or cyclic pulses by installing a throttling device. Ensure that there is no oil in gauges used on gas systems. This is important on oxygen systems since hydrocarbons and oxygen can combine explosively. Clean all gauges to be used on high-purity gas systems. Equip every flammable-gas drop or regulator/hose connection with a flash arrestor or a check valve, a pressure gauge, and a shut-off valve. If the flammable gas is to be (or could be) cross connected with oxygen or compressed air, a flash arrestor must be installed in the flammable-gas line and a check valve in the oxygen or compressed air line. Equip all oxygen drops with a check valve. This applies to all single- and multiple-station installations and portable equipment.

Designer Responsibilities

The person who designs a pressure vessel for use by Singleton Tower, LLC must review the inspection report for all completed pressure vessels to ensure that they are free from manufacturing defects that might affect their use.

Signs

All pressurized gas equipment operating at pressures greater than 500 psig must be painted yellow, must have the operating pressure clearly marked thereon, and must bear a sign, "DANGER, HIGH-PRESSURE EQUIPMENT."

Operator Qualifications

Singleton Tower, LLC will authorize only trained persons to operate pressure equipment. Use of personnel or equipment shields may be required when there is a probability of damage from blast and to protect personnel or equipment from blast. The User must ensure that the following safety precautions are taken:

* Flammable, radioactive, irritant, and/or toxic gases or liquids or oxygen must not be used in systems that are not specifically designed for their use.
* Flammable gas must not be used in combination with oxygen or compressed air unless there is a flash arrestor in the flammable-gas line and a check valve in the oxygen or air line.
* Oxygen and air, because of its oxygen content, can combine explosively with organic materials and flammable gases.

* Acetylene-gas pressure must not exceed 15 psig since acetylene is unstable and will explode spontaneously around 30 psig at room temperature.
* Work may not be performed on pressurized components unless the method has been approved by means of an SN or is specifically authorized by the User or designee.

Depressurized Vessels

Whenever practical, a system or vessel not in use must be depressurized. When a vessel or system is stored under pressure, the pressure, fluid, and date pressurized must be clearly indicated on the vessel. The Shutdown Procedures apply.

Safety Orders

State and federal Safety Orders establish minimum standards for the following:
* The design and construction of all unfired pressure vessels for Plant-Facility Pressure Systems.
* The installation, operation (including issuance of permits), inspection, and repair of air-pressure tanks and liquefied-petroleum-gas (LPG) tanks.
* The design, construction, repair, or alteration of storage tanks for liquefied-natural gas (LNG) at 15 psi or less.
* The installation, use, and repair of anhydrous ammonia tanks.
* The design and construction of pressure vessels for storing and dispensing natural gas for motor fuel and of motor-fuel tanks installed on vehicles not licensed to travel on highways.
* The installation, use, and repair of natural-gas vessels and systems that are not a part of hazardous research equipment.

State Safety Orders are not applicable to the following:
* Pressure vessels that are under the jurisdiction and inspection of the United States Government and that are specifically exempted by the State.
* Pressure vessels, except for LNG tanks, are subject to an internal or external pressure of not more than 15 psi, with no limitation on size, and vessels having an inside diameter less than 6 in., with no limitation on pressure. (However, such vessels must be designed and constructed in accordance with recognized standards, when applicable, or in accordance with good engineering practices concerning pressure-vessel design, with a factor of safety of at least 4, and must be fitted with controls and safety devices necessary for safe operation.)
* Natural-gas vessels and installations subject to the jurisdiction and inspection of the State Public Utilities Commission, Department of Transportation, or Highway Patrol;
*Air-brake tanks installed on units of transportation, including trucks, buses, trains, and streetcars, that are operated by any person, firm, or corporation subject to the jurisdiction and inspection of the Public Utilities Commission, the Department of Transportation, or the Highway Patrol.

The following vessels must be constructed, inspected, and stamped in accordance with the appropriate ASME Boiler and Pressure Vessel Code:
* Air-pressure tanks
* LPG tanks
* Anhydrous-ammonia tanks
* All Plant-Facility pressure vessels
LNG tanks for low-temperature storage at 15 psi or less must be designed, constructed, inspected, and certified in accordance with API (American Petroleum Institute) Standard 620. LPG vaporizers having a volume greater than one U.S. gallon must be constructed in accordance with the California State Boiler and Fired Pressure Vessel Safety Orders, Title 8, Subchapter 2. Permits to Operate are required for LPG tanks and air tanks larger than 1.5 ft sup 3 with relief valves set to open above 150 psi.

OSHA Standards

State Safety Orders establish minimum standards for the design, construction, installation, inspection, operation, and repair of all:

(1) power boilers, including nuclear,

(2) all low-pressure boilers and high-temperature-water boilers, and

(3) any other fired pressure vessels in California not specifically exempted from these Orders.

State Safety Orders are not applicable to:

(1) boilers and fired pressure vessels under the jurisdiction of, and inspected by, the United States Government,

(2) boilers and fired pressure vessels used in household service, and

(3) boilers used exclusively to operate highway vehicles, including automobiles.

Power Boilers

All new power boilers, high-temperature water boilers, and low-pressure boilers must be constructed, inspected, and stamped in full compliance with the ASME Boiler and Pressure Vessel Codes (Refs. 11 and 12) unless the design and construction of the boiler are accepted by the Singleton Tower, LLC Engineering Division as equivalent to Code. Vessels not included in the scope of the ASME Codes must be designed and constructed in accordance with good engineering practice regarding pressure-vessel design for the pressure and temperature to be expected in service, with a factor of safety of at least 4. Good engineering practice (as used in this Manual) must be construed to require details of design and construction at least as safe as required by the rules in the ASME Codes, including shop inspection. State Permits to Operate are required on all boilers and fired pressure vessels except for:

* Low-pressure boilers
* Miniature boilers
* High-temperature water boilers
* Boilers, including forced-circulation boilers, in which none of the following is exceeded: 100 ft sup 2 of heating surface, 16-in. steam-drum inside diameter, 100-psi MAWP, 35-gal. normal water capacity, and 400,000-Btu/hr burner power input.

Pressure Testing Standards

Whenever practical, pressure vessels and systems should be sent to an Assembly Shop or the Plant Maintenance Technician Shops for pressure testing. When this is not practical, the vessel or system must be tested in accordance with the In-Place Pressure Testing procedures described in this manual. Pressure tests performed at Singleton Tower, LLC must be conducted by a Plant Maintenance Technician, a Physical Plant Mechanic, or an Assembly Shop Machinist and must be observed (or conducted) and certified by the Responsible Safety Officer (or designee) or an outside independent Pressure Inspector. Pressure-test and pressure-inspection records must be maintained for the life of the vessel by the organization that certifies the test or inspection.

Pressure Testing

Pressure vessels must be tested in accordance with the rules in this Section, using an inert fluid. Pressure vessels for low-hazard inert systems for operation with nonflammable, nontoxic, and nonradioactive fluids must be hydrostatically tested to at least 1.5 times the MAWP or pneumatically tested to at least 1.25 times the MAWP (only when safety considerations or research requirements do not permit a hydrostatic test). Any special temperature conditions or temperature cycles to which the vessel will be subjected in use must be reproduced as closely as possible during the test. Pressure vessels for high-hazard reactive systems for operation with oxygen or flammable, toxic, and/or radioactive fluids must be tested to at least 2.0 times the MAWP with an inert liquid (preferred) or gas. Any special temperature conditions or temperature cycles to which the vessel will be subjected in use must be reproduced as closely as possible during the test. In addition, consider the need to inspect any vessel ultrasonically or to check the vessel surface for cracks using the

magnetic-particle test or (for nonmagnetic vessels) the fluorescent-penetrant test. During tests of pressure vessels in which the yield strengths of their construction materials is approached, strain-gauge measurements must be made at high-stress locations. Diameter measurements accurate to within plus or minus 0.025 mm (0.001 in.) must also be taken both before and after testing to determine whether detectable plastic yielding has occurred during pressurization. When the strength of the vessel is questionable (old or unknown design), strain-gauge measurements must be made during testing, and diameter measurements must be taken before and after testing. The MAWP for ASME Code pressure vessels made of the acceptable ductile materials listed in the code, must not exceed 0.4 times the test pressure and must comply with a Proof Test to establish MAWP.

Pressure Testing Procedures

Inert-substance (low-hazard) pressure systems that will operate with nonhazardous liquids, inert gases, or compressed air must be tested hydrostatically (preferred) at least 1.5 times the MAWP or pneumatically to at least 1.25 times the MAWP using an inert fluid. Reactive-substance (high-hazard) pressure systems that will operate with oxygen or with flammable, toxic, and/or radioactive fluids must be tested to at least 2.0 times the MAWP using an inert liquid (preferred) or gas.

Standards for Low Pressure Vessels

Pressure vessels and systems must be leak tested at their MAWP after successful pressure testing: Open flames must not be used for leak-testing Leak testing of non pressure-tested or undocumented pressure vessels or systems must be limited to a maximum of 20% of the test pressure (or proposed test pressure).

Leak Testing Required

If a leak is detected during pressure testing of a vessel or system, and it is decided to locate the leak before completing the test, the pressure must be reduced to not over one-half the immediately preceding test pressure while the leak is being located. A system or vessel must not be repaired while it is pressurized unless this is specifically authorized.

Leak Repairs

Any modification to a pressure vessel or system, other than repair or replacement (with an exact duplicate) of existing components, must be approved by the Responsible Safety Officer and recorded in a revision to the applicable engineering drawing, to the SN, and to the OSP (if applicable). The initial pressure test must be repeated before any further use of the modified vessel or system. If an ASME-Code vessel is modified, the Code stamping must be obliterated, and the Responsible Safety Officer must be notified. When pressure equipment has been modified for use at a pressure below the original design pressure, all modifications (e.g., use of fewer bolts in flanged joints) must be approved by the Responsible Designer. All safety requirements for the lower pressure must be met, and the reduced working pressure and the number of bolts or other supports required must be clearly marked on the equipment. If high-strength or other special bolts are required, this must also be clearly marked on the equipment near the bolt holes. Instructions on the precautions to be taken when the modified equipment is operated must be sent to all personnel concerned, and one copy must be filed in the SN file.

Inspections and Re-Testing

All high-hazard equipment that is not a part of Plant Facilities and/or under the jurisdiction of the State must be reinspected at least every three years and retested at the MAWP at least every six years, unless otherwise specified in the SN or OSP. Low-hazard pressure equipment that is not a part of Plant Facilities and/or under the jurisdiction of the State need not be periodically reinspected and retested, unless otherwise specified in an SN or OSP. Pressure reinspection is performed by a Pressure Inspector or by the Responsible Safety Officer and is recorded on a "Pressure Inspection Record" form. The completed form must be signed by the User and sent to Responsible Safety Officer to be kept for the life of the vessel. The result of the retest must be certified and a label must be fixed on the vessel or system as described earlier.

Inspections & Testing

If it is impractical to pressure test a vessel or system at the Mechanical Shop or some other approved location, pressure test it in place, in accordance with the provisions of this Section. The supervisor or user must ensure that in-place retesting of pressure equipment for which he or she is responsible is performed. Although other individuals may be designated to observe and direct testing or retesting, responsibility for safe conduct of the test and safe functioning of tested pressure equipment cannot be delegated. The user and the Responsible Safety Officer must prepare the required test procedure, direct the test personnel, and witness in-place pressure testing of vessels and systems for which he or she is responsible.

Pressure Testing On Site

A written test procedure must be prepared for every high-hazard pressure test conducted in the field. When testing will be conducted in place, the test procedure must be included in (or appended to) the SN or OSP (if applicable). Procedures for in-place testing of high-hazard vessels and systems must be approved. The Building Manager or Area Supervisor must be advised of pressure tests planned to occur in his or her facility, and the Responsible Safety Officer must be notified if toxic and/or radioactive material is involved. All pressure tests must be conducted by a person designated by the Responsible Safety Officer or conducted by a Plant Maintenance Technician, a Physical Plant Mechanic, or a Machinist in the Assembly Shop and must be observed (or conducted) and certified by a member of the Responsible Safety Officer (or designee) or a Pressure Inspector.

Pressure Testing with Liquids

Pressure testing with a gas is more dangerous than testing with a liquid. Therefore, tests must be conducted with liquids, whenever practical. Barricade the equipment being tested, shield the controls and operators, and evacuate all unauthorized personnel from the test area. Signs reading "Danger - High-Pressure Test in Progress - Keep Out" must be posted at all approaches to the test area. For in-place testing with liquids, all air must be removed from both the testing system and the equipment to be tested. Compressed air will expand violently in case of vessel failure. Spongy action of pumping equipment usually indicates the presence of trapped air.

Pressure Testing with Gas

For correct standards, refer to the following: ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 1, American Society of Mechanical Engineers, New York (latest version). ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 2, American Society of Mechanical Engineers, New York (latest version). ASME Boiler and Pressure Vessel Code, Section X, "Fiberglass-Reinforced Plastic Pressure Vessels," American Society of Mechanical Engineers, New York (latest version). ARI Standards, Air-Conditioning and Refrigeration Institute, Arlington, VA (latest version). Code of Federal Regulations 49, Transportation, Parts 100-199, General Services Administration (latest version). Unfired Pressure Vessel Safety Orders, State of California Administration Code, Title 8, Industrial Relations, Part 1, Department of Industrial Relations, Chapter 4, Division of Industrial Relations, Subchapter 1 (latest version). Boiler and Fired Pressure Vessel Safety Orders, State of California Administration Code, Title 8, Industrial Relations, Part 1, Department of Industrial Relations, Chapter 4, Division of Industrial Relations, Subchapter 2 (latest version). OSHA Order 6430.1, General Design Criteria (latest version). American Petroleum Institute, Standard 620 (latest version). ASME Boiler and Pressure Vessel Code, Section I, Power Boilers, American Society of Mechanical Engineers, New York (latest version). ASME Boiler and Pressure Vessel Code, Section IV, Heating Boilers, American Society of Mechanical Engineers, New York (latest version). American National Standard Code, ANSI-B31.1, Power Piping (latest version). American National Standard Code, ANSI-B31.3, Chemical Plant and Refinery Piping (latest version).

Chapter 15 Ladders and Scaffolds

Ladders

Ladders must be in good condition, made of suitable material, of proper length, and of the correct type for the use intended. Damaged ladders must never be used; they should be repaired or destroyed. Ladders used near electrical equipment must be made of a nonconducting material. Stored ladders must be easily accessible for inspection and service, kept out of the weather and away from excessive heat, and well supported when stored horizontally. A portable ladder must not be used in a horizontal position as a platform or runway or by more than one person at a time. A portable ladder must not be placed in front of doors that open toward the ladder or on boxes, barrels, or other unstable bases. Ladders must not be used as guys, braces, or skids. The height of a stepladder should be sufficient to reach the work station without using the top or next to the top steps. Bracing on the back legs of stepladders must not be used for climbing. The proper angle (75-1/2 degrees) for a portable straight ladder can be obtained by placing the base of the ladder a distance from the vertical wall equal to one quarter of the vertical distance from base to top of ladder's resting point. Ladders must be ascended or descended facing the ladder with both hands free to grasp the ladder. Tools must be carried in a tool belt or raised with a hand line attached to the top of the ladder. Extension ladders should be tied in place to prevent side slip.

Scaffolds All scaffolds, whether fabricated on site, purchased, or rented must conform with the specifications found in ANSI A10.8, Safety Requirements for Scaffolding. Rolling scaffolds must maintain a 3:1 height to base ratio (use smaller dimension of base). The footing or anchorage for a scaffold must be sound, rigid, and capable of carrying the maximum intended load without settling or displacement. Unstable objects such as barrels, boxes, loose brick, or concrete blocks must not be used to support scaffolds or planks. No scaffold may be erected, moved, dismantled, or altered unless supervised by competent persons. Scaffolds and their components must be capable of supporting at least four times the maximum intended load without failure. Guard rails and toe boards must be installed on all open sides and ends of scaffolds and platforms more than 10 ft above the ground or floor. Scaffolds 4 feet to 10 feet in height having a minimum horizontal dimension in either direction of less than 45 inches must have standard installed on all open sides and ends of the platform. Wire, synthetic, or fiber rope used for suspended scaffolds must be capable of supporting at least 6 times the rated load. No riveting, welding, burning, or open flame work may be performed on any staging suspended by means of fiber or synthetic rope. Treated fiber or approved synthetic ropes must be used for or near any work involving the use of corrosive substances. All scaffolds, bosun's chairs, and other work access platforms must conform with the requirements set forth in the Federal Occupational Safety and Health Regulations for Construction, 29 CFR 1926.451, except where the specifications in ANSI A10.8 are more rigorous.

Floors Workroom floors must be in a clean and, as much as possible, dry condition. Drainage mats, platforms, or false floors should be used where wet processes are performed. Floors must be free from protruding nails, splinters, holes, and loose boards or tiles. Permanent aisles or passageways must be marked. Floor holes must be protected by covers that leave no openings more than one inch wide. Floor openings into which persons can accidentally walk must be guarded by standard railings and toeboards. Open-sided floors, platforms, and runways higher than four feet must be guarded by standard railings. Toe boards must be used wherever people can pass below or hazardous equipment or materials are

below.

Fall Arrester Systems Required

When workers are required to work from surfaces that are in excess of 7-1/2 ft above an adjacent safe workplace and are unprotected by railings, the following procedures and guidelines must be applied: Before selecting personnel for work at elevated work stations, supervisors must consider the workers' physical condition, such as medical problems, fear of heights, and coordination. The Medical Services Department should be contacted for information in this regard. Approved fall-arrester systems are required for all work at heights of 10 or more feet. A recommended fall-arrester system consists of a full body-harness, a lanyard consisting of 1⁄2 inch nylon rope or equivalent with a breaking strength of 5400 lb and a maximum length to provide for a fall no greater than 6 feet, Sala-type fall-arrester block (optional), and an anchored hook-up location. Alternate equipment must be approved by the Responsible Safety Officer. Fall-arrester systems are recommended for light work at heights between 7-1/2 and 10 feet. Fall-arrester systems are not required when work is being done while standing on a ladder. Ladders should be tied off. Use of a controlled descent device is not necessary unless it is impossible to reach a stranded person by another means. The Responsible Safety Officer will advise, on request, regarding usage and procedures. It is the responsibility of the supervisor to plan the intended work sufficiently to ensure that job planning and proper precautions have been taken. The Responsible Safety Officer is available for consultation.

Personnel Platforms

Work may be performed from a crane-suspended platform where another procedure is not possible because of structure design or work site conditions. Personnel platforms must be designed by a qualified engineer and reviewed by the Responsible Safety Officer. The suspension system must minimize tipping. The platform must be designed with a minimum safety factor of 5 based on the ultimate strength of the members, and the design must conform to 29 CFR 1926.550(g).

Chapter 16 Seismic Safety

Intent It is Singleton Tower, LLC's policy to design and construct its physical plant and program facilities to prevent the loss of life and to minimize the risk of personal injury, program interruption, and property damage due to earthquakes.

Employee Responsibility Each worker is responsible for the seismic safety of any equipment he or she brings into the work area. Such things as book cases and heavy items must be securely fastened to the building. Also, shelves should be guarded to prevent falling objects. A bar or chain is recommended across all open shelving.

Miscellaneous Hazards Earthquake safety measures have been developed at Singleton Tower, LLC to protect personnel in the event of a seismic disturbance. Sufficient protection is required to allow time for personnel to exit an endangered area without injury. All equipment, hardware, and objects inside and outside of buildings must be adequately restrained and/or anchored to ensure that they do not block escape routes during seismic ground motion. The anchoring system must be analyzed to ensure that the primary support (floor, wall, etc.) is strong enough to support the restrained hardware and equipment during seismic motion.

Chapter 17 Tools

Company Provided Tools

Singleton Tower, LLC provides hand and powered portable tools that meet accepted safety standards. A damaged or malfunctioning tool must not be used; it must be turned in for servicing and a tool in good condition obtained to complete the job. Employees must use the correct tool for the work to be performed; if they are unfamiliar with the operation of the tool, they must request instruction from their supervisor before starting the job. Supervisors are responsible for ensuring that their subordinates are properly trained in the operation of any tool that they are expected to operate. An employee is not permitted to use a powder-actuated tool unless instructed and licensed by the manufacturer.

Grounding

Tools that are not double-insulated must be effectively grounded and tested. Testing must be accomplished before the initial issue, after repairs, and after any incident that could cause damage, such as dropping or exposure to a wet environment. Grounded tools must always be used with an effectively grounded circuit. Any extension cord used with a grounded tool must be a three-wire, grounded type. Electric-powered hand tools used on construction sites, on temporary wired circuits, or in wet environments will be used in conjunction with an approved ground fault circuit interrupter (GFCI). The responsibility for implementing and maintaining this program rests with the individual supervisors involved. Tool testing equipment will be maintained by the Responsible Safety Officer. Documentation of tool testing will be maintained by the group owning powered hand tools. Tools maintained in a tool crib and tested prior to issue are exempted from this requirement. Repairs of defective tools will only be made by qualified electrical personnel.

Shop Rules

Any Singleton Tower, LLC facility housing shop tools is defined by OSHA as a shop. It is the responsibility of the person in charge of each shop to ensure compliance with the following practices:

* Shop machines and tools are to be used only by qualified personnel. It is the responsibility of the person in charge of the shop to render a judgment as to who is qualified.
* The person in charge will take whatever action is deemed necessary to prevent a personal injury or damage to equipment.
* Equipment guards and protective devices must be used and must not be compromised.
* Approved eye protection (visitor's glasses) must be worn by anyone entering and/or passing through shop areas.
* Approved industrial safety eye protection must be worn by anyone working in a posted shop area.
* Shoes or boots covering the whole foot must be worn in shop areas.
* Persons using machine tools must not wear clothing, jewelry, or long hair in such a way as to represent a safety hazard.

Chapter 18 Traffic and Transportation

Official Vehicle Use

The Singleton Tower, LLC requires that an operator hold a valid driver's license for the class of vehicle that he/she is authorized to operate. Persons intending to operate forklifts are required to successfully complete the appropriate course as outlined in this manual.

Responsibility

Each Division Director and Department Head is responsible for restricting the use of Company-furnished vehicles to official Company business only. They are also responsible for limiting use of such vehicles to properly authorized personnel. Use of an official vehicle for an employee's personal convenience or benefit constitutes misuse and is prohibited. Employees who misuse Company vehicles are subject to disciplinary action and financial responsibility for any accident. All drivers of Company vehicles are responsible for reporting any damage or deficiency to their supervisor or motor pool director. Repairs, adjustments, and maintenance can only be accomplished if the driver adequately documents and reports these items. Failure to report unsafe vehicle conditions can result in an accident.

Safety Belts

Employees operating or riding in company-furnished vehicles, or personal vehicles on official company business, are required to wear safety belts at all times. The driver should instruct the passengers to fasten their safety belts before operating the vehicle.

Accidents

Any accident involving Company vehicles (including private, rented, or leased vehicles used on official Company business) must be reported to the driver's supervisor. If the driver is unable to make a report, another employee who knows the details of the accident must make the report. It is Singleton Tower, LLC's policy that employees should not admit to responsibility for vehicle accidents occurring while on official business. It is important that such admissions, when appropriate, be reserved for the company and its insurance carrier. The law requires that each driver involved in a vehicle accident must show his/her license on request by the other party. Be sure to obtain adequate information on the drivers involved as well as on the owner of the vehicles. Names, addresses, driver's license numbers, vehicle descriptions, and registration information are essential. In addition, a description of damages is needed for completion of accident reports. If the accident is investigated by off-site police agencies, request that a copy of the police report be sent to Singleton Tower, LLC, or obtain the name and department of the investigating officer. A printed card titled "In Case of Accident" is kept in each official vehicle to assist in collecting required information. In case of collision with an unattended vehicle (or other property), the driver of the moving vehicle is required by law to notify the other party and to exchange information pertaining to the collision. If unable to locate the other party, leave a note in, or attached to, the vehicle (or other property) giving the driver's name, address, and vehicle license number. The driver of any Singleton Tower, LLC vehicle involved in an accident must also complete a Company Motor Vehicle Accident Report and submit it to his/her supervisor within one work day of the accident. The supervisor should interview the driver and complete the supervisor's portion of the report. Within two work days of the accident, the completed form and vehicle must be taken to the Administration Office so that damages may be estimated and repairs scheduled. Forms for obtaining appropriate information about an accident are carried in the vehicle or may be obtained from Administration. The Responsible Safety Officer will receive copies of all accident reports and will prepare any required OSHA reports.

Chapter 19 Hazard Warnings

Introduction

Every reasonable method to warn employees of hazards and dangers and to inform them of the actions required must be utilized. Signs, characteristic lights, and audible alarms as additional safeguards for built-in mechanical and physical protection must be used. To ensure uniform response by personnel, the warning signs and devices must be of the same type for similar hazards. Obtaining and installing the warning systems is the responsibility of the group needing them.

Contents and Configuration

Signs must conform to the colors, symbols, lettering size, and proportions as specified by Singleton Tower, LLC, except that radiation signs must conform to the requirements stated in 10 CFR 20. Every warning sign must include the following components:

* An approved heading that indicates the relative hazard.
* A statement of the type of hazard.
* A statement of what to do or not to do in the area .

Chapter 20 Carcinogens

Introduction

This section of the Safety Manual describes the recommendations and requirements established to govern the use of substances that pose a carcinogenic risk. All personnel using chemical carcinogens are expected to be familiar with these guidelines and conduct their operations accordingly.

Responsibilities

The responsibilities of various groups involved with chemical safety at Singleton Tower, LLC are described below:

Responsible Safety Officer:

* Determines if the use of a carcinogen creates a significant potential for occupational exposure. * Evaluates operations for compliance with OSHA mandated standards. * Provides technical guidance to personnel regarding the selection of appropriate laboratory practices and engineering controls.

* Investigates all reported incidents that result in exposure of personnel or the environment to chemical carcinogens and recommends corrective actions to reduce the potential for recurrence.

* Supervises cleanup operations where incidents have resulted in significant contamination of laboratory areas or personnel.

* Updates and transmits list of carcinogens to the Purchasing Department. * Authorizes issue of carcinogens stocked at the Singleton Tower, LLC Storeroom.

Purchasing Department:

* Specifies special distribution procedures and purchase orders for carcinogens.

Materials Management Department:

* Obtains approval from the Responsible Safety Officer before issuing carcinogens.

Receiving Department:

* Notifies the Responsible Safety Officer of the receipt of carcinogens designated for special distribution (Distribution Category A).

Supervisor:

* Employs and ensures the use of appropriate practices, engineering controls, and personal protective equipment that reduce the potential for exposure as low as reasonably achievable.

* Informs employees under his/her supervision of the potential hazards associated with the use of carcinogens and provides proper training and instruction in the use of laboratory practices, engineering controls, and emergency procedures.

* Reviews operating procedures with the Responsible Safety Officer before the initiation of an operation or when significant changes occur in an ongoing operation.

* Reports to the Medical Services Department any incident that involves the exposure of personnel to carcinogens. * Reports to the Responsible Safety Officer any incident that results in danger of environmental contamination from carcinogens.

* Provides any necessary assistance during accident investigations.

Other Company Personnel:

* Know and comply with safety practices required for the assigned task.

* Wear appropriate protective clothing.

* Report all unsafe conditions to the laboratory supervisor.

* Attend appropriate training in safety procedures for handling and using carcinogenic materials.

* Report to the Responsible Safety Officer when pregnant to review working conditions.

* Report to the immediate supervisor and the Responsible Safety Officer all facts pertaining to incidents resulting in exposure to carcinogens or in environmental contamination.

Practices and Controls

The practices and engineering controls included in this section provide general safeguards that are recommended for the use of chemical carcinogens. To select the appropriate safeguards, knowledge is required of the physical and chemical properties, the proposed use, the quantity needed, the carcinogenic and other toxic hazards, and the applicable health and safety standards. Careful judgment is therefore essential in planning any activity that involves chemical carcinogens. Personnel within the Responsible Safety Officer's Department are available to assist the laboratory supervisor in selecting the appropriate safeguards. Carcinogen Safety Data Sheets provide details of chemical and physical properties, hazards, and safe operational procedures for specific carcinogens.

* Wear gloves appropriate to the task. Discard after each use and immediately after any obvious contact.
* Wear appropriate eye protection. The type of eyewear used will depend upon the hazard presented by the operation and chemical in use.
* Contact lenses should be removed.
* Do not eat, drink, smoke, chew gum or tobacco, or apply cosmetics in an area where carcinogens are used or stored.
* Do not pipette by mouth - use mechanical aids.
* Wash hands immediately after the completion of any procedure. Wash immediately after an exposure, or if appropriate, shower the affected area.
* Provide respirators for emergency use. (Personnel who will use respirators must have medical approval and be properly trained before use.)

Operational Practices:

* Label all primary and secondary containers and place warning signs on entrances to work or storage areas. To obtain appropriate labels and signs, call the Responsible Safety Officer.
* Limit entry to only personnel authorized by the supervisor for entry to work or storage areas. Women who are pregnant must consult with the Medical Services Department before the start of any activity involving chemical carcinogens.

Maintenance and Emergency Storage Areas:

Cover work surfaces with stainless steel or plastic trays, absorbent paper with a moisture-proof lining, or other impervious material. Decontaminate or discard the protective covering materials after the procedure has been completed. Conduct aerosol-generating procedures or procedures involving volatile carcinogens in a chemical fume hood, a glove box, or other suitable containment equipment. Examples of aerosol-producing operations opening of closed vessels; transfer operations; preparation of mixtures; blending; sonification; open vessel centrifugation. Capture vapors or aerosols produced by analytical instruments with local exhaust ventilation or ventilation into a chemical fume hood. Decontaminate obviously contaminated equipment. Transfer carcinogens in tightly closed containers placed within a durable outer container.

Maintain an inventory of all carcinogens including the quantities acquired, dates of acquisition, and disposition. Keep working quantities to a minimum; do not exceed the amounts required for use in one week. This does not include amounts stored in a designated area or a central cabinet. Dissolve finely divided powdered carcinogens, if possible, into a liquid. This reduces the possibility of generating an aerosol. Use mixtures that are as dilute as possible. Place contaminated materials in a closed plastic bag and sealed primary container. Place the primary container in a durable box before transporting. Label each primary container with content, amount, physical state, and percentage breakdown when dealing with a mixture. Each box must have a complete list of contents or description written on an official Hazardous Material packing list. To obtain blank packing lists, contact the Responsible Safety Officer.

Chlorinated Hydrocarbons

The chlorinated hydrocarbons as a whole have many industrial as well as laboratory uses. At Singleton Tower, LLC they are commonly used as cleaners, degreasers, paint removers, solvents, and extractants.

Hazards

Most of these compounds have an anesthetic (narcotic) effect, causing workers to feel "drunk," become unconscious, or even die if the amount of inhaled vapor is excessive. Individuals working around moving machinery can be subject to accidents when their judgment and coordination are impaired by the anesthetic effects of inhaled solvents. Usually it is the anesthetic effect that is responsible for sudden unconsciousness of persons exposed to solvents in tanks, pits, and other confined spaces. Trichloroethylene, ethylene dichloride, and chloroform are examples of compounds that are powerful anesthetics. Some, but not all, of the chlorinated hydrocarbons are strong poisons that damage the liver, kidneys, nervous system, and/or other parts of the body. This damage may be permanent or even cause death, although recovery from lesser exposures does occur. Single exposures to higher concentrations of vapors, as well as repeated exposure to small concentrations can produce symptoms of poisoning. These symptoms most often come on gradually, with nausea, loss of appetite, vomiting, headaches, weakness, and mental confusion most often noted. Carbon tetrachloride, tetrachloroethane, and 1,1,2-trichloroethane are examples of compounds that are strong poisons. All chlorinated hydrocarbons on repeated contact with the skin can cause rashes (dermatitis) because of their ability to remove the protective fats and oils from the skin. A few of these solvents are known to be capable of entering the body through contact with the skin. In addition, many of these compounds are highly irritating to the membranes around the eyes and in the nose, throat, and lungs. Examples of chlorinated hydrocarbons that have irritant properties are ethylene dichloride and chloroform. Some compounds are human suspect carcinogens, such as carbon tetrachloride and chloroform. In studies on laboratory animals, several chlorinated hydrocarbons have been linked to the production of cancer. These compounds are ethylene dichloride, perchloroethylene, and trichloroethylene. At present, there is no direct evidence associating these compounds with an increased risk of cancer in humans. When heated, these compounds can decompose, forming highly toxic fumes of phosgene, hydrochloric acid, and chlorine. Most of the chlorinated hydrocarbons are non flammable; however, there are exceptions. Because of their inherent properties, these compounds are harmful to varying degrees. For questions concerning the hazards of a specific compound, contact the Responsible Safety Officer.

Precautions

Characteristics including TLV, volatility, and flammability of compounds always must be taken into careful consideration in selecting a compound in order to minimize the health hazards connected with its use. 1,1,1-trichloroethane (ethyl chloroform) is recommended for degreasing operations. If there is a possibility of skin or eye contact, wear the appropriate protection equipment. Gloves made of impervious material should be worn for hand protection. Barrier creams are in no instance as protective as impervious gloves. However, if finger dexterity is an absolute requirement, a solvent resistant ointment may be used in some instances. For high vapor concentrations, control by local exhaust ventilation or chemical fume hoods is necessary. Chlorinated hydrocarbons should be stored in cool, dry, and well-ventilated areas. Containers should be checked for leaks because metal corrosion can occur from hydrochloric acid produced by the decomposition of the solvent. Decomposition may occur under conditions of high temperature, exposure

to moisture, and exposure to ultraviolet light. Compounds, both in the original containers and in containers used by employees, should be labeled so that the potentially injurious substances are plainly identified. Labels for perchloroethylene, trichlorethylene, 1,1,1-trichloroethane, and carbon tetrachloride can be obtained at the Singleton Tower, LLC Central Storeroom. Chlorinated hydrocarbons must be placed in an organic liquid waste can for disposal. When the waste can is full, Decontamination and Waste Disposal personnel must be called to pick it up.

Fiberglass

Fiberglass is found in many materials (such as flexible duct, Nema G-10, and electrical wire insulation) used at the Company.

Hazards

Irritation of the exposed skin, a common complaint among persons working with this material, is the result of the mechanical irritation from small glass fibers. The sensation varies from an itch to a prickling or burning sensation. Common locations involved are the arms, face, or neck. Another cause of dermatitis is contact with fiberglass binders or coating materials. Except for skin irritation, there is no other known health hazard associated with exposure to fiberglass particles. Results of medical research, including examinations of hundreds of persons who have worked in fiberglass plants for as long as 25 to 30 years, give evidence that fiberglass is inert and non injurious to the person's overall health. It will not cause silicosis.

Precautions

Persons with skin problems should consult the Medical Services Department before working with fiberglass. Wear loose-fitting clothing and change daily. Adherent fibers on the skin should be washed off with an ample amount of lukewarm or cool water. Air hoses and brooms should not be used to clean off fibers from the body because these methods may drive the fibers deeper into the skin. Showering at the end of a work shift is advisable. Plastic binders should be fully cured before working on fiberglass laminates. Use vacuum pickup units when machining fiberglass parts. Practice good housekeeping. Some skin protective creams may be of benefit. At home, clothing should be washed separately in a tub or basin. Washing machines should not be used. Ideally, rubber gloves should be worn. The tub or basin should then be fully rinsed.

Flammable Liquids

Class B combustibles are flammable and combustible liquids (including oils, greases, tars, oil based paints, lacquers) and flammable gases. Flammable aerosols (spray cans) are also treated here. Water should not be applied to fire in a Class B combustible. The use of water may float burning liquids, causing the fire to spread more rapidly. Class B fires are usually extinguished by excluding the air around the burning liquid. This is accomplished by one of several approved types of fire extinguishing agents, e.g., carbon dioxide, ABC multipurpose dry chemical, and Halon 1301 (a vaporizing liquid that breaks the flame front). Technically, flammable and combustible liquids do not burn. However, under appropriate conditions, they generate sufficient quantities of vapors to form ignitable vapor- air mixtures. As a general rule, the lower the flash point of a liquid, the greater the fire and explosion hazard. (The flash point of a liquid is the minimum temperature at which it gives off sufficient vapor to form an ignitable mixture with the air near its surface or within its containment vessel.) Many flammable and combustible liquids also pose health hazards. It is the responsibility of the user to ensure that all Class B combustibles are properly identified, labeled, handled, and stored. If assistance is required, contact the Responsible Safety Officer Safety.

Classifications

Flammable and combustible liquids are defined and divided into classes as shown below.

Flammable Liquids (Class I): Liquids having flash points below 100 F (37.8 C) and having vapor pressures not exceeding 40 pounds per square inch (absolute) at 100 F (37.8 C). Flammable Class I liquids are subdivided as follows:

Class IA. Liquids having flash points below 73F (22.8C) and boiling points below 100F (37.8C). Flammable aerosols (spray cans) are included in Class IA.

Class IB. Liquids having flash points below 73F (22.8C) and having boiling points at or above 100F (37.8C).

Class IC. Liquids having flash points at or above 73F (37.8C) and below 100F (37.8C).

Combustible Liquids (Classes II and III): Liquids having flash points at or above 100F (37.8C). Combustible liquids in Class II and Class III are subdivided as follows:

Class II. Liquids having flash points at or above 100F (37.8C) and below 140F (60.0C).

Class IIIA. Liquids having flash points at or above 140F (60.0C) and below 200F (93.4C).

Class IIIB. Liquids having flash points at or above 200F (93.4C).

Unstable (Reactive) Liquids: These are liquids that in the pure state, or as commercially produced or transported, will vigorously polymerize, decompose, combine, or become self-reactive under conditions of shock, pressure, or temperature. Use of such materials must have prior approval from the Responsible Safety Officer on a case-by-case basis.

Fire Hazards

Fires involving Class B combustibles are especially dangerous because they release heat quickly, causing the fire to spread rapidly. The handling and use of these combustibles presents the most significant single source of fire hazard. Misuse or improper storage threatens not only the employee and the entire building, but all fellow employees. Liquids with flash points below room temperature (Class IA and IB liquids) continually emit sufficient quantities of vapors to be ignitable, except when chilled to temperatures below their flash points. Even when chilled, if spilled on a floor or work surface, they will heat rapidly and pose severe fire and explosion hazards. Liquids with flash points above room temperature (Class IC, II, IIIA, and IIIB liquids) can easily be heated to the point at which they will create flammable vapor-air mixtures. Flammable liquid vapors are heavier than air. They can travel for appreciable distances and accumulate in low places. Since it is the vapor of flammable liquids that burns, the fire hazard may not be confined to the immediate vicinity of actual use. Vapors can be ignited several hundred feet from the point of vapor generation. Flammable liquid vapors generally have low ignition-energy requirements and can often be ignited by small sparks from electrical motors, switches, relay contacts, etc.

Precautions

Recommended precautions are based on the properties of the liquid to be used and the intended application. The user cannot make a correct decision on necessary precautions unless the properties of the liquid are known and the intended use is reviewed from a safety standpoint. There must be sufficient ventilation to preclude the accumulation of flammable vapors. Flammable liquids should be used in a fume hood or with local exhaust ventilation. Normal room ventilation may be sufficient to permit small-scale use of flammable liquids (milliliter quantities). However, if larger quantities of liquid must be used in such facilities, it will be necessary to provide additional ventilation by opening doors and windows or providing some form of temporary exhaust ventilation. Extreme care must be exercised when using flammable liquids in closed spaces with minimal ventilation (such as glove boxes and tanks). Even milliliter quantities of flammable liquids can cause the build-up of explosive mixtures in the confined space.

Fluorocarbon Solvents

Fluorocarbon solvents are organic compounds containing fluorine. Common names for some members of this family are Freon-TF, Freon-MF, and Freon-BF.

Hazards

The vapors are four to five times heavier than air and tend to accumulate in tanks, pits, and low places. This displaces the oxygen, which can cause suffocation, or the vapors themselves may be toxic in high concentrations. Fluorocarbon solvents will dissolve and extract the natural oils present in the skin. If contact is prolonged, the skin may become dry and perhaps cracked. The vapors have little or no effect on the eyes. If the liquid is splashed in the eyes, temporary redness may be produced. Lower boiling liquids may cause freezing if splashed on the skin or in the eyes. Fluorocarbon vapors decompose when exposed to high temperatures. Toxic fumes such as hydrofluoric acid, hydrochloric

acid, and phosgene may be formed. Fluorocarbon solvents are non flammable.

Precautions

Contact the Responsible Safety Officer if fluorocarbon solvents are used in enclosed areas such as tanks and pits. Forced-air ventilation and air supplied respirators may be required. Avoid contact with hot surfaces, electric heating elements, or open flames. If toxic fumes are formed, good ventilation will be required. Wear gloves made of neoprene or equivalent when there is the possibility of prolonged or repeated skin contact with the liquid. Wear protective clothing and eye goggles if the liquid may be splashed.

Hazardous Gases

The general precautions for compressed gas cylinders must be followed. Large cylinders of hazardous gases should not be purchased if it is possible to use small cylinders. The color coding must not be used on the cylinder to identify its contents. These colors have not been standardized by the suppliers. Read the label placed on the cylinder. The Responsible Safety Officer must be notified of all hazardous gases ordered to ensure that adequate facilities are available (e.g., fume hoods, safety showers, alarms, fire extinguishers, respirators, etc.) and that the user is aware of the hazardous properties of the material. When hazardous gases are received by Singleton Tower, LLC, the Responsible Safety Officer will pick up and deliver all cylinders of J-size and smaller. Larger cylinders will be released by the Responsible Safety Officer delivery by Singleton Tower, LLC or contractor employees. Cylinders should be returned to the vendor as soon as possible after use. It is not uncommon for gas cylinders to develop leaks during storage. Arrangements for pickup of used cylinders are made by contacting the Responsible Safety Officer. Before pickup, the cylinder valve must be closed, the regulator or needle valve must be removed, and the valve cover put back on the cylinder. Arrangements for pickup of cylinders that are leaking or have valves that are stuck open should be made by contacting the Responsible Safety Officer.

Oxygen Pumping in Vacuum Systems

Oxygen in concentrations 25% by volume should not be introduced into a mechanical vacuum pump charged with hydrocarbon oil, which is a combustible fluid. During compression in the pump, the pressure of the oxygen may reach as high as 2-3 atmospheres, and at this pressure it may cause an explosion if combined with a hydrocarbon oil.

Required Solution

Pump manufacturers recommend the use of an inert fluid in place of hydrocarbon oil. Various fluids are available, such as Fomblin or HaloVac (Sargent-Welch Science Company). Modification of the pump may be required because these fluids have high molecular weights and high specific gravities and may be incompatible with seals. An inquiry to the pump manufacturer is recommended. Pumps modified for oxygen service shall be permanently identified and used only with the specified fluid.

Peroxidizable Compounds

Isopropyl ether, ethyl ether, dioxane, tetrahydrofuran, and other alkyl ethers form peroxides on exposure to air and light. Because these chemicals are packaged in an air atmosphere, peroxides can form even though the containers have not been opened. The longer the storage period of these chemicals, the greater the amount of dangerous peroxides that may form. Experience has shown that isopropyl ether is by far the worst offender.

Hazards

These peroxides are highly unstable, explosive chemicals that may detonate if subjected to high temperature, shock, or friction. Concentration by evaporation or distillation of the ether increases the risk of detonation.

Polychlorinated Biphenyls (PCBs)

PCBs are a broad class of nonflammable, synthetic, chlorinated hydrocarbon insulating fluids used mostly in capacitors and transformers at Singleton Tower, LLC. Synonyms include askarel, aroclor, inerteen, pyranol, therminol, and many others.

Hazards Prolonged skin contact with PCB oils can cause skin irritation and occasionally the formation of temporary acne like cysts. Eye contact can cause severe irritation and inflammation. Breathing the vapor or mist from heated oil can cause respiratory irritation. PCBs are listed as suspect carcinogens. Because of their inert character and stability under extreme physical stresses, PCBs do not break down in the environment. PCBs are widely dispersed in the environment and can accumulate in foods found in the human diet.

Precautions When working with PCB-contaminated equipment or on PCB spills, the appropriate personnel must wear protective equipment, including viton gloves, coveralls, and splash goggles. Small spills can be absorbed in vermiculite or Sorb-all. Place waste material in plastic bags and call the Decontamination and Waste Disposal Unit. All equipment containing PCBs must be disposed of through the Responsible Safety Officer. In case of large spills or explosion of a capacitor, evacuate all personnel from the area. Call the Fire Department, 911, for assistance. Provide or maintain ventilation in the affected area, if possible. If entry to the area is necessary, self-contained breathing apparatus must be worn. All large capacitors containing PCBs and all PCB transformers must be labeled. Banks of capacitors may be labeled as a unit. Capacitors and transformers within a confined area with limited access may be labeled at each point of entry. Labels may be obtained at the Central Storeroom or from the Responsible Safety Officer. A record of the quantity, type, movement, and disposal of PCB items must be maintained by each owner. A yearly update of the record is made. Calibration of Gas Detection Systems: This policy covers the calibration of systems to detect flammable, toxic, or pyrophoric gases being used at Singleton Tower, LLC. Specifications of Calibration: The specifications of the calibration technique and the frequency of calibration must be described in the Operational Safety Procedure governing the operation of apparatus with which the gas-detecting system is associated. It is recommended that calibrations of these systems be performed by an approved outside contractor or by Scientific and Technical Resources personnel. In all cases calibrations must be carried out by an independent party: calibration of these systems may not be carried out by the group operating the apparatus. When changes are required in the Operational Safety Procedure, approval of the new procedure will be coordinated by the Responsible Safety Officer.

Chapter 21
Agriculture

Potable Water
Potable water shall be provided in all places of employment, for drinking, washing of the person, cooking, washing of foods, washing of cooking or eating utensils, washing of food preparation or processing premises, and personal service rooms. Portable drinking water dispensers shall be designed, constructed, and serviced so that sanitary conditions are maintained, shall be capable of being closed, and shall be equipped with a tap. Open containers such as barrels, pails, or tanks for drinking water from which the water must be dipped or poured, whether or not they are fitted with a cover, are prohibited. A common drinking cup and other common utensils are prohibited.

Toilet Facilities
Except as otherwise indicated in this section, toilet facilities, in toilet rooms separate for each sex, are provided in all places of employment. The number of facilities to be provided for each sex shall be based on the number of employees of that sex for whom the facilities are furnished. Where toilet rooms will be occupied by no more than one person at a time, can be locked from the inside, and contain at least one water closet, separate toilet rooms for each sex need not be provided. Where toilet facilities will not be used by women, urinals may be provided instead of water closets. This requirement does not apply to mobile crews or to normally unattended work locations so long as employees working at these locations have transportation immediately available to nearby toilet facilities which meet the other requirements of this section. The sewage disposal method shall not endanger the health of employees. Toilet paper with a holder shall be provided for every water closet. The requirements of this subsection do not apply to mobile crews or to normally unattended work locations.

Showers
Showers are mandatory on exit from the job site when residual chemicals allowed to remain on the skin between work shifts could cause a serious occupational illness. The employer is responsible for identifying such potential hazards and for insisting that the employee shower at the end of the shift. Whenever showers are required the showers shall be provided, as follows: One shower shall be provided for each 10 employees of each sex, or numerical fraction thereof, who are required to shower during the same shift. Body soap or other appropriate cleansing agents convenient to the showers shall be provided as specified in this section. Showers shall be provided with hot and cold water feeding a common discharge line. Employees who use showers shall be provided with individual clean towels. Change rooms equipped with storage facilities for street clothes and separate storage facilities for the protective clothing shall be provided, if employees are subject to contamination with toxic materials.

Food and Beverages on Premises

This section shall apply only where employees are permitted to consume food or beverages, or both, on the premises. Eating and drinking areas: No employee shall be allowed to consume food or beverages in a toilet room nor in any area exposed to a toxic material. Waste disposal containers: Receptacles, constructed of smooth, corrosion resistant, easily cleanable, or disposable materials, shall be maintained in a clean and sanitary condition. Receptacles shall be provided with a solid tight-fitting cover unless sanitary conditions can be maintained without use of a cover. Sanitary storage: No food or beverages shall be stored in toilet rooms or in an area exposed to a toxic material. Food handling: All employee food service facilities and operations shall be carried out in accordance with sound hygienic principles. In all places of employment where all or part of the food service is provided, the food dispensed shall be wholesome, free from spoilage, and shall be processed, prepared, handled, and stored in such a manner as to be protected against contamination.

Temporary Labor Camps

All sites used for camps shall be adequately drained. They shall not be subject to periodic flooding, nor located within 200 feet of swamps, pools, sinkholes, or other surface collections of water unless such quiescent water surfaces can be subjected to mosquito control measures. The camp shall be located so the drainage from and through the camp will not endanger any domestic or public water supply. All sites shall be graded, ditched, and rendered free from depressions in which water may become a nuisance. All sites shall be adequate in size to prevent overcrowding of necessary structures. The principal camp area in which food is prepared and served and where sleeping quarters are located shall be at least 500 feet from any area in which livestock is kept. The grounds and open areas surrounding the shelters shall be maintained in a clean and sanitary condition free from rubbish, debris, waste paper, garbage, or other refuse. Whenever the camp is closed for the season or permanently, all garbage, manure, and other refuse shall be collected and disposed of as to prevent nuisance. All abandoned privy pits shall be filled with earth and the grounds and buildings left in a clean and sanitary condition. If privy buildings remain, they shall be locked or otherwise secured to prevent entrance. The camp shall be constructed in a manner which will provide protection against the elements. Each room used for sleeping purposes shall contain at least 50 square feet of floor space for each occupant. At least a 7-foot ceiling shall be provided. Beds, cots, or bunks, and suitable storage facilities such as wall lockers for clothing and personal articles shall be provided in every room used for sleeping purposes. Such beds or similar facilities shall be spaced not closer than 36 inches both laterally and end to end, and shall be elevated at least 12 inches from the floor. If double-deck bunks are used, they shall be spaced not less than 48 inches both laterally and end to end. The minimum clear space between the lower and upper bunk shall be not less than 27 inches. Triple-deck bunks are prohibited. The floors of each shelter shall be constructed of wood, asphalt, or concrete. Wooden floors shall be of smooth and tight construction. The floors shall be kept in good repair. All wooden floors shall be elevated not less than 1 foot above the ground level at all points to permit free circulation of air beneath. Nothing in this section shall be construed to prohibit "banking" with earth or other suitable material around the outside walls in areas subject to extreme low temperatures. All living quarters shall be provided with windows the total of which shall be not less than one-tenth of the floor area. At least one-half of each window shall be so constructed that it can be opened for purposes of ventilation. All exterior openings shall be effectively screened with 16-mesh material. All screen doors shall be equipped with self-closing devices. Each dwelling unit shall have at least 70 square feet of floor space for the first occupant and at least 50 square feet of floor space for each additional occupant. A separate sleeping area shall be provided for the husband and wife in all family units in which one or more children over six years of age are housed. In camps where cooking facilities are used in common, stoves (in ratio of one stove to 10 persons or one stove to two families) shall be provided in an enclosed and screened shelter. Sanitary facilities shall be provided for storing and preparing food. If a camp is used during cold weather, adequate heating equipment shall be provided. All heating, cooking, and water heating equipment shall be installed in accordance with state and local ordinances, codes, and regulations governing such installation.

Chapter 22
Blasting Operations

Application This standard applies to all operations where an abrasive is forcibly applied to a surface by pneumatic or hydraulic pressure or by centrifugal force. It does not apply to steam blasting, or steam cleaning, or hydraulic cleaning methods where this work is done without the aid of abrasives.

Selection of Abrasives and Equipment

Each type of abrasive and each type of equipment has its particular advantages in producing the quality of work desired, and the selection will depend on the specific requirements of the user. Therefore, no rule or suggestion can be given in this standard for the selection of a particular abrasive or of particular equipment. With properly designed equipment and proper operation and maintenance all types of abrasives and equipment can be used safely. However, abrasives which create the minimum hazard should be used wherever feasible.

Abrasive Blasting Operations

- Abrasive: A solid substance used in an abrasive blasting operation.
- Abrasive blasting: The forcible application of an abrasive to a surface by pneumatic pressure, hydraulic pressure, or centrifugal force.
- Abrasive-blasting respirator: A continuous flow airline respirator constructed so that it will cover the wearer's head, neck, and shoulders to protect him from rebounding abrasive.
- Air-line respirator: A device consisting of a face-piece, helmet, or hood to which clean air is supplied to the wearer through a small-diameter hose from a source not on the wearer's body.
- Blast cleaning barrel: A complete enclosure which rotates on an axis, or which has an internal moving tread to tumble the parts, in order to expose various surfaces of the parts to the action of an automatic blast spray.
- Blast cleaning room: A complete enclosure in which blasting operations are performed and where the operator works inside of the room to operate the blasting nozzle and direct the flow of the abrasive material.
- Blasting cabinet: An enclosure where the operator stands outside and operates the blasting nozzle through an opening or openings in the enclosure.
- Clean air: Air of such purity that it will not cause harm or discomfort to an individual if it is inhaled for extended periods of time.
- Dust collector: A device or combination of devices for separating dust from the air handled by an exhaust ventilation system.
- Exhaust ventilation system: A system for removing contaminated air from a space, comprising two or more of the elements; enclosure or hood, duct work, dust collecting equipment, exhauster, and discharge stack.
- Dust hazards from abrasive blasting; dust sources: Abrasives and the surface coatings on the materials blasted are shattered and pulverized during blasting operations and the dust formed will contain particles of respirable size. The composition and toxicity of the dust from these sources shall be considered in making an evaluation of the potential health hazards.
- Types of abrasives: A large variety of solid materials may be used as abrasives, with qualities varying from hard deep-cutting to soft polishing. These include; mineral grains, either synthetic or natural, metallic shot or grit, generally of steel or chilled cast iron, and organic abrasives, such as ground corn cobs or walnut shells. Silica sand is the most hazardous mineral abrasive commonly used and its use should be limited wherever possible. The potential hazard from steel or iron dust is considered to be minimal. Readily combustible organic abrasives may be pulverized fine enough to be capable of forming explosive mixtures with air.
- Types of coatings: A surface coating formed during the fabrication of a part, or a protective coating applied after fabrication, will be removed and dispersed as a dust by abrasive blasting. The type of coating should be known to make a proper evaluation of the potential hazard. Silica sand is frequently embedded in the surface of castings and may be pulverized by blast cleaning. Coatings containing toxic metals will add to the potential seriousness of the dust exposures. Examples of such coatings are anti-fouling paints containing mercury, lead paints on structural steel, cadmium plating, and lead deposits on pistons of

internal combustion engines. Plastic or resin coatings may be decomposed by the action of the abrasives to form irritating by-products.

- Wet abrasive blasting: Wet methods will tend to keep dust exposures minimal, but droplets dispersed and dried residues which become airborne may create potential exposures.
- Concentrations of contaminants: The concentration of respirable dust or fumes in the breathing zone of the abrasive-blasting operator or any other worker shall be kept below the recommended levels. Use of combustible abrasives: Organic abrasives which are combustible shall be used only in automatic systems because the fine dust produced presents a potential fire and explosion hazard. Where flammable or explosive dust mixtures may be present, the construction of the equipment, including the exhaust system and all electric wiring shall conform to the requirements of American National Standard Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying, Z 33.1- 1961 (NFPA 91-1961; NBFU 91-1961), and chapter 296- 24 Part L. The blast nozzle shall be bonded and grounded to prevent the buildup of static charges. Where flammable or explosive dust mixtures may be present, the abrasive blasting enclosure, the ducts, and the dust collector shall be constructed with loose panels or explosion venting areas, located on sides away from any occupied area, to provide for pressure relief in case of explosion, following the principles set forth in the National Fire Protection Association Explosion Venting Guide, NFPA 68-1954.

Chapter 23 Possession and Handling of Explosives

Basic Legal Obligations

It is unlawful for any person to manufacture, purchase, sell, use, or store any explosive without having a validly issued license. Upon notice, any law enforcement agency having jurisdiction, a person manufacturing, purchasing, selling, using, or storing any explosives without a license shall immediately surrender any and all such explosives to the respective law enforcement agency.

Portable Storage Facilities

A Class 2 storage facility shall be a box, a trailer, a semi- trailer or other mobile facility. It shall be bullet-resistant, fire-resistant, weather-resistant, theft-resistant, and well ventilated. Portable magazines shall be at least one cubic yard in size. They are to be supported to prevent direct contact with

the ground. The ground around magazines shall slope away for drainage or other adequate drainage provided. When unattended, vehicular magazines shall have wheels removed or otherwise effectively immobilized by kingpin locking devices or other methods approved by the department. The exterior and doors shall be constructed of not less than 1/4-inch steel and lined with at least two inches of hardwood. Magazines with top openings shall have lids with water-resistant seals or shall overlap the sides by at least one inch when in a closed position. Hinges and hasps shall be attached to doors by welding, riveting, or bolting (nuts on inside of door). Hinges and hasps shall be installed so that they cannot be removed when the doors are closed and locked. Each door shall be equipped with two mortise locks; or with two padlocks fastened in separate hasps and staples; or with a combination of mortise lock and a padlock, or with a mortise lock that requires two keys to open; or a three-point lock. Padlocks shall have at least five tumblers and a case-hardened shackle of at least 3/8-inch diameter. Padlocks shall be protected with not less than 1/4- inch steel hoods constructed so as to prevent sawing or lever action on the locks, hasps, and staples. These requirements do not apply to magazine doors that are adequately secured on the inside by means of a bolt, lock, or bar that cannot be actuated from the outside. Except at doorways, a 2-inch air space shall be left around ceilings and the perimeter of floors. Foundation ventilators shall be not less than 4 by 6 inches. Vents in the foundation, roof, or gables shall be screened and offset. No sparking metal construction shall be exposed below the top of walls in the interior of storage facilities and all nails therein shall be blind-nailed, countersunk, or non sparking. Construction of detonator (blasting cap) indoor storage facilities: Class 3 storage facility for detonators (blasting caps) in quantities of 1,000 or less shall be fire-resistant and theft- resistant. They need not be bullet-resistant and weather-resistant if the locked uninhabited building in which they are stored provide protection from the weather and from bullet penetration. Sides, bottoms and covers shall be constructed of not less than number 12-gauge metal and lined with a non sparking material. Hinges and hasps shall be attached so they cannot be removed from the outside. One steel padlock (which need not be protected by a steel hood) having at least five tumblers and a case- hardened shackle of at least 3/8-inch diameter is sufficient for locking purposes.

Blasting Agent Storage

A Class 4 storage facility may be a building, an igloo, or army- type structure, a tunnel, a dugout, a box, a trailer, or a semi- trailer or other mobile facility. They shall be fire-resistant, weather-resistant and theft-resistant. The ground around such storage facilities shall slope away for drainage. When unattended, vehicular storage facilities shall have wheels removed or otherwise effectively immobilized by kingpin locking devices or other methods approved by the department. As a result of tests with electric blasting caps, it has been determined that these blasting caps are not subject to sympathetic detonation. Therefore, a Class 4 storage facility meets the necessary requirements for storage of electric blasting caps. These magazines shall be constructed of masonry, metal-covered wood, fabricated metal, or a combination of these materials. Foundations are to be constructed of brick, concrete, cement block, stone, or metal or wood posts. If piers or posts are used, in lieu of a continuous foundation, the space under the building shall be enclosed with fire-resistant material. The walls and floors are to be constructed of, or covered with, a non sparking material or lattice work. The doors shall be metal or solid wood covered with metal. Hinges and hasps shall be attached to doors by welding, riveting, or bolting (nuts on inside of door). Hinges and hasps shall be installed so that they cannot be removed when the doors are closed and locked. Each door shall be equipped with two mortise locks; or with two padlocks fastened in separate hasps and staples; or with a combination of mortise lock and a padlock, or with a mortise lock that requires two keys to open; or a three-point lock. Padlocks shall have at least five tumblers and a case-hardened shackle of at least 3/8-inch diameter. Padlocks shall be protected with not less than 1/4- inch steel hoods constructed so as to prevent sawing or lever action on the locks, hasps and staples. These requirements do not apply to magazine doors that are adequately secured on the inside by means of a bolt, lock, or bar that cannot be actuated from the outside. A Class 5 storage facility may be a building, igloo or army-type structure, tunnel, dugout, bin, box, trailer, or a semitrailer or other mobile facility. They shall be weather-resistant and theft-resistant. The ground around such storage facilities shall slope away for drainage. When unattended, vehicular storage facilities shall have wheels removed or otherwise effectively immobilized by kingpin locking devices or other methods approved by the department. The doors shall

be constructed of solid wood or metal. Hinges and hasps shall be attached to doors by welding, riveting, or bolting (nuts on inside of door). Hinges and hasps shall be installed so that they cannot be removed when the doors are closed and locked. Each door shall be equipped with two mortise locks; or with two padlocks fastened in separate hasps and staples; or with a combination of mortise lock and a padlock, or with a mortise lock that requires two keys to open; or a three- point lock. Padlocks shall have at least five tumblers and a case-hardened shackle of at least 3/8-inch diameter. Padlocks shall be protected with not less than 1/4-inch steel hoods constructed so as to prevent sawing or lever action on the locks, hasps, and staples. Trailers, semi trailers, and similar vehicular magazines may, for each door, be locked with one steel padlock (which need not be protected by a steel hood) having at least 3/8-inch diameter, if the door hinges and lock hasp are securely fastened to the magazine and to the door frame. These requirements do not apply to magazine doors that are adequately secured on the inside by means of a bolt, lock, or bar that cannot be actuated from the outside.

Explosives Day Box Storage

A temporary storage facility shall be a day box. It must be fire-resistant, weather-resistant and theft-resistant. The ground around such storage facilities shall slope away for drainage. A day box shall be constructed of not less than number 12-gauge (.1046 inches) steel, lined with at least either 1/2-inch plywood or 1/2-inch Masonite-type hardboard. Doors shall overlap sides by at least one inch. Hinges and hasps are to be attached by welding, riveting or bolting (nuts on inside). One steel padlock (which need not be protected by a steel hood) having at least five tumblers and a case-hardened shackle of at least 3/8-inch diameter is sufficient for locking purposes. No explosive materials shall be left in a day box if unattended. The explosive materials contained therein shall be removed to licensed storage facilities for unattended storage.

Detonators Day Box Storage

Temporary storage facilities for blasting caps in quantities of 100 or less shall be constructed as follows. Sides, bottoms and covers shall be constructed of number 12-gauge metal and lined with a non sparking material. Hinges and hasps shall be attached thereto by welding. A single five-tumbler proof lock shall be sufficient for locking purposes. No explosive materials shall be left in such facilities if unattended. The explosive materials contained therein shall be removed to licensed storage facilities for unattended storage.

Magazine Heating Systems

Magazines requiring heat shall be heated by either hot water radiant heating within the magazine building; or air directed into the magazine building over either hot water or low pressure steam (15 psig) coils located outside the magazine building. The magazine heating systems shall meet the following requirements: the radiant heating coils within the building shall be installed in such a manner that the explosive materials or their containers cannot contact the coils and air is free to circulate between the coils and the explosive materials or their containers; and the heating ducts shall be installed in such a manner that the hot air discharge from the duct is not directed against the explosive materials or their containers. The heating device used in connection with a magazine shall have controls which prevent the ambient building temperature from exceeding 130 degrees Fahrenheit. The electric fan or pump used in the heating system for a magazine shall be mounted outside and separate from the wall of the magazine and shall be grounded. The electric fan motor and the controls for electrical heating devices used in heating water or steam shall have overloads and disconnects, which comply with the National Electrical Code, (National Fire Protection Association, NFPA No. 70-1984). All electrical switchgear shall be located a minimum distance of 25 feet from the magazine. The heating source for water or steam shall be separated from the magazine by a distance of not less than 25 feet when electrical and 50 feet when fuel-fired. The area between the heating unit and the magazine shall be cleared of all combustible materials. The storage of explosive materials and their containers in the magazine shall allow uniform air circulation so temperature uniformity can be maintained throughout the explosive materials.

Lighting

Battery-activated safety lights or battery-activated safety lanterns may be used in explosives storage magazines. Electric lighting used in any explosives storage magazine shall meet the standards prescribed by the "National Electrical Code," (National Fire Protection Association, NFPA 70-84), for the conditions present in the magazine at any time. All electrical switches shall be located outside of the magazine and also meet the standards prescribed by the National Electrical Code.

Explosives Storage

The storage of caps with other explosives is prohibited. No blasting caps, or other detonating or fulminating caps, or detonators, or flame-producing devices shall be kept or stored in any magazine in which other explosives are kept or stored. All Class A, Class B, Class C explosives, and special industrial explosives, and any newly developed and unclassified explosives, shall be kept in proper magazines unless they are in the process of manufacture, being physically handled in the operating process, being used or being transported to a place of storage or use. No explosives and no detonators (blasting caps) in quantities of 1,001 or more shall be stored in any building or structure except a Class 1, permanent, magazine that has been approved and licensed. There shall be separate storage of components capable of detonation when mixed. Any two components which, when mixed, become capable of detonation by a number 6 cap must be stored in separate locked containers or in a licensed, approved magazine. Blasting operations or storage of electrical detonators shall be prohibited in vicinity of operating radio frequency transmitter stations except where the clearances can be observed. Blasting caps, electric blasting caps, detonating primers and primed cartridges shall not be stored in the same magazine with other explosives.

Quantity Restrictions

Explosive materials in excess of 300,000 pounds or blasting caps in excess of 20,000,000 shall not be stored in one storage magazine. Magazines shall be in the charge of a competent person at all times who shall be at least twenty- one years of age, and who shall be held responsible for the enforcement of all safety precautions. All explosives shall be accounted for at all times. Explosives not being used shall be kept in a locked magazine, unavailable to persons not authorized to handle them. The employer shall maintain an inventory and use record of all explosives. Appropriate authorities shall be notified of any loss, theft, or unauthorized entry into a magazine. Firearms (except firearms carried by guards) shall not be permitted inside of or within 50 feet of magazines. The land surrounding a magazine shall be kept clear of all combustible materials, brush, dried grass, leaves and other materials for a distance of at least 25 feet. Combustible materials shall not be stored within 50 feet of magazines. Smoking, matches, open flames, and spark-producing devices are not permitted in any magazine or within 50 feet of any outdoor magazine; or within any room containing an indoor magazine. The premises on which a magazine is located shall be conspicuously marked with signs containing the words "EXPLOSIVES KEEP OFF" in letters at least three inches high. Such signs shall warn any person approaching the magazine of the presence of explosives, but shall be so located that a bullet passing directly through the face of the sign will not strike the magazine. Temporary storage at a site for blasting operations shall be located away from neighboring inhabited buildings, railways, highways, and other magazines. A distance of at least one hundred and fifty feet shall be maintained between magazines and the work in progress when the quantity of explosives kept therein is in excess of 25 pounds, and at least 50 feet when the quantity of explosives is 25 pounds or less. Explosives recovered from blasting misfires shall be placed in a separate magazine until competent personnel has determined from the manufacturer the method of disposal. Caps recovered from blasting misfires shall not be reused. Such explosives and caps shall then be disposed of in the manner recommended by the manufacturer.

Storage Within Magazines

Packages of explosives shall be laid flat with top side up. Black powder when stored in magazines with other explosives shall be stored separately. Black powder stored in kegs shall be stored on ends, bungs down, or on side, seams down. Corresponding grades and brands shall be stored together in

such a manner that brands and grade marks show. All stocks shall be stored so as to be easily counted and checked. Packages of explosives shall be piled in a stable manner. When any kind of explosive is removed from a magazine for use, the oldest explosive of that particular kind shall always be taken first. Packages of explosives shall not be unpacked or repacked in a magazine nor within 50 feet of a magazine or in close proximity to other explosives. Tools used for opening packages of explosives shall be constructed of non sparking materials, except that non sparking metallic slitters may be used for opening fiberboard boxes. A wood wedge and a fiber, rubber, or wood mallet shall be used for opening or closing wood packages of explosives. Opened packages of explosives shall be securely closed before being returned to a magazine. Magazines shall not be used for the storage of any metal tools nor any commodity except explosives, but this restriction shall not apply to the storage of blasting agents and blasting supplies. Magazine floors shall be regularly swept, kept clean, dry, free of grit, paper, empty used packages, and rubbish. Brooms and other cleaning utensils shall not have any spark-producing metal parts. Sweepings from floors of magazines shall be properly disposed of. Magazine floors stained with nitroglycerin shall be cleaned according to instructions by the manufacturer. When any explosive has deteriorated to an extent that it is in an unstable or dangerous condition, or if nitroglycerin leaks from any explosives, then the person in possession of such explosive shall immediately proceed to destroy such explosive in accordance with the instructions of the manufacturer. Only experienced persons shall be allowed to do the work of destroying explosives. When magazines need inside repairs, all explosives shall be removed therefrom and the floors cleaned. In making outside repairs, if there is a possibility of causing sparks or fire the explosives shall be removed from the magazine. Explosives removed from a magazine under repair shall either be placed in another magazine or placed a safe distance from the magazine where they shall be properly guarded and protected until repairs have been completed, when they shall be returned to the magazine.

Underground Storage

Explosives and related materials shall be stored in approved facilities. No explosives or blasting agents shall be permanently stored in any underground operation until the operation has been developed to the point where at least two modes of exit have been developed. Permanent underground storage magazines shall be at least 300 feet from any shaft, adit, or active underground working area. Permanent underground magazines containing detonators shall not be located closer than 50 feet to any magazine containing other explosives or blasting agents. Upon the approach of an electrical storm, unless a greater hazard would be created thereby, explosives at the adit or the top of any shaft leading to where persons are working shall be moved away from such location a distance equal to that required for inhabited buildings, as listed in the American table of distances for storage of explosive materials. All explosive manufacturing buildings and magazines in which explosives or blasting agents, except small arms ammunition and smokeless powder are had, kept, or stored, must be located at distances from inhabited buildings, railroads, highways, and public utility transmission systems in conformity with the following quantity and distance tables, and these tables shall be the basis on which applications for license for storage shall be made and license for storage issued. Blasting and electric blasting caps in strength through number 8 should be rated as one and one-half pounds of explosives per one thousand caps. Blasting and electric blasting caps of strength higher than number 8 should be computed on the combined weight of explosives.

Multiple Magazines

When two or more storage magazines are located on the same property, each magazine must comply with the minimum distances specified from inhabited buildings, railways, and highways, and in addition, they should be separated from each other by not less than the distances shown for "separation of magazines", except that the quantity of explosives contained in cap magazines shall govern in regard to the spacing of said cap magazines from magazines containing other explosives. If any two or more magazines are separated from each other by less than the specified "separation of magazines" distances, then such two or more magazines, as a group, must be considered as one magazine, and the total quantity of explosives stored in such group must be treated as if stored in a single magazine located on the site of any magazine of the group, and must comply with the minimum of distances specified from other magazines, inhabited buildings, railways and highways.

Ammonium Nitrate Storage

This subsection applies to the storage of ammonium nitrate in the form of crystals, flakes, grains, or prills including fertilizer grade, dynamite grade, nitrous oxide grade, technical grade, and other mixtures containing 60 percent or more ammonium nitrate by weight but does not apply to blasting agents. This section does not apply to the transportation of ammonium nitrate. This section does not apply to storage under the jurisdiction of and in compliance with the regulations of the United States Coast Guard (see 46 CFR Parts 146-149). The storage of ammonium nitrate and ammonium nitrate mixtures that are more sensitive than allowed by the "definition of test procedures for ammonium nitrate fertilizer" is prohibited.

Bulk Ammonium Nitrate Storage

Warehouses shall have adequate ventilation or be capable of adequate ventilation in case of fire. Unless constructed of non-combustible material or unless adequate facilities for fighting a roof fire are available, bulk storage structures shall not exceed a height of 40 feet. Bins shall be clean and free of materials which may contaminate ammonium nitrate. Due to the corrosive and reactive properties of ammonium nitrate, and to avoid contamination, galvanized iron, copper, lead, and zinc shall not be used in a bin construction unless suitably protected. Aluminum bins and wooden bins protected against impregnation by ammonium nitrate are permissible. The partitions dividing the ammonium nitrate storage from other products which would contaminate the ammonium nitrate shall be of tight construction. The ammonium nitrate storage bins or piles shall be clearly identified by signs reading "ammonium nitrate" with letters at least 2 inches high. Piles or bins shall be so sized and arranged that all material in the pile is moved out periodically in order to minimize possible caking of the stored ammonium nitrate. Height or depth of piles shall be limited by the pressure-setting tendency of the product. However, in no case shall the ammonium nitrate be piled higher at any point than 36 inches below the roof or supporting and spreader beams overhead. Ammonium nitrate shall not be accepted for storage when the temperature of the product exceeds 130 F. Dynamite, other explosives, and blasting agents shall not be used to break up or loosen caked ammonium nitrate.

Contaminants

Ammonium nitrate shall be in a separate building or shall be separated by approved type firewalls of not less than 1 hour fire-resistance rating from storage or organic chemicals, acids, or other corrosive materials, materials that may require blasting during processing or handling, compressed flammable gases, flammable and combustible materials or other contaminating substances, including but not limited to animal fats, baled cotton, baled rags, baled scrap paper, bleaching powder, burlap or cotton bags, caustic soda, coal, coke, charcoal, cork, camphor, excelsior, fibers of any kind, fish oils, fish meal, foam rubber, hay, lubricating oil, linseed oil, or other oxidizable or drying oils, naphthalene, oakum, oiled clothing, oiled paper, oiled textiles, paint, straw, sawdust, wood shavings, or vegetable oils. Walls referred to in this subsection need extend only to the underside of the roof. In lieu of separation walls, ammonium nitrate may be separated from the materials referred to above by a space of at least 30 feet. Flammable liquids such as gasoline, kerosene, solvents, and light fuel oils shall not be stored on the premises. LP-Gas shall not be stored on the premises. Sulfur and finely divided metals shall not be stored in the same building with ammonium nitrate. Explosives and blasting agents shall not be stored in the same building with ammonium nitrate except on the premises of makers, distributors, and user- compounders of explosives or blasting agents. Where explosives or blasting agents are stored in separate buildings, other than on the premises of makers, distributors, and user- compounders of explosives or blasting agents, they shall be separated from the ammonium nitrate.

Explosives Transportation

The transportation of explosives by vehicle on public highways shall be administered by the United States Department of Transportation, CFR 49-1978, Parts 100 through 199, and any state regulations. The following sections cover the transportation of explosives on the job site. No employee shall be allowed to smoke, carry matches or any other flame-producing device, or carry any firearms or loaded cartridges

while in or near a motor vehicle transporting explosives; or drive, load, or unload such vehicle in a careless or reckless manner. Explosives shall not be carried on any vehicle while the vehicle is being used to transport workers other than the driver and two persons. Explosives shall be transferred from the disabled vehicle to another, only when proper and qualified supervision is provided. Other materials or supplies shall not be placed on or in the cargo space of a conveyance containing explosives, detonation cord or detonators, except carrying safety fuse, and properly secured, non- sparking equipment used expressly in the handling of such explosives will be permissible. Vehicles used for transporting explosives shall be strong enough to carry the load without difficulty and be in good mechanical condition. If vehicles do not have a closed body, the body shall be covered with a flameproof and moisture-proof tarpaulin or other effective protection against moisture and sparks. All vehicles used for the transportation of explosives shall have tight floors and any exposed spark-producing metal on the inside of the body shall be covered with wood or other non sparking materials to prevent contact with packages of explosives. Packages of explosives shall not be loaded above the sides of an open-body vehicle. Vehicles shall be placarded and displayed as specified by the United States Department of Transportation, CFR 49-1981, Parts 100 through 199. Each motor vehicle used for transporting explosives shall be equipped with a minimum of two extinguishers, each having a rating of at least 10-BC. Only extinguishers listed or approved by a nationally recognized testing laboratory shall be deemed suitable for use on explosives-carrying vehicles. Extinguishers shall be filled and ready for immediate use and readily available. Extinguishers shall be examined periodically by a competent person. A motor vehicle used for transporting explosives shall be inspected to determine that it is in proper condition for safe transportation of explosives.

Use of Explosives

While explosives are being handled or used, smoking, matches, or any other source of fire or flame shall not be allowed within 100 feet of the blast site. No person shall be allowed to handle explosives while under the influence of intoxicating liquors, narcotics, or other dangerous drugs. This rule does not apply to persons taking prescription drugs and/or narcotics as directed by a physician providing such use shall not endanger the worker or others. Original containers or day box magazines shall be used for taking detonators and other explosives from storage magazines to the blast site. When blasting is done in congested areas or in close proximity to a structure, railway, or highway or any other installation that may be damaged, the blast shall be covered before firing with a mat or material that is capable of preventing fragments from being thrown. Persons authorized to prepare explosive charges or conduct blasting operations shall use every reasonable precaution, including but not limited to warning signals, flags and barricades or woven wire mats to insure the safety of the general public and workers. Blasting operations shall be conducted during daylight hours whenever possible. Whenever blasting is being conducted in the vicinity of gas, electric, water, fire alarm, telephone, telegraph, and steam utilities, the user (blaster) shall notify the appropriate representatives of such utilities at least twenty-four hours in advance of blasting, specifying the location and intended time of such blasting. Verbal notice shall be confirmed with written notice. Due precautions shall be taken to prevent accidental discharge of electric blasting caps from current induced by radar, radio transmitters, lightning, adjacent power lines, dust storms, or other sources of extraneous electricity. These precautions shall include the suspension of all blasting operations and removal of persons from the blast site during the approach and progress of an electric storm and the posting of signs, warning against the use of mobile radio transmitters, on all roads shall be in accordance with the applicable provisions of the American National Standards Institute D6.1-1971, Manual on Uniform Traffic Control Devices for Streets and Highways, as amended by Washington State Department of Highways Manual M24-01, (February 22, 1972). Ensuring that mobile radio transmitters which are less than 100 feet away from electric blasting caps, when the caps are in other than original containers, shall be de-energized and effectively locked. Compliance with the recommendations of The Institute of the Makers of Explosives (IME) with regard to blasting in the vicinity of radio transmitters as stipulated in Radio Frequency Energy--A Potential Hazard in the Use of Electric Blasting Caps, IME Publication No. 20, September 1971. When electric blasting caps are being used in blasting operations in the proximity of fixed radio transmitters, the following table of distances must be observed, unless it is determined by designated test procedures that there is

not sufficient radio frequency energy present to create a hazard. The test procedure shall be to attach a No. 47 radio pilot lamp in place of the cap in the blasting circuit progressively as the circuit is connected, starting with the initial hole. In the event the lamp glows, the length of the wires connecting the circuit shall be altered by adding or cutting off wire until the lamp does not glow. A radio frequency field strength meter may be used in lieu of the test lamp. No fire shall be fought where the fire is in imminent danger of contact with explosives. All employees shall be removed to a safe area and the fire area guarded against intruders. Electric detonators shall be shunted until wired into the blasting circuit. Explosives shall not be handled near open flames, uncontrolled sparks or open electric circuits. Delivery and issue of explosives shall only be made by and to authorized persons and into authorized magazines or approved temporary storage or handling areas. All loading and firing shall be directed and supervised by licensed persons thoroughly experienced in this field.

Storage at Use Sites

Empty boxes and paper and fiber packing materials which have previously contained high explosives shall not be used again for any purpose, but shall be destroyed by burning at an approved isolated location out of doors, and no person shall be nearer than 100 feet after the burning has started. When opening kegs or wooden cases, no sparking metal tools shall be used; wooden wedges and either wood, fiber or rubber mallets shall be used. Non sparking metallic slitters may be used for opening fiberboard cases. Should cartridges or packages of explosives show signs of discoloration or deterioration, the manufacturer or the department shall be notified. Such explosives must be carefully set aside and properly disposed of. Loading of explosives or blasting agents in blast holes. Procedures that permit safe and efficient loading shall be established before loading is started. All drill holes shall be sufficiently large to admit freely the insertion of the cartridges of explosives. Tamping shall be done only with wood rods or with approved plastic tamping poles without exposed metal parts, but non sparking metal connectors may be used for jointed poles. Violent tamping shall be avoided. The primer shall never be tamped. No holes shall be loaded except those to be fired in the next round of blasting. After loading, all remaining explosives and detonators shall be immediately returned to an authorized magazine. Drilling shall not be started until all remaining butts of old holes are examined for unexploded charges, and if any are found, they shall be refired before work proceeds. When a charge of explosives has been exploded in a bore hole to enlarge or "spring" it, an interval of at least two hours must be allowed to pass before an additional charge of explosives can be loaded into the hole. There may be an exception made to this rule provided the sprung hole is thoroughly wet down with water before it is loaded. No person shall be allowed to deepen drill holes which have contained explosives or blasting agents. No explosives or blasting agents shall be left unattended unless stored in a licensed magazine. Users (blasters) shall not load, store or use explosives closer than the length of the steel being used for drilling and in no event nearer than fifty feet of drilling operations. Machines and all tools not used for loading explosives into bore holes shall be removed from the immediate location of holes being loaded with explosives. Equipment shall not be operated within 50 feet of loaded holes except when equipment is needed to add burden, mats or tracking of drills out of the loading area. Power lines and portable electric cables for equipment being used shall be kept a safe distance from explosives or blasting agents being loaded into drill holes. Cables in the proximity of the blast area shall be de-energized and locked out by the blaster. Holes shall not be drilled where there is danger of intersecting a charged or misfired hole. All blast holes in open work shall be stemmed to the collar or to a point which will confine the charge. No explosives for underground operations other than those in Fume Class 1, as set forth by the Institute of Makers of Explosives, shall be used; however, explosives complying with the requirements of Fume Class 2 and Fume Class 3 may be used if adequate ventilation has been provided. Warning signs, indicating a blast area, shall be maintained at all approaches to the blast area. The warning sign lettering shall not be less that 4 inches in height on a contrasting background. All loaded stumps must be marked for identification on logging sites. A bore hole shall never be sprung when it is adjacent to or near a hole which has been loaded. Flashlight batteries shall not be used for springing holes. No loaded holes shall be left unattended or unprotected. The user (blaster) shall keep an accurate record of explosives, blasting agents, and blasting supplies used in a blast and shall keep an accurate running inventory of all explosives

and blasting agents stored on the operation. When loading blasting agents pneumatically over electric blasting caps, semi conductive delivery hose shall be used and the equipment shall be bonded and grounded.

Electric Blasting Only electric blasting caps shall be used for blasting operations in congested districts, or on highways, or adjacent to highways open to traffic, except where sources of extraneous electricity make such use dangerous. Blasting cap leg wires shall be kept short-circuited (shunted) until they are connected into the circuit for firing. Before adopting any system of electrical firing, the user (blaster) shall conduct a thorough survey for extraneous currents, and all dangerous currents shall be eliminated before any holes are loaded. In any single blast using electric blasting caps, all caps shall be of the same style or function and be of the same manufacture. Electric blasting shall be carried out by using blasting circuits or power circuits in accordance with the electric blasting cap manufacturer's recommendations. The firing line shall be checked with an approved testing device at the terminals before being connected to the blasting machine or other power source. The circuit including all caps shall be tested with an approved testing device before being connected to the firing line. When firing a circuit of electric blasting caps, care shall be exercised to ensure that an adequate quantity of delivered current is available, in accordance with the manufacturer's recommendations. Connecting wires and lead wires shall be insulated single solid wires of sufficient current-carrying capacity, and shall not be less than twenty gauge (American wire gauge) solid core insulated wire. Firing line or leading wires shall be solid single wires of sufficient current-carrying capacity, and shall be not less than fourteen gauge (American wire gauge) solid core insulated wire. Bus wires - depends on the size of the blast, fourteen gauge (American wire gauge) copper is recommended. The ends of lead wires which are to be connected to a firing device shall be shorted by twisting them together or otherwise connecting them before they are connected to the leg wires or connecting wires, and they shall be kept in the possession of the person who is doing the loading until loading is completed and the leg wires attached. Lead wires shall not be attached to the firing device until the blaster is ready to fire the shot and must be attached by the user (blaster) themselves. The ends of the leg wires on electric detonators shall be shorted in a similar manner and not separated until all holes are loaded and the loader is ready to connect the leg wires to the connecting wires or lead wires. When firing electrically, the insulation on all firing lines shall be adequate and in good condition. A power circuit used for firing electric blasting caps shall not be grounded. In underground operations when firing from a power circuit, a safety switch shall be placed at intervals in the permanent firing line. This switch shall be made so it can be locked only in the "off" position and shall be provided with a short- circuiting arrangement of the firing lines to the cap circuit. In underground operations there shall be a "lightning" gap of at least 5 feet in the firing system ahead of the main firing switch; that is, between this switch and the source of power. This gap shall be bridged by a flexible jumper cord just before firing the blast. When firing from a power circuit, the firing switch shall be locked in the open or "off" position at all times, except when firing. It shall be so designed that the firing lines to the cap circuit are automatically short- circuited when the switch is in the "off" position. Keys to this switch shall be entrusted only to the user (blaster). Blasting machines shall be in good condition and the efficiency of the machine shall be tested periodically to make certain that it can deliver power at its rated capacity. When firing with blasting machines, the connections shall be made as recommended by the manufacturer of the electric blasting caps used. The number of electric blasting caps connected to a blasting machine shall not be in excess of its rated capacity. Furthermore, in primary blasting, a series circuit shall contain no more caps than the limits recommended by the manufacturer of the electric blasting caps in use. The user (blaster) shall be in charge of the blasting machines, and no other person shall connect the leading wires to the machine. Users (blasters), when testing circuits to charged holes, shall use only blasting testers especially designed for this purpose. Whenever the possibility exists that a leading line or blasting wire might be thrown over a live power line by the force of an explosion, care shall be taken to see that the total length of wires are kept too short to hit the lines, or that the wires are securely anchored to the ground. If neither of these requirements can be satisfied, a nonelectric system shall be used. In electrical firing, only the person making leading wire connections shall fire the shot. All connections shall be made from the bore hole back to the source of firing current, and the leading wires shall remain shorted and not be connected to the blasting machine or other

source of current until the charge is to be fired. After firing an electric blast from a blasting machine, the leading wires shall be immediately disconnected from the machine and short-circuited. When electric blasting caps have been used, workers shall not return to misfired holes for at least thirty minutes.

Use of Safety Fuse

A fuse that is deteriorated or damaged in any way shall not be used. The hanging of a fuse on nails or other projections which will cause a sharp bend to be formed in the fuse is prohibited. Before capping safety fuse, a short length shall be cut from the end of the supply reel so as to assure a fresh cut end in each blasting cap. Only a cap crimper of approved design shall be used for attaching blasting caps to safety fuse. Crimpers shall be kept in good repair and accessible for use. No unused cap or short capped fuse shall be placed in any hole to be blasted; such unused detonators shall be removed from the working place and disposed of or stored in licensed magazine. No fuse shall be capped, or primers made up, in any magazine or near any possible source of ignition. Capping of fuse and making of primers shall only be done in a place selected for this purpose and at least one hundred feet distant from any storage magazine. Fuse must be cut long enough to reach beyond the collar of the bore hole and in no case less than three feet. When shooting choker holes, not less than three feet of fuse shall be used. At least two persons shall be present when multiple cap and fuse blasting is done by hand lighting methods. Not more than 12 fuses shall be lighted by each blaster when hand lighting devices are used. However, when two or more safety fuses in a group are lighted as one by means of an igniter cord, or other similar fuse-lighting devices, they may be considered as one fuse. The so-called "drop fuse" method of dropping or pushing a primer or any explosive with a lighted fuse attached is prohibited. Cap and fuse shall not be used for firing mud cap charges unless charges are separated sufficiently to prevent one charge from dislodging other shots in the blast. When blasting with safety fuses, consideration shall be given to the length and burning rate of the fuse. Sufficient time, with a margin of safety, shall always be provided for the blaster to reach a place of safety. The burning rate of the safety fuse in use at any time shall be measured, posted in conspicuous locations, and brought to the attention of all workers concerned with blasting. No fuse shall be used that burns faster than one foot in forty seconds or slower than one foot in fifty-five seconds. For use in wet places the joint between the cap and fuse shall be waterproofed with a compound prepared for this purpose. In making up primers only non sparking skewers shall be used for punching the hole in the cartridge to insert the capped fuse. No blasting cap shall be inserted in the explosives without first making a hole in the cartridge of proper size or using a standard cap crimper. Only sufficient primers for one day's use shall be made up at one time. They shall be stored in a box type magazine in which no other explosives are stored. Any loose cartridges of explosives, detonators, primers and capped fuse unused at the end of the shift shall be returned to their respective magazines and locked up.

Use of Detonating Cord

Care shall be taken to select a detonating cord consistent with the type and physical condition of the bore hole and stemming and the type of explosives used. Detonating cord shall be handled and used with the same respect and care given other explosives. For quantity and distance purposes detonating a fuse up to 60 grains per foot should be calculated as equivalent to 9 lbs. of high explosives per 1,000 feet. Heavier cord loads should be rated proportionately. If using a detonating type cord for blasting the double-trunk- line or loop systems shall be used. Trunk lines in multiple-row blasts shall make one or more complete loops, with cross ties between loops at intervals of not over two hundred feet. All detonating cord knots shall be tight and all connections shall be kept at right angles to the trunk lines. The line of detonating cord extending out of a bore hole or from a charge shall be cut from the supply spool before loading the remainder of the bore hole or placing additional charges. Detonating cord shall be handled and used with care to avoid damaging or severing the cord during and after loading and hooking-up. Detonating cord connections shall be competent and positive in accordance with approved and recommended methods. Knot-type or other cord connections shall be made only with detonating cord in which the explosive core is dry. All detonating cord trunk lines and branch lines shall be free of loops, sharp kinks, or angles that direct the cord back toward the oncoming line of detonation. All detonating cord connections

shall be inspected before firing the blast. When detonating cord millisecond-delay connectors or short-interval-delay electric blasting caps are used with detonating cord, the practice shall conform strictly to the manufacturer's recommendations. When connecting a blasting cap or an electric blasting cap to a detonating cord, the cap shall be taped or otherwise attached securely along the side or the end of the detonating cord, with the end of the cap containing the explosive charge pointed in the direction in which the detonation is to proceed. Detonators for firing the trunk line shall not be brought to the loading area nor attached to the detonating cord until everything else is in readiness for the blast.

Firing the Blast

A code of blasting signals equivalent to Table T-1 shall be posted on one or more conspicuous places at the operation, and all employees shall be required to familiarize themselves with the code and conform to it. Danger signs shall be placed at suitable locations. All charges shall be covered with blasting mats before firing, where blasting may cause injury or damage by flying rock or debris. Before a blast is fired, a loud warning signal shall be given by the blaster in charge, who has made certain that all surplus explosives are in a safe place and all employees, vehicles, and equipment are at a safe distance, or under sufficient cover. Flagmen shall be safely stationed on highways which pass through the danger zone so as to stop traffic during blasting operations. It shall be the duty of the blaster to fix the time of blasting. The blaster shall conduct all blasting operations and no shot shall be fired without the blaster' approval. Before firing an underground blast, warning shall be given, and all possible entries into the blasting area, and any entrances to any working place where a drift, raise, or other opening is about to hole through, shall be carefully guarded. The blaster shall make sure that all employees are out of the blast area before firing a blast.

- WARNING SIGNAL - A 1-minute series of long blasts 5 minutes prior to blast signal.
- BLAST SIGNAL - A series of short blasts 1 minute prior to the shot.
- ALL CLEAR SIGNAL - A prolonged blast following the inspection of the blast area.

Inspection After Blasting

Immediately after the blast has been fired, the firing line shall be disconnected from the blasting machine, or where power switches are used, they shall be locked open or in the off position. Sufficient time shall be allowed, not less than fifteen minutes in tunnels, for the smoke and fumes to leave the blasted area before returning to the shot. An inspection of the area and the surrounding rubble shall be made by the user (blaster) to determine if all charges have been exploded before employees are allowed to return to the operation, and in tunnels, after the muck pile has been wetted down.

Misfires

If a misfire is found, the user (blaster) shall provide proper safeguards for excluding all employees from the danger zone. No other work shall be done except that necessary to remove the hazard of the misfire and only those employees necessary to do the work shall remain in the danger zone. No attempt shall be made to extract explosives from any charged or misfired hole; a new primer shall be put in and the hole blasted. If refiring of the misfired hole presents a hazard, the explosives may be removed by washing out with water or, where the misfire is under water, blown out with air. If there are any misfires while using cap and fuse, all employees shall remain away from the charge for at least one hour. Misfires shall be handled under the direction of the person in charge of the blasting. All wires shall be carefully traced and a search made for unexploded charges. When electric blasting caps have been used, workers shall not return to misfired holes for at least thirty minutes. All wires shall be carefully traced and a search made for unexploded charges. If explosives are suspected of burning in a hole, all persons in the endangered area shall move to a safe location and no one shall return to the hole until the danger has passed, but in no case within one hour. No drilling, digging, or picking shall be permitted until all missed holes have been detonated or the authorized representative has approved that work can proceed.

Underwater Blasting

A user (blaster) shall conduct all blasting operations, and no shot shall be fired without the blaster's approval. Loading tubes and casings of dissimilar metals shall not be used because of possible electric transient currents from galvanic action of the metals and water. Only water-resistant blasting caps and detonating cords shall be used for all underwater blasting. Loading shall be done through a non sparking metal loading tube when tube is necessary. No blast shall be fired while any vessel under way is closer than 1,500 feet to the blasting area. Those on board vessels or craft moored or anchored within 1,500 feet shall be notified before a blast is fired. No blast shall be fired while any swimming or diving operations are in progress in the vicinity of the blasting area. If such operations are in progress, signals and arrangements shall be agreed upon to assure that no blast shall be fired while any persons are in the water.

Display of Blasting Flags

The storage and handling of explosives aboard vessels used in underwater blasting operations shall be according to provisions outlined herein on handling and storing explosives. When more than one charge is placed under water, a float device shall be attached to an element of each charge in such manner that it will be released by the firing.

Blasting in Excavation Work

Detonators and explosives shall not be stored or kept in tunnels, shafts, or caissons. Detonators and explosives for each round shall be taken directly from the magazines to the blasting zone and immediately loaded. Detonators and explosives left over after loading a round shall be removed from the working chamber before the connecting wires are connected up. When detonators or explosives are brought into an air lock, no employee except the powder man, user (blaster), lock tender and the employees necessary for carrying, shall be permitted to enter the airlock. No material, supplies, or equipment shall be brought through with the explosives. Primers, detonators and explosives shall be taken separately into pressure working chambers. The user (blaster) or powder man shall be responsible for the receipt, unloading, storage, and on-site transportation of explosives and detonators. All metal pipes, rails, air locks, and steel tunnel lining shall be electrically bonded together and grounded at or near the portal or shaft, and such pipes and rails shall be cross-bonded together at not less than 1,000-foot intervals throughout the length of the tunnel. In addition, each air supply pipe shall be grounded at its delivery end. The explosives suitable for use in wet holes shall be water- resistant and shall be Fume Class 1, or other approved explosives. When tunnel excavation in rock face is approaching mixed face, and when tunnel excavation is in mixed face, blasting shall be performed with light charges and with light burden on each hole. Advance drilling shall be performed as tunnel excavation in rock face approaches mixed face, to determine the general nature and extent of rock cover and the remaining distance ahead to soft ground as excavation advances.

Vibration and Damage Control

Blasting operations in or adjacent to coffer dams, piers, underwater structures, buildings, structures, or other facilities shall be carefully planned with full consideration for all forces and conditions involved. Black blasting powder shall not be used for blasting except when a desired result cannot be obtained with another type of explosive such as in quarrying certain types of dimension stone. In the use of black blasting powder: Containers shall not be opened in, or within fifty feet of any magazine; within any building in which a fuel-fired or exposed- element electric heater is in operation; where electrical or incandescent-particle sparks could result in powder ignition; or within fifty feet of any open flame. Granular powder shall be transferred from containers only by pouring. Spills of granular powder shall be cleaned up promptly with non sparking equipment, contaminated powder shall be put into a container of water and its content disposed of promptly after the granules have disintegrated, or the spill area shall be flushed with a copious amount of water to completely disintegrate the granules. Containers of powder shall be kept securely closed at all times other than when the powder is being transferred from or into a container. Containers of powder transported by vehicles shall be in a wholly enclosed cargo space. Misfires shall be disposed of by washing the stemming and powder charge from the bore

hole, and removal and disposal of the initiator as a damaged explosive. Bore holes of shots that fire but fail to break, or fail to break promptly, shall not be recharged for at least twelve hours. No person shall store, handle, or transport explosives or blasting agents when such storage, handling, and transportation of explosives or blasting agents constitutes an undue hazard to life. Do not abandon explosives or explosive substances.

Fixed Location Mixing

Buildings or other facilities used for mixing blasting agents shall be located appropriate distances away from inhabited buildings, passenger railroads, and public highways. In determining the distance separating highways, railroads, and inhabited buildings from potential explosions the sum of all masses which may propagate from either individual or combined donor masses are included. However, when the ammonium nitrate must be included, only fifty percent of its weight shall be used because of its reduced blast effects. Buildings used for the mixing of blasting agents shall conform to the requirements of this section. Buildings shall be of noncombustible construction or sheet metal on wood studs. Floors in a mixing plant shall be of concrete or of other nonabsorbent materials. All fuel oil storage facilities shall be separated from the mixing plant and located in such a manner that in case of tank rupture, the oil will drain away from the mixing plant building. The building shall be well ventilated. Heating units which do not depend on combustion processes, when properly designed and located, may be used in the building. All direct sources of heat shall be located outside the mixing building. All internal-combustion engines used for electric power generation shall be located outside the mixing plant building, or shall be properly ventilated and isolated by a firewall. The exhaust systems on all such engines shall be located so any spark emission cannot be a hazard to any materials in or adjacent to the plant. Equipment used for mixing blasting agents shall conform to the requirements of this subsection. The design of the mixer shall minimize the possibility of frictional heating, compaction, and especially confinement. All bearings and drive assemblies shall be mounted outside the mixer and protected against the accumulation of dust. All surfaces shall be accessible for cleaning. Suitable means shall be provided to prevent the flow of fuel oil to the mixer in case of fire. In gravity flow systems an automatic spring- loaded shutoff valve with fusible link shall be installed. The provisions of this subsection shall be considered when determining blasting agent compositions. The sensitivity of the blasting agent shall be determined by means of a No. 8 test blasting cap at regular intervals and after every change in formulation. Oxidizers of small particle size, such as crushed ammonium nitrate prills or fines, may be more sensitive than coarser products and shall, therefore, be handled with greater care. No hydrocarbon liquid fuel with flash point lower than that of No. 2 diesel fuel oil 125 F. minimum shall be used. Crude oil and crankcase oil shall not be used. Metal powders such as aluminum shall be kept dry and shall be stored in containers or bins which are moisture-resistant or weather tight. Solid fuels shall be used in such manner as to minimize dust explosion hazards. Peroxides and chlorates shall not be used. All electrical switches, controls, motors, and lights located in the mixing room shall conform to the requirements in; otherwise they shall be located outside the mixing room. The frame of the mixer and all other equipment that may be used shall be electrically bonded and be provided with a continuous path to the ground. Safety precautions at mixing plants shall include the requirements of this subsection. Floors shall be constructed so as to eliminate floor drains and piping into which molten materials could flow and be confined in case of fire. The floors and equipment of the mixing and packaging room shall be cleaned regularly and thoroughly to prevent accumulation of oxidizers or fuels and other sensitizers. The entire mixing and packaging plant shall be cleaned regularly and thoroughly to prevent excessive accumulation of dust. Smoking, matches, open flames, spark-producing devices, and firearms (except firearms carried by guards) shall not be permitted inside of or within 50 feet of any building or facility used for the mixing of blasting agents. The land surrounding the mixing plant shall be kept clear of brush, dried grass, leaves, and other materials for a distance of at least 25 feet. Empty ammonium nitrate bags shall be disposed of daily in a safe manner. No welding shall be permitted or open flames used in or around the mixing or storage area of the plant unless the equipment or area has been completely washed down and all oxidizer material removed. Before welding or repairs to hollow shafts, all oxidizer material shall be removed from the outside and inside of the shaft and the shaft vented with a minimum one-half inch diameter opening. Explosives shall not be permitted inside of or within 50 feet of any building or facility used for the mixing

of blasting agents.

Bulk Delivery and Mixing Vehicles

The provisions of this subsection shall apply to off-highway private operations as well as to all public highway movements. A bulk vehicle body for delivering and mixing blasting agents shall conform with the requirements of this subsection. The body shall be constructed of noncombustible materials. Vehicles used to transport bulk premixed blasting agents on public highways shall have closed bodies. All moving parts of the mixing system shall be designed to prevent a heat buildup. Shafts or axles which contact the product shall have outboard bearings with 1-inch minimum clearance between the bearings and the outside of the product container. Particular attention shall be given to the clearances on all moving parts. A bulk delivery vehicle shall be strong enough to carry the load without difficulty and be in good mechanical condition. Operation of bulk delivery vehicles shall conform to the requirements of federal regulations for interstate transportation of dangerous substances. These include the placarding requirements as specified by the department of transportation. The operator shall be trained in the safe operation of the vehicle together with its mixing, conveying, and related equipment. The employer shall assure that the operator is familiar with the commodities being delivered and the general procedure for handling emergency situations. The hauling of either blasting caps or other explosives but not both, shall be permitted on bulk trucks provided that a special wood or nonferrous-lined container is installed for the explosives. Such blasting caps or other explosives shall be in DOT-specified shipping containers. No person shall smoke, carry matches or any flame- producing device, or carry any firearms while in or about bulk vehicles affecting the mixing transfer or down-the- hole loading of blasting agents at or near the blasting site. Caution shall be exercised in the movement of the vehicle in the blasting area to avoid driving the vehicle over or dragging hoses over firing lines, cap wires, or explosive materials. The employer shall assure that the driver, in moving the vehicle, has assistance from a second person to guide the driver's movements. No in transit mixing of materials shall be performed. Pneumatic loading from bulk delivery vehicles into blast holes primed with electric blasting caps or other static-sensitive systems shall conform to the requirements of this subsection. A positive grounding device shall be used to prevent the accumulation of static electricity. A discharge hose shall be used that has a resistance range that will prevent conducting stray currents, but that is conductive enough to bleed off static buildup. A qualified person shall evaluate all systems to determine if they will adequately dissipate static under potential field conditions. Repairs to bulk delivery vehicles shall conform to the requirements of this section. No welding or open flames shall be used on or around any part of the delivery equipment unless it has been completely washed down and all oxidizer material removed. Before welding or making repairs to hollow shafts, the shaft shall be thoroughly cleaned inside and out and vented with a minimum one-half-inch diameter opening.

Bulk Storage Bins

The bin, including supports, shall be constructed of compatible materials, waterproof, and adequately supported and braced to withstand the combination of all loads including impact forces arising from product movement within the bin and accidental vehicle contact with the support legs. The bin discharge gate shall be designed to provide a closure tight enough to prevent leakage of the stored product. Provision shall also be made so that the gate can be locked. Bin loading manways or access hatches shall be hinged or otherwise attached to the bin and be designed to permit locking. Any electrically driven conveyors for loading or unloading bins shall conform to the requirements of through . They shall be designed to minimize damage from corrosion. Bins containing blasting agents shall be located, with respect to inhabited buildings, passenger railroads, and public highways and separated from other blasting agent storage and explosives storage. Bins containing ammonium nitrate shall be separated from blasting agent storage and explosives storage.

Transporting Packaged Blasting Agents

Vehicles transporting blasting agents shall only be driven by and in charge of a driver at least twenty-one years of age who is capable, careful, reliable, and in possession of a valid motor vehicle operator's license. Such a person shall also be familiar with the state's vehicle

and traffic laws. No matches, firearms, acids, or other corrosive liquids shall be carried in the bed or body of any vehicle containing blasting agents. No person shall be permitted to ride upon, drive, load, or unload a vehicle containing blasting agents while smoking or under the influence of intoxicants, narcotics, or other dangerous drugs. It is prohibited for any person to transport or carry any blasting agents upon any public vehicle carrying passengers for hire. Vehicles transporting blasting agents shall be in safe operating condition at all times. When offering blasting agents for transportation on public highways the packaging, marking, and labeling of containers of blasting agents shall comply with the requirements of DOT. Vehicles used for transporting blasting agents on public highways shall be placarded in accordance with DOT regulation.

Water Gel Explosives and Agents

Unless otherwise set forth in this section, water gels shall be transported, stored and used in the same manner as explosives or blasting agents in accordance with the classification of the product. Water gels containing a substance in itself classified as an explosive shall be classified as an explosive and manufactured, transported, stored, and used as specified for "explosives" in this manual. Water gels containing no substance in itself classified as an explosive and which are cap-sensitive as defined in under blasting agent shall be classified as an explosive and manufactured, transported, stored and used as specified for "explosives" in this section. Water gels containing no substance in itself classified as an explosive and which are not cap-sensitive as defined in under blasting agent shall be classified as blasting agents and manufactured, transported, stored, and used as specified for "blasting agents" in this section. When tests on specific formulations of water gels result in a department of transportation classification as a Class B explosive, bullet-resistant magazines are not required.

Fixed Location Mixing

Buildings or other facilities used for mixing water gels shall be located with respect to inhabited buildings, passenger railroads and public highways. In determining the distances separating highways, railroads, and inhabited buildings from potential explosions, the sum of all masses that may propagate from either individual or combined donor masses are included. However, when the ammonium nitrate must be included, only fifty percent of its weight shall be used because of its reduced blast effects. Buildings used for the mixing of water gels shall conform to the requirements of this subsection. Buildings shall be of non- combustible construction or sheet metal on wood studs. Floors in a mixing plant shall be of concrete or of other nonabsorbent materials. Where fuel oil is used all fuel oil storage facilities shall be separated from the mixing plant and located in such a manner that in case of tank rupture, the oil will drain away from the mixing plant building. The building shall be well ventilated. Heating units that do not depend on combustion processes, when properly designed and located, may be used in the building. All direct sources of heat shall be provided exclusively from units located outside of the mixing building. All internal- combustion engines used for electric power generation shall be located outside the mixing plant building, or shall be properly ventilated and isolated by a firewall. The exhaust systems on all such engines shall be located so any spark emission cannot be a hazard to any materials in or adjacent to the plant.

Construction of Magazines

Construction of all explosive storage magazines must comply with state and Bureau of Alcohol, Tobacco, and Firearms regulations. A Class 1 storage facility shall be a permanent structure; a building, an igloo or army-type structure, a tunnel, or a dugout. It shall be bullet-resistant, fire-resistant, weather-resistant, theft-resistant, and well ventilated. All building type storage facilities shall be constructed of masonry, wood, metal, or a combination of these materials and shall have no openings except for entrances and ventilation. Ground around such storage facilities shall slope away for drainage. Masonry wall construction shall consist of brick, concrete, tile, cement block, or cinder block and shall be not less than 6 inches in thickness. Hollow masonry units used in construction shall have all hollow spaces filled with well tamped coarse dry sand or weak concrete (a mixture of one part cement and eight parts of sand with enough water to dampen the mixture while tamping in

place). Interior wall shall be covered with a non-sparking material. Metal wall construction shall consist of sectional sheets of steel or aluminum not less than number 14 gauge, securely fastened to a metal framework. Such metal wall construction shall be either lined inside with brick, solid cement blocks, hardwood not less than 4 inches in thickness or material of equivalent strength, or shall have at least a 6 inch sand fill between interior and exterior walls. Interior walls shall be constructed of or covered with a non sparking material. Wood frame wall construction. The exterior of outer wood walls shall be covered with iron or aluminum not less than number 26 gauge. An inner wall of non sparking materials shall be constructed so as to provide a space of not less than 6 inches between the outer and inner walls, which space shall be filled with coarse dry sand or weak concrete. Floors shall be constructed of a non sparking material and shall be strong enough to ear the weight of the maximum quantity to be stored. Foundations shall be constructed of brick, concrete, cement block, stone, or wood posts. If piers or posts are used, in lieu of a continuous foundation, the space under the buildings shall be enclosed with metal. Except for buildings with fabricated metal roofs, the outer roof shall be covered with no less than number 26-gauge iron or aluminum fastened to a 7/8- inch sheathing. Where it is possible for a bullet to be fired directly through the roof and into the storage facility at such an angle that the bullet would strike a point below the top of inner walls, storage facilities shall be protected by one of the following methods a sand tray shall be located at the tops of inner walls covering the entire ceiling area, except that necessary for ventilation, lined with a layer of building paper, and filled with not less than 4 inches of coarse dry sand. A fabricated metal roof shall be constructed of 3/16-inch plate steel lined with 4 inches of hardwood or material of equivalent strength (for each additional 1/16-inch of plate steel, the hardwood or material of equivalent strength lining may be decreased one inch). All doors shall be constructed of 1/4-inch plate steel and lined with 2 inches of hardwood or material of equivalent strength. Hinges and hasps shall be attached to the doors by welding, riveting or bolting (nuts on inside of door). They shall be installed in such a manner that the hinges and hasps cannot be removed when the doors are closed and locked. Each door shall be equipped with two mortise locks; or with two padlocks fastened in separate hasps and staples; or with a combination of mortise lock and a padlock, or with a mortise lock that requires two keys to open; or a three-point lock. Padlocks shall have at least five tumblers and a case-hardened shackle of at least 3/8-inch diameter. Padlocks shall be protected with not less than 1/4-inch steel hoods constructed so as to prevent sawing or lever action on the locks, hasps, and staples. These requirements do not apply to magazine doors that are adequately secured on the inside by means of a bolt, lock, or bar that cannot be actuated from the outside. Except at doorways, a 2-inch air space shall be left around ceilings and the perimeter of floors. Foundation ventilators shall be not less than 4 by 6 inches. Vents in the foundation, roof, or gables shall be screened and offset. No sparking metal construction shall be exposed below the top of walls in the interior of storage facilities, and all nails therein shall be blind-nailed, countersunk or non sparking. Storage facilities shall be constructed of reinforced concrete, masonry, metal or a combination of these materials. They shall have an earth mound covering of not less than 24 inches on the top, sides and rear. Interior walls and floors shall be covered with a non sparking material.

Addendum 1

Midland Communications Fall Protection Program

It is the policy of Singleton Tower, LLC to conduct all operations in a responsible manner, free from recognized hazards. This program applies to any and all employees and subcontractors.

In order to access high and low places on jobsites, a variety of equipment may be used such as ladders, scaffolding, suspended platforms, aerial lifts, and stairways. The use of these access systems often present fall hazards. In addition, employees may be exposed to falls while working on elevated structures, climbing onto and off of equipment, and even while walking by falling through holes or by slipping or tripping.

Some form of fall protection must be used to protect workers when they are exposed to fall hazards of 6 feet or more. This includes employees falling onto a lower level, into dangerous equipment, and being struck by falling objects.

Major Fall Protection Systems

In all cases, we will treat Fall Protection with the following priorities:

1. Where there is a hazard for a fall of over six feet, a barricade of wood or steel cable shall be erected. This barricade shall be of such strength that it will sustain 200 pounds of force applied in any direction with three inches or less of deflection.

2. Where a barrier cannot be erected, Personal Fall Arrest Systems shall be our next line of defense.

3. Where 1 and 2 above cannot be employed, consideration shall be given to other methods and means of accomplishing the task. Our last method of protection shall be a written Fall Protection Plan. Fall Protection Plans shall be specific to the work in progress.

Personal Fall Arrest System- The three main parts of a personal fall arrest system are the harness, the lanyard/lifeline, and a suitable anchorage. The anchorage point(s) must be capable of supporting 5000 lbs. or two times the maximum load on an engineered system. These systems must be set up so that workers do not fall further than 6 feet, nor contact the lower level. Note: The use of body belts for fall arrest is not allowed after January 1, 1998.

Personal Fall Protection System- Personal Fall Protection System must be inspected before each use. Any equipment that is frayed, worn, or has excessive wear or deterioration will be discarded. Any equipment that has been used in a fall incident is to be discarded.

Full Body Harness- Full body harness with a retracting or shock absorbing lanyard that limits a fall to 6 feet. Lanyard will have a minimum breaking strength of 5,000 lbs. and a maximum arresting force on an employee of 1,800 lbs.

Guardrail Systems- Guardrail systems are comprised of a top rail (42 + 3 in), a midrail, and if necessary a

toeboard. Guardrail systems can be made of various materials, so long as it can withstand a force of 200 pounds. Guardrail systems must be smooth to protect workers from punctures or lacerations and to prevent clothing or PPE from snagging.

Safety Nets- Safety nets need to be provided for all work areas where the use of scaffolds, catch platforms, temporary floors, or where a personal fall arrest system is impractical. Safety nets must extend at least 8 feet (depending on the fall hazard height) beyond the edge of the surface where employees are exposed. Nets shall be hung no more than 30 feet (9.1 m) below the work surface with sufficient clearance to prevent user's contact with the surfaces or structures below. Safety nets must be impact load tested prior to commencing operations.

Protection from Falling Objects- When toeboards are used as fall protection, they must be erected along the sides and ends of overhead walking/working surfaces 3 1⁄2 inches in height and cannot have any openings greater than 1 inch. When canopies are used for falling object protection, they must be strong enough to prevent collapse and to prevent penetration by any objects that may fall onto them.

In an effort to prevent falls on our job sites, the minimum fall protection requirements on every project will include:

1. All fall protection systems must meet the requirements of Part 1926, subpart M. Fall protection requirements when working on scaffolds, ladders, and in steel erection are covered under their related subparts.

2. For situations where lifelines are interrupted, double lanyards are necessary to ensure that the worker is continuously protected from falling by attaching one lanyard ahead of the discontinuity prior to unhooking the trailing lanyard.

3. Where scaffolds are necessary to provide temporary access to work areas, they must be in compliance with 1926.451. Personal fall arrest systems are required to protect workers during installation and removal of the railings, and in situations where physical restrictions preclude installation of a standard railing.

4. Fall protection is required for each employee that is exposed to a fall hazard from open sides or ends of walking/working surfaces, holes, ramps, runways, or other walkways. In no case shall a height of 6 feet (1.8 m) remain unprotected.

5. All workers in approved personnel aerial lifts must use a personal fall arrest system meeting the criteria of subpart M, with the lanyard attached to the boom or basket.

6. Instances in which it is impossible to provide fall protection for workers are rare. When an individual worker must rig the fall protection system, and it cannot be accomplished from an aerial lift or by tying off to the existing structure, momentary exposure to a fall hazard may be unavoidable. It is essential that adequate construction procedures minimize such occurrence of unprotected exposure to fall hazards. It is equally essential that the fall protection systems used actually enhance safety, rather than creating a secondary hazard.

7. When guardrail systems are used to prevent materials from falling from one level to another, any openings must be small enough to prevent passage of potential falling objects. Excess materials and debris must be kept clear of the working area by removal at regular intervals.

8. All workers must receive training on the nature of the fall hazards at the site and how to avoid falls. Employees should be trained in and familiar with the fall protection system in use and must wear the proper equipment when necessary.

Emergency Rescue Plan- Before the beginning of each day's work or before climbing any tower or structure, safety policy will be reviewed and local emergency phone numbers will be made available in case of emergency. A plan for emergency and rescue will be discussed and specific to each site.

Climbing- All workers approved to climb shall be trained by a competent person qualified in the nature of fall hazards in the work area, and the proper uses of personal fall arrest system, and equipment before the worker is allowed to climb. No one will be allowed to climb alone. Two or more persons will be present at the tower site. The ground person will also be a competent climber. Two way radio contact between climbers and the ground will be maintained.