

Pickering Associates, Inc.

Injury and Illness Prevention Program

Pickering Associates, Inc.

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Introduction

Now that you have your SAFETY MANUAL, please take the time to read and understand it. We also recommended that you make copies and distribute it to all employees. You may also want to put together a safety hand book and distribute it to your employees. To be effective the safety program must have a method to clearly communicating Pickering Associates, Inc. safety policies and rules to its employees.

Since all Federal Agencies require that everything be documented, we suggest that you have each employee sign an acknowledgement that he or she has been issued their copy of the safety manual and are required to read it. If nothing else, a signed statement from your employees that they have received a copy of the manual displays a good-faith effort by the company to communicate the safety policies and rules.

Another idea is to have your company hold weekly safety meeting to review the manual in a group setting. This is an effective way to have any questions addressed, discussed and reviewed. We also suggest that you keep records of these meetings: who is in attendance, which chapters or material were discussed and on what date, and have the employee sign an attendance sheet for each meeting.

The Occupational Safety & Health Administration requires **every company** to establish and implement an **effective safety and health program**. Such a program must include evidence of the following:

- Management commitment
- Employee involvement
- Work site analysis
- Hazard prevention and control
- Training

This **manual** has been developed and written to **meet these requirements** set down by OSHA and / or the state of West Virginia's regulations - which depending on certain industries, may take precedent over the Federal OSHA Standards. The criteria for establishing, implementing and maintaining an effective Injury and Illness Prevention Program are contained in the following eight elements:

- Written designation of a responsible safety person
- System for ensuring employee compliance
- Effective employee communication
- Accident / Exposure Investigation
- Procedures for identifying workplace hazards including inspections
- A method for reporting unsafe conditions and proper hazard assessment / correction
- Training and instruction
- Record keeping

An Injury and Illness Prevention Program must be maintained by the company in order to be effective. Any company in an industry which has been classified by OSHA as being a non-high hazard who adopts, posts, and implements this model program in good faith is not subject to assessment of a civil penalty for the first violation. For the exact West Virginia regulations please contact your local OSHA Consultation Area Office.

USING THE MANUAL AS PART OF THE SAFETY COMPLIANCE PROCESS

You will be identifying each safety hazard and potential safety problem as you go through the chapters and sections. Once you have identified a problem, your safety manual should be used to reference what your possible courses of action are and what will be required to remediate the problem or situation

Having printed and distributed the manual, you are ready to read the manual to your employees in safety meetings. The manual will simplify your record keeping requirements for safety meetings by referring to pages in the manual, which were discussed. A safety meeting provides the opportunity for two-way communication and assures that all involved employees communicate the safety lesson in a form that is readily understandable.

A meeting held Quarterly will also encourage employees to inform management about any workplace hazards without fear of reprisal. These employee safety meetings must provide a forum where all safety issues are freely and openly discussed by all present. Such meetings should be mandatory in attendance for all employees and managers so that maximum attendance can be achieved.

In multi-shift operations, schedule meetings for all shifts. Many companies' find it cost effective to hold safety meetings at shift change time, with a brief overlap of schedules to accomplish the meetings. Not only does this save time and money, but also it encourages the shift ending to tell the shift beginning of any newly discovered or unusual hazard that they encountered during their shift.

If properly planned, an effective safety meeting can be held in 15 to 20 minutes. Stress that the purpose of the meeting is safety and concentrate on the factors that will make the workplace safe. We suggest you begin with the occupational accident and injury history of your own facility.

To start your safety meetings, we suggest you review reports and communication from the safety committee, if you have one. You may want to enlist guest speakers from your workers' compensation insurance carrier, your liability insurance carrier, your trade association and other outside sources. One of our Safety Consultants may be available to come to your workplace and speak on safety or consult with your company on

preventing injuries and reducing risks. Consider buying safety “materials” like hats that say “Think Safety”, or sponsoring prizes or contests. Post the accident free workdays count so that everyone can see. Make safety a part of the company spirit.

Don't be afraid to use your manual as the safety meeting text, supplemented by other visual aids and instructional materials. Make the manual a part of each meeting. Assign pages or paragraphs to be read before the next meeting. Use the safety manual as part of any training program. Refer to the manual in the company newsletter. Print the manual in a form that is easily read by everyone. And refer to manual pages in documentation of the safety meetings, so that you have a ready reference for the topics listed.

THE SAFETY COMMITTEE ALTERNATIVES

The safety committee can also benefit from the manual. In some states, safety committees are optional. Safety committees are perceived as an excellent vehicle for facilitating communication between labor and management on occupational safety and health issues. The committee should:

- Meet regularly, at least once a month. Except low hazard work environments that should meet at least quarterly.
- Prepare and post written records of safety and health issues discussed at the committee meetings, with records maintained for review upon request by federal agencies.
- Make periodic work site inspections at least quarterly, and ensure that any recommended corrective actions are taken.
- Review reports of investigations of prior accidents, workers' compensation claims, injuries or exposures to hazardous substances so as to form and suggest procedures for correction or avoidance.
- Review safety complaints or concerns with the employees.
- Evaluated safety recommendations.

WORKPLACE INSPECTIONS

Assessment of your workplace should be conducted by Ryan K. Taylor for the Injury and Illness Prevention Program, and/or by a professional occupational safety and health hygienist. Workplace assessment consists of the following activities:

Conducting a Safety and Health Survey

First, conduct a comprehensive safety and health survey of your facility to

identify existing or potential safety and health hazards. This survey should evaluate workplace conditions regarding: safety and health regulations; generally recognized safe work practices; physical hazards, list of any hazardous materials; employee work habits; and a discussion of safety and health problems with employees. Your safety and health survey also needs to cover:

Equipment -- Make a list of your equipment and tools; include their principle area of use. Pay special attention to inspection schedules, maintenance activities, and the physical layout of your facility.

Chemical -- Make a list of all chemicals used in your workplace, obtain Material Safety Data Sheets on the materials used, identify where they are used, and possible employee exposures.

Work Controls -- Detail specific work practices associated with equipment, tools, and chemical use. Extra attention must be given to personal protective equipment, guarding, ventilation, emergency procedures, and use of appropriate tools.

OSHA Rules -- Review the rules applicable to your operation, equipment, process, materials, and the like. These rules are the minimum requirements for workplace safety and health. Most workplaces fall under OSHA's General Industrial Safety and Health Rules. If you are involved in construction, forest or maritime activities, petroleum, agriculture, or certain other industries, there are certain sections that must be included into your manual depending on the specific industry and company safety issues. Please call us if you have any questions.

Prior Incident Assessment

The next activity is an evaluation of your existing Injury and Illness Prevention Program to identify areas that may be working well and those that may need improvement. Examine your companies:

- Accident, injury or illness dates
- Workers' compensation costs
- Rates of employee turnover or absenteeism
- Information on safety and health activities ongoing or previously tried
- Company policy statements
- Rules -- both work safety and health
- Guidelines for proper work practices and procedures
- Records of training programs
- Compliance with State or Federal "Right to Know" Laws and Hazard

Communication Rules

- Employee expertise -- make an alphabetical list of employees, showing the dates they were hired, what their jobs are, and their experience and training
- Joint labor-management safety and health committee activities, if applicable
- Other safety-related issues and programs

Physically Inspecting the Work Place for Hazards

Hazard control is the **heart** of an effective Injury and Illness Prevention Program. Periodic inspections are mandatory to provide methods of identifying existing or potential hazards in the workplace. The hazard control system provides a basis for developing safe work procedures, and injury and illness prevention training. If hazards occur or recur, this reflects a breakdown in the hazard control system.

Self-Inspections -- Scheduled inspections are made in addition to the everyday safety and health checks that are part of the routine duties of managers and supervisors. You should be familiar with OSHA rules that apply to your workplace, and you should use them to identify potential hazards. We have included a 30+ page Hazard Identification Checklist to assist you in the documentation of any hazards. Also, an OSHA employee can assist you in identifying occupational safety and health rules applicable to your work process. OSHA is available to do phone consultations and to answer your questions.

Encourage Reports -- Employees should be encouraged to tell supervisors about possible hazardous situations, knowing their reports will be given prompt and serious attention without fear of reprisal.

Document Maintenance -- Workplace equipment and personal protective equipment should be maintained in good, safe working condition. Monitoring the operation of workplace equipment and verifying routine maintenance can prevent costly breakdowns and undue exposures while meeting OSHA requirements.

Document Immediate Correction -- Hazards should be corrected as soon as they are identified.

Safety and Health Training -- OSHA rules require each company to train workers for any job or task they are assigned.

OSHA TRAINING MODEL

The Occupational Safety and Health Administration has developed a set of voluntary training guidelines as a model to assist company's in providing the safety and health information and instruction needed for their employees to work at minimal risk to themselves, to fellow employees, and to the public. The guidelines are designed to help companies:

- Determine whether a work site problem can be solved by training
- Determine what training, if any, is needed
- Identify goals and objectives for the training
- Design learning activities
- Conduct training
- Determine the effectiveness of the training
- Revise the training program based on feedback from employees, supervisors, and others.

OSHA CONSULTATION SERVICE

Using a free consultation service largely funded by OSHA, employers can find out about potential hazards at their worksites, improve their occupational safety and health management systems, and even qualify for a one-year exemption from routine OSHA inspections.

The service is delivered by state governments using well-trained professional staff. Most consultations take place on-site, though limited services away from worksites are available.

Primarily targeted for smaller businesses, this safety and health consultation program is completely separate from the OSHA inspection effort. In addition, no citations are issued or penalties proposed.

It's confidential, too. Your name, your firm's name, and any information you provide about your workplace, plus any unsafe or unhealthful working conditions that the consultant uncovers, will not be reported routinely to the OSHA inspection staff.

Your only obligation will be to commit yourself to correcting serious job safety and health hazards – a commitment which you are expected to make prior to the actual visit and carry out in a timely manner. Your manual will also be evaluated during this process.

For more information on this service you can visit the OSHA Consultation Service site

@ <http://www.osha.gov/oshaprogs/consult.html>

OSHA Compliance Group, Inc. personal are not OSHA representatives and shall not be held liable or responsible for any related costs, fees, fines or damages from the use or misuse of this manual.

To ensure that your company or business is in full compliance, we recommend that you call the West Virginia State OSHA Consultation Office and schedule a visit.

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We wish you good luck in implementing your safety program. For further help or information contact:

Customer Service

888.801.0247

helpdesk@oshasafetymanual.com

www.safetymanual.com

Best regards,

***OSHA COMPLIANCE GROUP, INC.
And Staff***

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Chapter 1 - Injury and Illness Prevention Program

1.1 Written Plan

Every company must have a written Injury and Illness Prevention Plan. This is Pickering Associates, Inc.'s plan. Please read it carefully. While no plan can guarantee an accident free work place, 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.

1.2 Introduction to Our Program

State and federal law, as well as company policy, makes 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 Pickering Associates, Inc. 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 his or her 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.

1.3 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.

1.4 Individual Cooperation Necessary

Pickering Associates, Inc. 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 the cooperation in all safety and health matters, not only of the company and employee, but also 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.

1.5 Safety Program Goals

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The objective of Pickering Associates, Inc. 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.

1.6 Safety Policy Statement

It is the policy of Pickering Associates, Inc. that accident prevention shall be considered of primary importance in all phases of operation and administration. It is the intention of Pickering Associates, Inc.'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.

1.7 Safety Rules for All Employees

It is the policy of Pickering Associates, Inc. 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 supervisor on duty and their immediate supervisor, if corrective action is not taken immediately, a governmental authority with proper jurisdiction over such practices.
2. The Vice President of Operations shall be responsible for implementing these policies by insisting that employees observe and obey all rules and

- regulations necessary to maintain a safe work place 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. Keeping your work area clean and free from materials or equipment that could cause workers to slip or trip.
 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 is 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 Vice President of Operations.
 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 Vice President of Operations 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. Bend all exposed nails so they do not hurt anyone removing the waste.
 16. Do not wear shoes with thin or torn soles.

1.8 Responsible Safety Officer

The identity of the person who is responsible for the Pickering Associates, Inc.'s safety program is Ryan K. Taylor. This person must be someone of sufficient authority to implement the program. In addition to other titles, this person is called the Responsible Safety Officer.

1.9 Designated

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In accordance with Pickering Associates, Inc.'s safety and injury prevention program, Ryan K. Taylor has been designated as the Responsible Safety Officer, and has responsibility and authority to do the following in the name of Pickering Associates, Inc.:

1. Develop and implement rules of safe practices for each function within the company.
2. Develop and implement safe operating rules for use of electrical and mechanical equipment consistent with manufacturer's recommendations and specifications.
3. Develop and implement a system to encourage employees to report unsafe conditions immediately.
4. Conduct a thorough investigation of each accident, whether or not it results in an injury, to determine the cause of the accident and to prevent recurrence. In cases of a known injury accident, the investigation shall proceed only after consultation with Pickering Associates, Inc. attorneys, who shall direct the investigation (the product of which investigation shall be considered the work product of the attorney).
5. Instruct supervisors in safety responsibilities.
6. Develop and implement a program of employee safety education.
7. Conduct scheduled and unscheduled inspections to identify and correct unsafe working conditions. Special attention shall be given to notice of serious concealed dangers.
8. Maintain records of training, periodic inspections, corrective actions and investigations as required by law. The Responsible Safety Officer for Pickering Associates, Inc. is Ryan K. Taylor. Pickering Associates, Inc. will inform every person of the name of the Responsible Safety Officer and post his or her name and telephone/office number on the bulletin board where all other safety information is routinely maintained.

1.10 Duties

Overall responsibility and authority for implementing the injury and illness prevention program is vested in Ryan K. Taylor, the Responsible Safety Officer. Management fully supports the Responsible Safety Officer. As part of the job, the Responsible Safety Officer will supplement this written injury and illness prevention program by: establishing workplace objectives and safety recognition programs; working with all government officials in both accident investigation and safety inspection procedures; maintaining safety and individual training records; encouraging reporting of unsafe conditions and promoting a safe workplace. Some of these responsibilities will be delegated to your immediate supervisor for implementation.

1.11 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.

1.12 Agreement to Participate

Every company is required to provide a safe and healthful workplace. Pickering Associates, Inc. is committed to fulfilling this requirement. A safe and healthful workplace is one of the highest priorities of Pickering Associates, Inc.. The information in this manual constitutes a written injury and illness prevention program. While Pickering Associates, Inc. cannot anticipate every workplace hazard, the following general principals 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 Vice President of Operations. Attend all company sponsored training and safety meetings. Read all posters and warnings. Listen to instructions carefully. Follow the Code of Safe Work Place Practices contained herein. Participate in accident investigations as requested. Accept responsibility for the safety of others. Maintain all required documentation. By signing the acknowledgement 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.

1.13 Safety Contest Awards / Accident Free Workplace

To recognize the importance of safety, Pickering Associates, Inc. may award a safety bonus based upon any or all of the following criteria:

1. No time-loss accidents.
2. Successfully passed periodic workplace safety inspections.
3. Active participation in Company safety discussions.
4. Active participation in safety suggestion program.
5. Other factors indicating a concern for safety.

The award and time period if and when implemented, will be announced in regular safety meetings or posted with the regular safety communications.

1.14 Employee Safety Suggestion Box

From time to time, Pickering Associates, Inc. may award a prize for the best safety suggestion. If and when implemented the following shall apply. To be eligible, please give your written safety suggestions to your supervisor during the safety meetings. All these safety suggestions will be discussed at the meeting. The supervisor whose employee wins the best safety suggestion will also be given a prize. The group that consistently has the best safety suggestions will also be recognized. Management is the

sole judge of the value of safety suggestions, and will implement as many of the good suggestions as possible.

1.15 Training

Employee safety training is another requirement of an effective injury and illness prevention program. While Pickering Associates, Inc. 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.

1.16 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 Pickering Associates, Inc.'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 Pickering Associates, Inc.'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.

1.17 Periodic Safety Training Meetings

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Pickering Associates, Inc. will hold safety meetings Quarterly. 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 Vice President of Operations 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.

1.18 Employee Responsibility for Training

Teaching safety is a two-way street. Pickering Associates, Inc. can preach safety, but only employees can practice safety. Safety education requires employee participation. Quarterly, 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.
- h) The employer shall include methods and/or procedure for correcting unsafe or unhealthy conditions, work practices and work procedures in a timely manner based on the severity of the hazard based on:

(A) When observed or discovered; and,

(B) When an imminent hazard exists which cannot be immediately abated without endangering employee(s) and/or property, remove all exposed personnel from the area except those necessary to

correct the existing condition. Employees necessary to correct the hazardous condition shall be provided the necessary safeguards.

- i) Training shall also be provided to all employees given new job assignments for which training has not previously been received;
- j) Whenever new substances, processes, procedures or equipment are introduced to the workplace and represent a new hazard;
- k) Whenever the employer is made aware of a new or previously unrecognized hazard; and,
- l) For supervisors to familiarize themselves with the safety and health hazards to which employees under their immediate direction and control may be exposed.

1.19 Communication

Companies should communicate to employees their commitment to safety and to make sure that employees are familiar with the elements of the safety program. Pickering Associates, Inc. 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.

1.20 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 Pickering Associates, Inc. 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, a comprehensive safety check of all workplaces Weekly, coupled with ongoing compliance of all established safety standards and codes will reduce accidents and make our Company a better place to work.

1.21 Labor/Management Safety Committee

A Safety Committee has been established to help implement Pickering Associates, Inc.'s injury prevention program. The committee shall meet regularly, but not less than once every six months. Written notes of all Safety Committee meetings shall be available and distributed to all employees and shall be maintained for three years. The Safety Committee will inspect the work areas Monthly and review production and safety programs and practices. The Committee also reviews investigations of occupational accidents and causes of incidents resulting in occupational injury, illness or exposure to hazardous substances, and where appropriate, submits suggestions to prevent future incidents. The Committee encourages and reviews employee safety suggestions, initiates investigations of hazardous conditions or unsafe workplaces, and upon request from OSHA, verifies abatement action taken in reaction to health and safety citations.

1.22 Safety Committees

A Safety Committee made up of 3 employees and management has been established. The committee will conduct regular meetings, keep minutes and make regular inspections of machinery, equipment, appliances and working conditions. Any conditions found unsafe by the Safety Committee shall be corrected or repaired immediately.

We recognize that cooperative effort is required to ensure a safe operation. For this reason, Pickering Associates, Inc. has established a Safety Committee, composed of employees and management representatives. It is the duty of this committee to cooperate to maintain safe working conditions throughout the Company, to advise and educate employees in safe working practices, to investigate accidents and their causes, and to seek preventive measures. Meetings are held Monthly to consider the regular inspection report, make recommendations for improvement of conditions, review and analyze accident reports, and to attend to any other business involving safety. If you would like to become part of the Safety Committee, now or in the future, please let the Responsible Safety Officer know of your interest.

The safety committee of 3 will meet periodically with management to discuss safety and other problems which may occur in the work area. In the event problems or questions do arise or in the event an employee feels unsure of his or her job requirements or performance, the following steps are to be followed:

A. First, take the problem up with the supervisor or department head. If, after discussion, the problem remains unresolved, use Step B.

B. After discussing the problem with your crew representative, you and the crew representative should take the matter up with the superintendent. If you and the crew representative are still not satisfied, the matter will then be referred to the Committee for disposition at the next regular meeting or at a special meeting, if such special meeting is deemed necessary.

C. All decisions arrived at by the Committee in Step B will be subject to review by the Personnel Director of Pickering Associates, Inc.. The review will ensure that the rules, regulations and procedures of this manual are being followed, and that the policy of Pickering Associates, Inc. is followed. Your question, complaint or grievance will be examined, considered and answered after a full investigation has been conducted.

1.23 Safety Meetings

Pickering Associates, Inc. has safety meetings Quarterly. The format of these meetings will be to review, in language understandable to every employee, the content of Pickering Associates, Inc.'s Injury and Illness Prevention program, special work site hazards, serious concealed dangers, and MSDS sheets, which a copy of are kept by copier. Pickering Associates, Inc. requires all its employees to accept responsibility for their own safety, as well as that of others in the workplace. It is your responsibility to read this manual and to become familiar with the Code of Safe Work Practices and Specific Safety Rules contained in this manual, as well as any posted government Safety Orders.

1.24 Progressive Employee Disciplinary Program

Every employee that works for Pickering Associates, Inc. shall know and understand that safety and safety training are very important. We take safety seriously and do not and will not tolerate employees who do not comply with the written safety training or the safety program in general. Know that disciplinary action will result from a violation of the safety rules. As stated all employees are required to report any unsafe act or procedure immediately to the proper person. Pickering Associates, Inc. will give written warnings to employees for any violation of the safety rules or safety training. A safety violation may also include willfully not attending or participating in a safety training session or safety meeting. The 1st warning will serve as such, just a warning. It will be in writing and given to the employee in violation by Responsible Safety Officer. The safety committee will

determine if the violation occurred due to lack of training. If the safety committee or the Responsible Safety Officer come to the conclusion that further training is required, then training will be provided. At any time you as an employee feel that you are not properly trained on how to perform a specific job or work procedure, you are immediately required to report to a supervisor. Pickering Associates, Inc. never wants anyone to do any type of work where the employee does not feel safe or properly trained. At that point, work must not be performed. If an employee performs work or continues to perform work where they are not properly trained, you are in direct violation of our safety rules. As stated, Pickering Associates, Inc. will give written warnings to employees for any violation of the safety rules or safety training. The 2nd safety infraction or violation will result in a 1 (one) day suspension without pay, if you are deemed properly trained and in direct violation of Pickering Associates, Inc.'s safety rules. The 3rd safety infraction or violation will result in one of the following depending on the severity of the violation

- a 5 to 6 (five to six) day suspension without pay, if you are deemed properly trained and in direct violation of Pickering Associates, Inc.'s safety rules or;
- **be terminated**, if the violation is of a severe nature where others direct safety or risk of life are seriously at risk.

The 4th safety infraction or violation will result in Termination.

1.25 Hazard Identification & Abatement

This written safety and health plan sets out a system for identifying workplace hazards and correcting them in a timely fashion. This process is implemented in order to correct any identified hazards from inspections, accident investigations, anonymous reporting, employee safety suggestions and system hazard identifications. Please review it carefully with your supervisor. Remember, safety is everyone's responsibility. Hazards must be corrected in order of priority based on severity in a expeditiously manner.

1.26 Reporting Safety Hazards Anonymously

From time to time an employee may encounter a situation where he or she may feel threatened in reporting a safety hazard or unsafe working condition. If this situation arises the following are ways for an employee to report the situation anonymously. This is our policy on "Anonymous Safety Hazard Reporting":

- Please give your written safety hazard or safety suggestions to your supervisor at any time or during the safety meetings on the form named "Employee's Safety Suggestion" or form "G" in the packet of safety forms. This form is also available at the "Employee Safety Suggestion Box". Your name and any personal information can be left off of the form.

- This form - “Employee’s Safety Suggestion” can also be filled out and placed in the “Employee Safety Suggestion Box”. Your name and any personal information can be left off of the form.
- An employee can also fill out this “Employee’s Safety Suggestion” form and can also be filled out and placed in the U.S. Mail and mailed to:
Pickering Associates, Inc.
Attn: Ryan K. Taylor
11283 Emerson Ave.
Parkersburg, West Virginia 26104

Your name and any personal information can be left off of the form.

1.27 Safety Audits

The best method to establish a safer workplace is to study past accidents and worker compensation complaints. By focusing on past injuries, Pickering Associates, Inc. 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.

1.28 Workplace Inspections

In addition to the examination of records, work place safety inspections will occur periodically Weekly, when conditions change, or when a new process or procedure is implemented. During these safety inspections all obtained information will be documented. Furthermore, there will be a review of the injury and illness prevention policy and Pickering Associates, Inc. code of safe work practices.

1.29 Accident Investigation

A primary tool used by Pickering Associates, Inc. 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 Pickering Associates, Inc.'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. Every job location will have on site at least one camera, preferably either a video or a sixty second type, with enough film to take pictures immediately after any occurrence. Some workplaces will have a video camera.

A written report should be prepared from notes and diagrams made at the scene 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 juror 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 eyewitnesses 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.

1.30 Records

Pickering Associates, Inc. maintains records of employee training, hazard identification and abatement, and accident investigation. Records shall be kept to document safety and health training for each employee by name or other identifier, training date, types of training and training providers.

1.31 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 Injury and Illness Log (OSHA Form 300) and Summary of Occupational Injuries and Illnesses Form 300A according to its instructions. Supplemental records of each injury are maintained on OSHA Form 301 (OSHA Injury and Illness Incident Record), and/or an equivalent of Form 301, such as Companies Report of Injury or Illness as per West Virginia requirements. This form must be completed 7 calendar days after the company receives information that a recordable work-related injury or illness has occurred. To be considered an equivalent form, any substitute must contain all the information asked on the OSHA Form 301.

Every year, a summary of all reported injuries or illnesses is posted no later than February 1 to April 30 of the year following the year covered by the form on OSHA Form 300. These records are maintained for five years from the date of preparation. The OSHA Form 300 and 300A has replaced OSHA Form 200 and OSHA Form 301 has replaced OSHA Form 101.

1.32 General Safety Rules

These rules set out basic procedures to minimize workplace hazards. Please follow them always.

1.33 General Statement on Safety

Familiarize yourself with and then follow all safety and health rules and regulations. General safety rules are:

1. Observe all smoking and fire prevention regulations.
2. Employees with long hair, regardless of their sex, must maintain their hair in such a way that it does not become a safety hazard.
3. Work clothing must not present a safety hazard. Shorts, loose or bulky clothing is not permitted.
4. Canvas or soft leather shoes will not be allowed on Construction Jobsites. Work boots or shoes must be worn. Safety toe shoes are highly recommended.
5. Protective head gear (hard hats), hearing protection, eye protection and other personal protective equipment will be worn in designated areas.
6. Horseplay is prohibited. This includes scuffling, yelling, running, throwing tools or material, or playing practical jokes on other employees.
7. No fighting will be allowed.
8. There will be no throwing of food or paper in lunchrooms. All garbage will be placed in a covered waste receptacle.
9. No equipment will be operated until safety guards are in place.
10. Lock out tags or locks shall not be removed unless authorization to remove them is given.
11. There will be no adjustment or removal of safety devices unless authorization is given.
12. Safety signs must be observed.
13. No riders will be allowed in or on company vehicles or any other equipment.
14. Drivers of vehicles must make daily safety inspections of their machines prior to operation. Report defects immediately to the supervisor or the repair shop.
15. Industrial injuries are to be reported to your supervisor immediately.
16. Orderly and clean work places are every employee's responsibility.
17. Fire extinguishers that have been used or that have a broken seal must be turned in to your supervisor.
18. Fire hoses are to be used for fire only.
21. Personal vehicles are to be parked in the designated area.
22. Obey the posted property speed limit.

You are Pickering Associates, Inc.'s most important asset. We want to conduct all operations in a safe manner. Your cooperation is necessary for the protection of yourself and others. It is important that you follow safety rules; that you use the safeguards and the safety equipment provided; and, that you make safety part of your job. The Company is covered by the Occupational Safety and Health Act, and must

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comply with its requirements. Employees are expected to cooperate fully in maintaining such compliance, including notifying your supervisor immediately of any known or concealed dangers in your work area. If you feel uncomfortable or unsafe in any work situation please let a supervisor know that you need assistance. Do not perform any task or duty that you do not feel properly equipped or trained on executing.

Pickering Associates, Inc. does not believe that "accidents are bound to happen." Pickering Associates, Inc. gives utmost consideration to the safety of our employees. We constantly strive to eliminate hazards using the most up-to-date safety devices, constant inspection, and constant and continuous safety education. Part of your job is to help prevent accidents. The right way to perform a job is the safe way! We cannot give you an ironclad set of rules applying to all situations. Familiarize yourself with the general safety rules that are listed below. Be sure to familiarize yourself with your own departmental safety rules that are posted on the bulletin board in your department. When you see a dangerous work practice or safety hazard while working, be sure to report it immediately to your supervisor or to a member of the Employee Safety Committee.

Eyes - Protect your eyes. Safety glasses or face shields must be worn.

Housekeeping - Keep yourself and your work area clean. Dirty and disorderly conditions cause many accidents. Serious injury can be caused by an employee slipping on an oil spot. Any time you see oil or grease on the floor, be sure to report it to your supervisor immediately.

Compressed Air - To safeguard yourself and others from the danger of flying chips, do not use compressed air to clean off machines; use a brush. Never direct an air hose toward another employee. Never use compressed air to blow chips from your hands, face or hair. Above all, do not be guilty of using an air hose for any kind of horseplay.

Lifting - Do not strain to lift or push objects that are too heavy for you. Ask for help. Be sure you lift the right way by bending your knees, keeping your body erect and then pushing yourself upward with your legs. Make your legs do the work, not your back.

Machines - Inspect your machine for defective or worn parts. Safety guards on your machine are installed for your protection. Do not remove them without your supervisor's permission. Never try to repair machines, electrical equipment, or tools. Do not attempt to clean machines while they are in operation. Report any defective equipment to your supervisor. Defective tools should be exchanged for good ones at the tool crib.

Horseplay - We aren't trying to dampen anyone's spirits, but serious accidents can result from running, throwing things, scuffling, or playing practical jokes. Don't indulge in horseplay during rest or lunch periods or during working hours.

Clothing - Wear clothing suitable to your job. All employees working on or around machines must wear short-sleeved shirts or blouses, except those working around high temperatures.

Shoes - Substantial shoes must be worn to protect feet and toes. Those handling material or heavy objects should wear safety shoes. No cloth tennis shoes, sandals, or moccasins may be worn in construction zones.

Running - Running on company property, particularly in aisles or on stairs is dangerous and strictly prohibited.

Fires - A fire could burn us all out of a job. Be careful with matches, cigars, and cigarettes. Be sure that they are extinguished before you dispose of them. In case of fire, the plant is protected by an automatic sprinkler system. To report a fire in your own department, activate the nearest fire alarm. In case of fire in another part of the plant, do not leave your area until ordered to do so, unless you have been designated to handle fire equipment. Remember to leave your place of work in an orderly manner. Use only regular exits. Exits must always be kept clear of obstructions.

1.34 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 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.

1.35 Hand Tools

The company shall be responsible for the condition of tools when furnished by him and the user shall inspect any tool prior to using it to determine that it is in proper operating condition. Defective tools shall be removed from service. Handles shall be sound, straight and tight fitting. Driven tools shall be dressed to remove any mushrooming. Cutting tools shall be kept sharp and properly shaped. Tools shall be used for purposes for which they were designed. Hand tools shall be sheathed or boxed if transported in a vehicle with personnel. If not contained in a box, the sheathed tools shall be fastened to the vehicle. Proper storage facilities shall be provided for hand tools. Tools shall be stored in the provided location at all times when not in use.

1.36 Housekeeping

Good housekeeping not only improves the appearance of the work place, it also helps prevent fires, accidents and personal injuries. Clean workbenches, machines, lockers and floors also enable you to maintain a high standard of quality in your work. For your safety, do not leave tools, scrap, or materials piled on the floor where someone may stumble over them, or overhead where there is danger of them falling. When piling material, be careful not to exceed a safe height. Do not pile anything in front of or against fire fighting apparatus, electrical equipment or drinking fountains. If you are a machine operator, give your machine the best possible care and be alert for signs of wear or faulty operations. Handle tools carefully and store them so that they cannot cause accidents.

1.37 Maintenance

Maintenance is essential to safe and efficient operation. A maintenance crew is employed full-time to keep the plant in order. However, they cannot keep the plant up to the required standard of cleanliness without the cooperation of everyone. If you notice a situation that requires maintenance, report it to your supervisor.

1.38 Emergencies

If a fire breaks out at Pickering Associates, Inc., certain employees have volunteered to aid in extinguishing the fire. Pickering Associates, Inc. recognizes the potential risks involved in fighting fires, and employees will be compensated for those dangers. We do not require employees to help fight any fires; employees will only be allowed to participate after executing a mutual release of liability agreement between the Company and the employee. Unless you have been specially trained and assigned to fight a fire, in the event of fire, you must exit the facility immediately, in a safe manner. Every work area will have an evacuation diagram showing the most logical exits. You should familiarize yourself with the diagram. **FIRE DOORS MAY NEVER BE LOCKED FROM THE INSIDE.** Report any obstruction to egress routes to your supervisor immediately. If the obstruction is not cleared, send a written report to the Responsible Safety Officer.

It is every employee's responsibility to know the locations of the first aid stations that have been placed throughout the facility. Instructions for use of first aid equipment are located at each station. In the event of an emergency, contact the Responsible Safety Officer or a supervisor who is trained in first aid. Supervisors and employees who are trained in first aid have a first aid emblem on their hardhat or jacket.

1.39 Smoking & Fire Safety

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

- Smoking is not allowed on the site, except in designated areas.
- Smoking is not permitted in rest rooms.
- If you are not sure about where you may smoke, ask the supervisor.

1.40 Fire Fighting

A fire may break out at a wooded location during certain times of the year. If such an emergency occurs Pickering Associates, Inc. recognizes the potential risks involved in fighting fires, and we do not require employees to help fight any fires; employees will only be allowed to participate upon a mutual agreement releasing liability between the Company and the employee.

1.41 Special Rules

No employee shall work alone on high-voltage electrical lines. In certain areas, no employee will be allowed to work bare handed with wire or electricity at all. Rubber or other insulated gloves will be required. Everyone is required to be responsible for all tools and equipment that you use; remember which vehicle you took the item from and return it to that vehicle. When you lay the item or tool on the ground, remember where you placed it so you can return it to the proper vehicle. It would be appreciated that when leaving the job, that all Employees help by looking around for any tools or equipment that wasn't replaced.

1.42 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 - Code of Safe Work Practices

2.1 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 and all company trucks that may encounter a potential fire hazard. 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.

2.2 Power Actuated Tools

The employees using power-actuated tools must be properly trained and will be issued a card as proof of that training. Some of the power-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 "POWER-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.

2.3 Machine Guarding

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. All equipment and machinery should be securely placed and anchored when necessary, to prevent tipping or other movement that could result in personal injury. Most of the time, machinery should be bolted to the floor to prevent falling during an earthquake, and the electrical

cord to the machinery fixed with a breaker or other shut-off device to stop power in case of machine movement. There must be a power shut-off switch within reach of the operator's position at each machine. Electrical power to each machine shall be capable of being locked out for maintenance, repair or security. The non-current carrying metal parts of electrically operated machines must be bonded and grounded. The foot-operated switches are guarded and/or arranged to prevent accidental actuation by personnel or falling objects. All manually operated valves and switches controlling the operation of equipment and machines must be clearly identified and readily accessible. All EMERGENCY stop buttons are colored RED. All the pulleys and belts which are within 7 feet of the floor or working level are properly guarded. All moving chains and gears must be properly guarded. All splashguards mounted on machines that use coolant must be positioned to prevent coolant from splashing the employees. 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 secured 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. A protective mechanism has been installed to prevent machines from automatically starting when power is restored after a power failure or shutdown. 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. All fan blades should be protected by a guard having openings no larger than 1/2 inch when operating within 7 feet of the floor. 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.

2.4 Lockout/Blockout Procedures

Anyone who operates, cleans, services, adjusts, and repairs machinery or equipment should be aware of the hazards associated with that machinery. Any powered machinery or electrical equipment that can move in a way that would put people in danger is a hazard that can be prevented by following locking or tagging procedures. Failure to lock out or tag power sources on equipment can result in electrocutions, amputations, and other serious-sometimes fatal-accidents.

What are the most common causes of these accidents?

- The machine or piece of equipment was not completely shut off before a maintenance or repair operation. Not only must the machine be turned off but also the power source that goes to it.

- The machine was turned on accidentally, either out of carelessness or because the person who turned it on didn't realize that another worker was there and could get hurt.
- The machine wasn't working correctly but wasn't fixed, turned off, locked or tagged, and someone who didn't know about the problem used it.
- Moving equipment wasn't blocked.
- Safety procedures were inadequate or hadn't been properly explained.

Remember the dangers and be on your guard around any machinery and moving equipment. Even if you don't operate the machinery, you could get caught in it and injured if it isn't properly disconnected. So what can you do to prevent accidental injury from moving machinery?

- Identify all jobs and equipment that require lockout of power sources
- Post warning signs wherever possible to indicate that lockout is required
- Develop written procedures explaining how lockout is to be done
- Train all personnel in the lockout procedures for their particular job and offer periodic refresher training
- Allow no deviation from the written policies and procedures
- Use engineering and administrative controls as much as possible to eliminate the need for lockout
- Perform regular maintenance to prevent malfunctioning equipment

Be aware of your personal safety and the safety of others when working with or around moving equipment and machinery. Always follow proper lockout and tagout procedures, even for a quick or minor repair!

All machinery or equipment capable of movement must be de-energized or disengaged and blocked or locked out during cleaning, servicing, adjusting or setting up operations, whenever required. The locking out of the control circuits in lieu of locking out main power disconnects is prohibited. All equipment control valve handles must be provided with a means for locking out. The lock-out procedure requires that stored energy (i.e. mechanical, hydraulic, air) be released or blocked before equipment is locked out for repairs. Appropriate employees are provided with individually keyed personal safety locks. Employees are required to keep personal control of their key(s) while they have safety locks in use. Employees must check the safety of the lockout by attempting a start up after making sure no one is exposed. Where the power disconnect does not also disconnect the electrical control circuit, the appropriate electrical enclosures must be identified. The control circuit can also be disconnected and locked out.

2.5 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. Firewatchers 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.

2.6 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 drainpipe 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.

2.7 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.

2.8 Hoists & Auxiliary Equipment

Every overhead electrical hoist shall be equipped with a limit device to stop the hook travel at its highest and lowest points of safe travel. Check these limits without a load to ensure the device is working correctly. Each hoist should automatically stop and hold any load up to 125 percent of its rated load if its actuating force is removed. Check this periodically under controlled conditions. Make sure that the rated load of each hoist is legibly marked and visible to the operator. Stops should be provided at the safe limits of travel for trolley hoists. The controls of hoists should be plainly marked to indicate

direction of travel or motion. Every cage-controlled hoist must be equipped with an effective warning device. Close-fitting guards or other suitable devices should be installed on hoists to assure hoist ropes will be maintained in the sheave grooves. All hoist chains or ropes must be of sufficient length to handle the full range of movement for the application, while maintaining two full wraps on the drum at all times. All nip points or contact points between hoist ropes and sheaves which are permanently located within 7 feet of the floor, ground or working platform must be guarded. It is prohibited to use chains or rope slings that are kinked or twisted. 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.

2.9 Powered Industrial Truck Operator Training.

A. Safe Operation.

1. The company shall ensure that each powered industrial truck operator is competent to operate a powered industrial truck safely, as demonstrated by the successful completion of the training and evaluation specified in this subsection.
2. Prior to permitting an employee to operate a powered industrial truck (except for training purposes), the company shall ensure that each operator has successfully completed the training required by this subsection, except as permitted in subsection E.

B. Training program implementation. Trainees may operate a powered industrial truck only:

1. Under the direct supervision of persons who have the knowledge, training and experience to train operators and evaluate their competence; and
2. Where such operation does not endanger the trainee or other employees.
3. Training shall consist of a combination of formal instruction (e.g., lecture, discussion, interactive computer learning, video tape, written material), practical training (demonstrations performed by the trainer and practical exercises performed by the trainee) and evaluation of the operator's performance in the workplace.
4. All operator training and evaluation shall be conducted by persons who have the knowledge, training and experience to train powered industrial truck operators and evaluate their competence.

C. Training program content. Powered industrial truck operators shall receive initial training in the following topics, except in topics which the company can demonstrate are not applicable to the safe operation of the truck in the

company's workplace.

1. Truck-related topics:

- i. Operating instructions, warnings, and precautions for the types of truck the operator will be authorized to operate;
- ii. Differences between the truck and the automobile;
- iii. Truck controls and instrumentation: where they are located, what they do, and how they work;
- iv. Engine or motor operation;
- v. Steering and maneuvering;
- vi. Visibility (including restrictions due to loading);
- vii. Fork and attachment adaptation, operation, and use limitations;
- viii. Vehicle capacity;
- ix. Vehicle stability;
- x. Any vehicle inspection and maintenance that the operator will be required to perform;
- xi. Refueling and/or charging and recharging of batteries;
- xii. Operating limitations;
- xiii. Any other operating instructions, warnings, or precautions listed in the operator's manual for the types of vehicle that the employee is being trained to operate.

2. Workplace-related topics:

- i. Surface conditions where the vehicle will be operated;
- ii. Composition of loads to be carried and load stability;
- iii. Load manipulation, stacking, and unstacking;
- iv. Pedestrian traffic in areas where the vehicle will be operated;
- v. Narrow aisles and other restricted places where the vehicle will be

- operated;
- vi. Hazardous (classified) locations where the vehicle will be operated;
 - vii. Ramps and other sloped surfaces that could affect the vehicle's stability;
 - viii. Closed environments and other areas where insufficient ventilation or poor vehicle maintenance could cause a build-up of carbon monoxide or diesel exhaust;
 - ix. Other unique or potentially hazardous conditions in the workplace that could affect safe operation.

D. Refresher training and evaluation. Refresher training, including an evaluation of the effectiveness of that training, shall be conducted as required by subsection D1 to ensure that the operator has the knowledge and skills needed to operate the powered industrial truck safely.

1. Refresher training in relevant topics shall be provided to the operator when:

- i. The operator has been observed to operate the vehicle in an unsafe manner;
- ii. The operator has been involved in an accident or near-miss incident;
- iii. The operator has received an evaluation that reveals that the operator is not operating the truck safely;
- iv. The operator is assigned to drive a different type of truck; or
- v. A condition in the workplace changes in a manner that could affect safe operation of the truck.

2. An evaluation of each powered industrial truck operator's performance shall be conducted at least once every three years.

E. Avoidance of duplicative training. If an operator has previously received training in a topic specified in subsection C of this section, and such training is appropriate to the truck and working conditions encountered, additional training in that topic is not required if the operator has been evaluated and found competent to operate the truck safely.

F. Certification. The company shall certify that each operator has been

trained and evaluated as required by this section. The certification shall include the name of the operator, the date of the training, the date of the evaluation, and the identity of the person(s) performing the training or evaluation.

G. Dates. The company shall ensure that operators of powered industrial trucks are trained, as appropriate, in accordance with the following dates:

1. If the employee was hired before July 15, 2000, the initial training and evaluation of that employee must be completed by July 15, 2000;
2. If the employee was hired after July 15, 2000, the initial training and evaluation of that employee must be completed before the employee is assigned to operate a powered industrial truck.

2.10 Industrial Trucks/Forklifts

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 is also 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 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 truck 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 are 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.

2.11 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.

2.12 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.

2.13 Environmental Controls

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.

2.14 Hazardous Chemical Exposures

In any company, which utilizes chemical substances, a training program on the handling, hazards, storage, exposure risks, symptoms of chemical exposure, and first aid needs to be part of any new employees training. There must also be follow-up training sessions as to any new chemical or processes that may be initiated by the company. Follow-up training sessions act as a reinforcement of safety standards that need to be followed on a daily basis. In a training program, employees will learn acceptable levels of chemical exposure, proper storage and labeling of chemicals, and usage of protective clothing and equipment for handling chemicals. They will also learn about potential fire and toxicity hazards, when not to have a chemical in a confined area, or to store in closed containers, usage of eye wash fountains and safety showers, and the necessary posting of open, and dangerous areas. It is important that an employee recognize the Threshold Limit Values or Permissible Exposure Limits of airborne contaminants and physical agents in the workplace. A procedural manual or set of instructions must be part of the program, with periodic inspections that clearly indicate whether an employee may be mishandling a chemical or endangering himself or others. Part of the manual or procedures must establish a standard of when and how to deal with chemical spills, neutralizing, and disposing of spills or overflows. These procedures must also be posted in an area that is easily accessible for reference usage. First Aid training and equipment will be routine in any facility where chemicals are used. Employees must know how to handle equipment in emergency situations, what equipment needs to be used and whether the equipment is adequate for the situation. Respirators may be used either as protective safety equipment or for emergency usage. Therefore, the employee should recognize that respirators need to be stored in a clean, sanitary and convenient location and inspected on a regular basis. Also what respirators are approved by NIOSH for their particular applications. With a first aid program an employee will recognize when a problem may be occurring by exposure to a chemical ranging from headaches, nausea, and dermatitis problems to other factors of discomfort when they use solvents or chemicals. In the design of a facility that transports chemicals from storage to vats, the content of pipes and storage containers must be clearly marked. Within that facility design there must be an emergency shut off system in case of accident. Each employee will be trained as to these emergency shut-off systems. Ventilation is another major factor in the design of any facility. Whether by natural means or mechanical, the system must be designed to control dust, fumes, solvents, gases, smoke or vapors which may be generated in the workplace. It is also important that a medical or biological monitoring system be in operation as part of the safety standards. If internal combustion engines are used in the facility, or if there is a

chance of leakage or mixture with a chemical that could create a toxic gas, atmospheric gas levels must be monitored. If toxic chemicals are used and stored in the facility they should be located in an isolated area to guarantee safety.

2.15 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 company'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.

2.16 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, and 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 cardio-pulmonary resuscitation (CPR) methods. Employees will be trained on how to work on energized lines or equipment over 600 volts.

2.17 Noise

Noise levels are measured using a sound level meter or an octave bank analyzer and records kept. 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.

2.18 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.

2.19 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.

2.20 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 brake 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.

2.21 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.

2.22 Ventilation

In the operation of any facility ventilation system, there needs to be a design to integrate several systems of control, which will expel contaminants 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.

2.23 Sanitizing Equipment & Clothing

In any operation where protective clothing is used, a set of standards of the handling, cleaning, and disposal of the clothing will be developed. In the line of work where an employee is exposed to a hazardous substance, is the employee required to change or take a shower? If so, both a change and shower room will be provided along with appropriate disposal areas of collection for the cleaning and sanitizing of the clothing. When working in a facility where employees need protective clothing, a training course will be held. Employees will also know where and when they can eat or smoke in such a facility. Conspicuously posted signs will be arranged throughout the plant.

2.24 Infection Control

When a facility is engaged in using a laboratory or any research that involves the handling of infectious diseases, or other biotechnological materials, the personnel will be trained in the handling of such materials. Technicians must have training in the handling of these materials, as safety precautions must be observed on a constant basis. The facilities will be designed to comply with the needed and standardized

practices that are used by the industry and recognized by state licensing agencies. The standards used and developed by the facility must also take into consideration environmental hazards and laws, which are applicable. Technicians normally will handle cultures, which contain human specimens as blood or body fluids that carry infectious bacteria. The practices of a laboratory will include proper ventilation, emergency equipment, necessary protective clothing, refrigeration, hand-washing sinks, bio-hazard tags, labels, needle containers, detergents/disinfectants and a manual on emergency procedures in case of an accident. The training of the technician will include universal precautions, how to manage and handle a needle stick exposure, HVB evaluations, antibody testing and vaccinations and how to dispose of these materials when finished with testing or evaluation. The workplace must be equipped with the proper equipment to meet the safety precautions universally recognized by the state-licensing agency. A general practice of cleaning and disinfecting the equipment and environment must be observed.

2.25 Ergonomics

With the introduction of computers into the workplace, new areas of physical debilitation have been recognized. These new potential hazards have required a redesigning of both the workplace and how employees work. A set of standards will be developed and practiced with this new technology. Furniture will be adjustable, positioned and arranged to minimize strain on all parts of the body. The glare of a computer screen will be minimized by a glare screen to prevent eyestrain. Repetitive motions can harm, back, shoulders, neck, wrists and other parts of the body, so employees will not proceed with a task when they are physically feeling an impairment. Each employee will be entitled to a rest break.

2.26 Ventilation for Indoor Air Quality

HVAC systems should provide at least the quantity of outdoor air required by the State Building Standards code, Title 24, Part 2. The HVAC systems should be inspected annually for any potential problems and there should be an approved inspection certificate available for review. Records should be retained for a minimum five year period.

2.27 Crane Checklist

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.

2.28 Safety Posters

Pickering Associates, Inc. is required to post certain employment related information. The required information is maintained by copier 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 Pickering Associates, Inc.'s code of Safe Work Practices and a Fire Prevention and Evacuation Plan will be posted. Material Data Safety Sheets for Pickering Associates, Inc.'s premises are available by copier. When employees are required to work on the premises of any other company, 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 company'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 By Copier. In most cases of 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.

2.29 Licenses and Permits

In addition to other postings required by law, Pickering Associates, Inc. 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 by copier.

2.30 Personal Protective Equipment Clothing

A. Protective Goggles/Ear Protection

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 Pickering Associates, Inc..

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. In cases where the noise level exceeds certain levels, ear protection is required.

B. Protective Clothing/ Footwear

1. 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.
2. From time to time long pants may be required for certain operations or certain jobs.
3. In cases of cleaning toxic or hazardous materials, protective clothing provided must be worn.
4. Hard hats must be worn in areas subject to falling objects, and at all times while at construction sites.
5. 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.

C. Safety Equipment

1. When necessary employees must use the approved respirators, which are provided for regular and emergency use.
2. All safety equipment must be maintained in sanitary condition and ready for use. Report any defective equipment immediately.

D. Emergency Eyewash/Shower

1. An eye wash facility is located in the kitchen. If any irritant gets into an employee's eyes, call for medical assistance immediately and flush the eye out with clean water.
2. A shower is provided for emergencies. Ask your supervisor for more details on use of this facility.

E. Safe Eating Places

1. 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.

2.31 Hardhats

In Pickering Associates, Inc., hardhats may be required [in designated areas, when appropriate]. Hardhats will be required when working in areas, on or near roads where any vehicle and / or equipment are traveling at speeds in excess of 35 miles an hour or more. 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 type 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 you supervisor if you're having trouble adjusting the hardhat.

2.32 Ground Personnel /Site Work Personnel

This section applies to employees or personnel working around heavy operating equipment.

2.32.a Earth Moving Equipment

Wearing a bright or fluorescent upper garment will be required for all ground personal. It is required for all Equipment to have back-up alarms. Always work in front of all Equipment so that operators can see you. Always try to have eye contact with operators. Always try to have at all times a mental note of where each piece of Equipment is located, as well as where they are going and the direction they are heading. Do not run directly behind any operated piece of Equipment. Never stand on an embankment, curb or on the high side of a slope to allow the Equipment to pass, try to stand on the driver side of the Equipment if possible. Always try to keep a safe distance; keeping in mind you might need to have a plan for an egress. Do Not Stand or allow yourself to be positioned under any Folk lift, Loader Buckets or Cranes.

2.32.b Trucks (Bottom Dumps and End Dumps)

When directing trucks always stand on the driver's side. END DUMPS, TRANSFERS and 10 WHL. DUMPS -Never stand along side a truck that is raising their dump bed. Try to stand on the driver's side, back corner of the dump bed keeping the driver in site thru their mirror. Never stand directly behind any truck.

2.32.c Equipment Operation Requirements

Before Starting

Walk Around : Check for any kind of trash around the radiator, fans or any where in the engine compartments, etc..

Check for proper levels :

- ENGINE OIL
- HYDRAULIC OIL
- COOLING SYSTEMS
- TRANSMISSION OIL
- DIFFERENTIAL OIL

Check Air Inlet for dirt or trash build-up.

When Starting

Always warm up engine before moving. Observe all gauges for the correct readings and the proper operation. (Oil Pressure should be obtained within 30 seconds, if Not, turn engine Off)

2.33 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.

2.34 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.

2.35 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 insure 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.

2.36 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 be not 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 over exertion and strain when carrying loads. No alcohol or any intoxicating substance may be consumed prior to or during work.

2.37 Driving

Drive safely. If vehicles are used during the workday, 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. All employees must practice defensive driving. We require that employees provide proof of insurance when they are hired and annually thereafter. Our company uses the agency vans or vehicles when they are available. If there are no vans or vehicles available they use their own vehicles and are reimbursed mileage at .28 cents per mile (or the approved rate). When children are riding in the vehicle they need to be securely fastened with a seatbelt. If the child is under 40 pounds or less than 5 years old they must be in a child safety seat. Check with the local authorities on the laws and regulations for children requiring safety seats. Employees should park their vehicles in well-lighted areas at/or near entrances to avoid criminal misconduct.

2.38 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. Employees to avoid over-exertion when lifting packages must use proper lifting techniques.

2.39 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. Covered metal waste cans are provided for oily and paint-soaked waste. Use them. 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.

2.40 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 defect. 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.

2.41 Commercial Sewing Machines.

- (a) The lower pulley nip points shall be guarded.
- (b) The upper pulley nip points shall be guarded by a plate or structural shape the thickness of the minimum width of the v-belt. This guard shall fit between the runs of the v-belt and extend from at least three inches from the pulley's outer rim to within 1/8-inch of and conforming to the arc of the perimeter of the pulley groove.
- (c)
 - (1) On sewing machines having the pulley outboard of the hand wheel or no hand wheel at all, a disc guard with a rolled edge shall be installed on the outside of the pulley. The diameter of the disc shall be at least one and one-half inches greater than the root diameter of the v-belt pulley.
 - (2) On sewing machines with the pulley inboard of the hand wheel, the diameter of the hand wheel shall be at least one and one-half inches greater than the root diameter of the pulley, or a disc guard as described in (1) above shall be installed on the outside of the hand wheel.

2.42 Hand Bailing Machine

A handle stop guard shall be installed at the right angle to the frame of the machine. The stop guard shall be so designed and so located that it will prevent the handle from traveling beyond the vertical position should the handle slip from the operator's hand when the pawl has been released from the teeth of the take-up gear.

2.43 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 stepladders 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.

2.44 Portable Power Tools

Portable power tools pose a special danger to employees because they are deceptively small and light, yet they can do great bodily harm if used improperly or poorly maintained. These rules apply to all power tools, but are especially important when handling portable saws, drills and power screwdrivers. Check your equipment before you use it. All grinders, saws and similar equipment should be equipped with appropriate safety guards. Power tools should not be used without the correct shield, guard, or attachment, recommended by the manufacturer. Portable circular saws must be equipped with guards above and below the base shoe. Circular saw guards should be checked periodically and before each use to assure they are not wedged up, thus leaving the lower portion of the blade unguarded. All rotating or moving parts of equipment should be guarded to prevent physical contact. All cord-connected, electrically-operated tools and equipment should be effectively grounded or of the approved double insulated type. Effective guards must be in place over belts, pulleys, chains, sprockets, on equipment such as concrete mixers, air compressors, etc. If portable fans are provided, they must be equipped with full guards or screens having openings 1/2 inch or less. Do not attempt to lift heavy objects without proper equipment. Hoisting equipment will be made available for lifting heavy objects, with hoist ratings and characteristics appropriate for the task. Power tools are either battery operated or wired. If battery operated, don't under-estimate their power. A small electric drill or power screwdriver can cause a severe injury if it lands in the wrong place. While not

usually a shock hazard, the battery pack contains toxic chemicals and does emit a low voltage electric current. Don't drop or incinerate the battery pack, or a tool with a self-contained power source. Hard-wired equipment can be portable or fixed. Typically used with extension cords, the more powerful hard-wired equipment presents a double safety problem: the actual equipment plus its electrical power source. Ground-fault circuit interrupters must be provided on all temporary electrical 15 and 20 ampere circuits used during periods of construction. Pneumatic and hydraulic hoses on power-operated tools should be checked regularly for deterioration or damage.

2.45 Abrasive Wheel Equipment (Grinders)

The work rest used should be kept adjusted to within 1/8 inch of the wheel. The adjustable tongue on the top side of the grinder should be kept adjusted to within 1/4 inch of the wheel. The side guards should cover the spindle, nut and flange and 75 percent of the wheel diameter. Bench and pedestal grinders should be permanently mounted. Goggles or face shields should always be worn when grinding. The maximum RPM rating of each abrasive wheel should be compatible with the RPM rating of the grinder motor. Fixed or permanently mounted grinders must be connected to their electrical supply system with metallic conduit or by other permanent wiring method. Each grinder should have an individual on and off control switch. The switch should be easily accessible anytime you operate the machine. Each electrically operated grinder is effectively grounded. Do not defeat the grounding mechanism, especially by using non-three prong plug adapters. Note the method by which new abrasive wheels are mounted. Visually inspect and ring test new abrasive wheels. The dust collectors and powered exhausts provided on grinders must be used in operations that produce large amounts of dust. The splashguards mounted on grinders that use a coolant should be mounted so that no one is ever splashed with the coolant. The work area around a grinder must be kept clean at all times. It is your responsibility as operator of any machine to ensure the necessary safety precautions are taken before using the machine.

2.46 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 switchboards 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.

2.47 Mechanical Lockout/Tagout

Point of operation devices shall protect the operator by: Preventing and/or stopping normal stroking of the press if the operator's hands are inadvertently placed in the point of operation; or Preventing the operator from inadvertently reaching into the point of operation or withdrawing his/her hands if they are inadvertently located in the point of operation, as the dies close; or Preventing the operator from inadvertently reaching into the point of operation at all times; or Requiring application of both of the operator's hands to machine operating controls and locating such controls at such a safety distance from the point of operation that the slide completes the downward travel or stops before the operator can reach into the point of operation with his/her hands; or Enclosing the point of operation before a press stroke can be initiated and maintaining this closed condition until the motion of the slide had ceased; or Enclosing the point of operation before a press stroke can be initiated, so as to prevent an operator from reaching into the point of operation prior to die closure or prior to cessation of slide motion during the downward stroke. A gate or movable barrier device shall protect the operator. A presence sensing point of operation device shall protect the operator by interlocking into the control circuit to prevent or stop slide motion if the operator's hand

or other part of his/her body is within the sensing field of the device during the down stroke of the press slide. The device may not be used on machines using full revolution clutches. The device may not be used as a tripping means to initiate slide motion. The device shall be constructed so that a failure within the system does not prevent the normal stopping action from being applied to the press when required, but does prevent the initiation of a successive stroke until the failure is corrected. The failure shall be indicated by the system. Muting (bypassing of the protective function) of such device, during the upstroke of the press slide, is permitted for the purpose of parts ejection, circuit checking, and feeding only. The safety distance from the sensing field to the point of operation shall be greater than the distance determined by the following formula: $D_s = 63 \text{ inches/second} \times T_s$ where: D_s = minimum safety distance (inches); 63 inches/second = hand speed constant; and T_s = stopping time of the press measured at approximately 90° position of crankshaft rotation (seconds). Guards shall be used to protect all areas of entry to the point of operation not protected by the presence sensing device. The pull-out device shall protect the operator and shall include attachments for each of the operator's hands. Attachments shall be connected to and operated only by the press slide or upper die. Attachment shall be adjusted to prevent the operator from reaching into the point of operation or to withdraw the operator's hands from the point of operation before the dies close. A separate pull-out device shall be provided for each operator if more than one operator is used on a press. Each pull-out device in use shall be visually inspected and checked for proper adjustment at the start of each operator shift, following a new die set-up, and when operators are changed. Necessary maintenance or repair or both shall be performed and completed before the press is operated. The sweep device shall protect the operator as specified in this subsection, by removing his/her hands safely to a safe position if they are inadvertently located in the point of operation, as the dies close or prior to tripping the clutch. Devices operating in this manner shall have a barrier, attached to the sweep arm in such a manner as to prevent the operator from reaching into the point of operation, past the trailing edge of the sweep arm on the downward stroke of the press. This device may not be used for point of operation safeguarding. The sweep device must be activated by the slide or by motion of a foot pedal trip rod. The sweep device must be designed, installed and operated so as to prevent the operator from reaching into the point of operation before the dies close. The sweep device must be installed so that it will not itself create an impact or shear hazard between the sweep arm and the press tie rods, dies, or any other part of the press or barrier. Partial enclosure conforming with this subsection, as to the area of entry which they protect, must be provided on both sides of the point of operation to prevent the operator from reaching around or behind the sweep device and into the point of operation after the dies start to close. Partial enclosures shall not themselves create a pinch point or shear hazard. A holdout or a restraint device shall protect the operator and shall include attachments for each of the operator's hands. Such attachments shall be securely anchored and adjusted in such a way that the operator is restrained from reaching into the point of operation. A separate set of restraints shall be provided for each operator if more than one operator is required on a press. The two hand control device shall protect the operator. When used in press operations requiring more than one operator, separate two hand controls shall be provided for each operator, and shall be designed to require concurrent application of all

operators' controls to activate the slide. The removal of a hand from any control button shall cause the slide to stop. The safety distance between each two hand control device and the point of operation shall be greater than the distance determined by the following formula: $D_s = 63 \text{ inches/second} \times T_s$, where: D_s = minimum safety distance (inches); 63 inches/second = hand speed constant; and T_s = stopping time of the press measured at approximately 90° position of crankshaft rotation (seconds).

2.48 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.

2.49 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.

2.50 Late Night Crime Prevention

All establishments operating between the hours of 11:00 p.m. and 6:00 a.m. should provide crime prevention training to their employees. Crime prevention training shall be a part of the accident prevention program. Training will be made available to ensure that the purpose and function of robbery and violence prevention are understood by employees and that the knowledge and skills required for their safety have been provided. The training and training materials outline security policies, safety and security procedures, and personal safety and crime avoidance techniques. Formal instruction through a training seminar or training video presentation will be made available and upon completion the employee shall sign off on the date, time, and place of training. The training documentation will be placed in the employee's personnel file. The following elements will be covered in the crime prevention training program: An explanation of the importance of keeping the location clean, neat, and uncluttered thereby making it as unattractive as possible to robbers. An explanation of the purpose of maintaining an unobstructed view of the cash register from outside the store, provided the cash register is located in a position visible from the street. Instruction on reasons for operating only minimum number of cash registers at night. Keeping the cash register fund to a minimum. Taking extra precautions after dark, i.e., keep alert, observe lighting and dark corners, spot possible hiding places. Violence prevention procedures in case of robbery. A refresher course on crime prevention on or near the employee's anniversary date. Videotape and crime prevention material shall be available for employee's review at their request. In addition to providing crime prevention training as defined in this section, the company posts a conspicuous sign in the window or door which states that there is a safe on the premises and it is not accessible to the employees on the premises and that the cash register contains only the minimal amount of cash needed to conduct business. All displays, and any other material posted in window(s) or door(s) should be arranged so as to provide a clear and unobstructed view of the cash register; provided the cash register is located in such a position so as to be visible from the street. If there is any cash on the premises after dark, the Company has a drop-safe, limited access safe, or comparable device on the premises. Please use it. In addition, the outside lights will be on for that portion of the

approach and parking area that is necessary to accommodate customers during all night hours the late night retail establishment is open.

2.51 Company Fire Brigades

In some industries, the company establishes a fire fighting brigade. The company does this by drafting a policy statement that announces the existence of a fire brigade; the basic organizational structure; the type, amount, and frequency of training to be provided to fire brigade members; the expected number of members in the fire brigade; and the functions that the fire brigade is to perform at the workplace. The organizational statement is available for inspection by government officials and by employees or their designated representatives. Employees who are expected to do interior structural fire fighting must be physically capable of performing duties, which may be assigned to them during emergencies. The company shall not permit employees with known heart disease, epilepsy, or emphysema, to participate in fire brigade emergency activities unless a physician's certificate of the employees' fitness to participate in such activities is provided. Approved self-contained breathing apparatus shall be provided to and worn by fire brigade members while working inside buildings or confined spaces where toxic products of combustion or an oxygen deficiency may be present. Such apparatus shall also be worn during emergency situations involving toxic substances. Approved self-contained breathing apparatus may be equipped with either a "buddy-breathing" device or a quick disconnect valve, even if these devices are not certified by NIOSH. If these accessories are used, they shall not cause damage to the apparatus, or restrict the air flow of the apparatus, or obstruct the normal operation of the apparatus. Approved self-contained compressed air breathing apparatus may be used with approved cylinders from other approved self-contained compressed air breathing apparatus provided that such cylinders are of the same capacity and pressure rating. All compressed air cylinders used with self-contained breathing apparatus shall meet DOT and NIOSH criteria. Self-contained breathing apparatus shall have a minimum service life rating of thirty minutes in accordance with the methods and requirements of the mine safety and health administration (MSHA) and NIOSH, except for escape self-contained breathing apparatus (ESCBAs) used only for emergency escape purposes. Self-contained breathing apparatus shall be provided with an indicator which automatically sounds an audible alarm when the remaining service life of the apparatus is reduced to within a range of twenty to twenty-five percent of its rated service time.

2.52 Positive Pressure Breathing Apparatus

Self-contained breathing apparatus ordered or purchased after January 1, 1982, for use by fire brigade members performing interior structural fire fighting operations, are of the pressure-demand or other positive-pressure type. Effective July 1, 1983, only pressure-demand or other positive-pressure self-contained breathing apparatus shall be worn by fire brigade members performing interior structural fire fighting. This does not prohibit the use of a self-contained breathing apparatus where the apparatus can be switched from a demand to a positive-pressure mode. However, such apparatus shall be in the

positive-pressure mode when fire brigade members are performing interior structural fire fighting operations. Negative-pressure self-contained breathing apparatus with a rated service life of more than two hours and which have a minimum protection factor of 5,000, as determined by an acceptable quantitative fit test performed on each individual, is acceptable for use only during those interior structural fire fighting situations for which the company demonstrates that long duration breathing apparatus is necessary. Quantitative fit test procedures shall be available for inspection by the director or authorized representative. Such negative-pressure breathing apparatus will continue to be acceptable for eighteen months after a positive-pressure breathing apparatus with the same or longer rated service life is certified by NIOSH. After this eighteen-month period, all self-contained breathing apparatus used for these long duration situations shall be of the positive-pressure type. This section does not require a company to organize a fire brigade. It is suggested that pre-fire planning be conducted by the local fire department and/or the workplace fire brigade in order for them to be familiar with the workplace and process hazards. Involvement with the local fire department or fire prevention bureau is encouraged to facilitate coordination and cooperation between members of the fire brigade and those who might be called upon for assistance during a fire emergency. Body protection. Fire brigade members may wear a fire-resistive coat in combination with fully extended boots, or they may wear a fire-resistive coat in combination with protective trousers.

Fire-resistive coats and protective trousers meeting all of the requirements contained in NFPA 1971-1975, "Protective Clothing for Structural Fire Fighters," are acceptable as meeting the requirements of this standard. The lining is required to be permanently attached to the outer shell. However, it is permissible to attach the lining to the outer shell material by stitching in one area such as at the neck. Fastener tape or snap fasteners may be used to secure the rest of the lining to the outer shell to facilitate cleaning. Reference to permanent lining does not refer to a winter liner which is a detachable extra lining used to give added protection to the wearer against the effects of cold weather and wind. Hand protection. Fire fighters should wear protective gloves or a glove system. A glove system consists of a combination of different gloves. The usual components of a glove system consist of a pair of gloves, which provide thermal insulation to the hand, worn in combination with a second pair of gloves, which provide protection against flame, cut and puncture. Protective gloves should provide dexterity and a sense of feel for objects. Criteria and test methods for dexterity are contained in the NIOSH publications, "The Development of Criteria for Firefighters' Gloves; Vol. I: Glove Requirements," and "Vol. II: Glove Criteria and Test Methods." These NIOSH publications also contain a permissible modified version of Federal Test Method 191, Method 5903, (paragraph of Appendix E) for flame resistance when gloves, rather than glove material, are tested for flame resistance. Head, eye and face protection. Head protective devices which meet the requirements contained in NFPA No. 1972 are acceptable as meeting the requirements of this standard for head protection. Head protective devices are required to be provided with earflaps so that the earflaps will be available if needed. It is recommended that ear protection always be used while fighting interior structural fires. Many head protective devices are equipped with face shields to protect the eyes and face. These face shields are permissible as meeting the eye and

face protection requirements of this paragraph as long as such face shields meet the requirements of the general safety and health standards. Additionally, full-face pieces, helmets or hoods of approved breathing apparatus are also acceptable as meeting the eye and face protection requirements. It is recommended that a flame resistant protective head covering such as a hood or snood, which will not adversely affect the seal of a respirator face piece, be worn during interior structural fire fighting operations to protect the sides of the face and hair.

Chapter 3 - Responsible Safety Officer

3.1 General Statement

The Responsible Safety Officer is Ryan K. Taylor,, and that person who has been delegated the authority to develop and administer Pickering Associates, Inc.'s health and safety program.

3.2 Duties

By law, the Responsible Safety Officer is the person designated by the company with the duty and authority to implement and maintain Pickering Associates, Inc.'s Injury and Illness Prevention Program. The Responsible Safety Officer is assigned the responsibility of providing technical guidance and services in the field of health and safety needed by Pickering Associates, Inc. management. To fulfill this objective the Responsible Safety Officer is required to: Provide management at all levels with the information, advice, and assistance needed to formulate Pickering Associates, Inc.'s health and safety policy, directives, procedures, and standards. Assist management at all levels in establishing and maintaining a healthful and safe working environment free from unacceptable risks, in conformance with OSHA health and safety guidelines and in compliance with applicable standards, codes, and regulations. Monitor operations within Pickering Associates, Inc. and, where appropriate at off-site facilities, provide management with the information needed to maintain a healthful and safe working environment, free from unacceptable risks. Develop and provide general safety education and training programs. Assist in the development of specific job safety training programs. Develop plans and train response personnel to control emergency situations (earthquake, radiation, injury, fire, etc.). Maintain a staff of specialists or consultants knowledgeable in all areas of safety. Prepare and maintain Pickering Associates, Inc.'s Health and Safety Manual and other documents that relate to safety. Specify proper protective equipment for issuing to employees. Check plans of all new projects for construction safety, industrial safety, and other safety reviews as required by OSHA and Pickering Associates, Inc. regulations. Stop hazardous operations where life hazard or major property damage is imminent and follow with documented evidence. To carry out its responsibilities, the Responsible Safety Officer maintains a staff of specialists and outside consultants in the appropriate environment, health, and safety disciplines. These disciplines include: Construction Safety, Engineering Services, Environmental Protection, Industrial Hygiene, Laser Safety, Mechanical Safety, Non-destructive Testing, Occupational Safety, Radiation Safety, Safety Training and Education Seismic Safety

3.3 Five Functions

The functions of the Responsible Safety Officer are divided into five areas:

1. Operations
2. Health Physics
3. Engineering Services/Occupational Safety

4. Industrial Hygiene
5. Environmental Protection.

Some of these functions may be delegated in whole or in part to staff and/or outside consultants.

3.4 Operations

This area deals with the day-to-day safety operations of the Pickering Associates, Inc.. It includes the following personnel: Field Supervisors or Field Safety Officers help in the planning or preparation of hazardous projects and analysis of difficult safety problems. They provide on-site training; protective equipment and other safety-related equipment for hazardous operations; maintenance of environmental monitoring devices; evaluation of ventilation and air cleaning equipment; and radioactive or chemical source inventory. Decontamination and Waste Disposal Contractors provide services to decontaminate special equipment; assistance with clean-up of radioactive or hazardous chemical spills; collection and disposal of radioactive materials and hazardous chemicals. Special Transportation Contractor provides services for receiving and shipping of radioisotopes and consultation on the regulations concerning transportation of hazardous chemicals.

3.5 Radiation Physics

This area is composed of the following functions: The Radiation Physics Section is primarily concerned with the radiation safety aspects of accelerators. The areas of immediate concern are the following: Radiation intensity in occupied areas Adequacy of radiation safety interlock systems Access control to radiation areas Proper sign and warning systems Review and approval of facility radiation Operational Safety Procedures In addition, the Radiation Physics Section performs the following functions: Experimental beam line safety analysis Shielding calculations for proposed new accelerators Radiation damage studies Development of measurement instruments and techniques Experimental source term measurements Neutron energy spectral measurements The X-Ray Safety Section evaluates the use of x-ray equipment at Pickering Associates, Inc.. This is accomplished by periodic radiation surveys, physical inspection of x-ray facilities and logbooks, approval of Operational Safety Procedures, and the receipt of Certification of Training documents. This Section also advises on matters of instrument selection, measurement techniques, and safety apparatus design (interlocks, barriers, monitors, etc.). This Section files and distributes all documentation generated by the above operations.

3.6 Engineering Occupational Safety

The primary concern of this area is the general safety of Pickering Associates, Inc.. Its responsibilities include: Occupational Safety: Investigation, statistical analysis, and review of personal injury, property damage, and vehicle accident reports.

Recommendation on protective clothing and equipment for eyes, head, feet, and hands to prevent traumatic injury. Evaluation of material-handling and storage facilities, such as manual and mechanical handling devices, slings, ropes, chains, and hooks. Review of design, layout, and code compliance of new or modified facilities and buildings and follow-up inspections of construction sites. Recommendation on proper use and care of ladders, ramps, elevated walks, and work platforms. Review of traffic safety, such as traffic signs and markings, traffic patterns, and layout planning. Determination of qualified operators of special vehicles and equipment. Mechanical Safety: Review/design/inspection of hazardous equipment. Advise on vehicle safety (design, consultation). Recommendation of adherence to mechanical design codes, standards, and procedures. Provision of non-destructive testing services. Reviews of Operational Safety Procedure relating to hazardous equipment. Seismic Safety: Design of anchoring or restraining devices. Inspections and consultations. Interface with building and construction contractors.

3.7 Industrial Hygiene

This function must recognize, evaluate, and recommend control for occupational health hazards. Outside consultants are responsible for providing the following services: Toxicology of occupational chemical hazards Control of non-ionizing electromagnetic spectrum hazards, such as lasers, ultraviolet, infrared, and microwave-radio frequency radiation Evaluation of ventilation for comfort, dilution, and local exhaust Noise and sound analysis Illumination evaluation Environmental sanitation, such as food, water, and vector and pest and/or weed control Measurement of physiological stresses, such as temperature extremes Provision of protective equipment, such as respiratory, hearing, and special eye protection Control of bio-hazards Laser safety

3.8 Environmental Protection

This area is involved with the identification and quantification of environmental quality concerns, development and maintenance of operating permits, assessment of pollution abatement programs, and liaison with environmental protection agencies. It includes the following services: Environmental monitoring, surveillance and analysis of contaminants in air, rain, surface water, soil, and stack exhaust Air pollution control Water pollution control Polychlorinated biphenyl inventory in transformers and capacitors. Underground tank monitoring and reporting Treatment facilities permitting and sampling for regulatory compliance Environmental remediation of contaminated sites.

3.9 Common Functions

All the functions of the Responsible Safety Officer include the following areas of responsibilities: Environmental Monitoring, including both workplace and office data collection and measurement techniques. Decontamination and Waste Disposal. Safety

Resource Library Maintenance. The Responsible Safety Officer should either maintain or have the Company maintain a library that contains copies of codes, standards, safety manuals, and reports that regulate Pickering Associates, Inc.'s safety program. The library also contains copies of texts and reports regarding health and safety. Industrial Hygiene and Environmental Protection. Health Physics laboratory. Maintain extra protective clothing, safety glasses and safety shoes for guests and existing employees needing temporary replacement of their protective equipment.

Chapter 4 - Employee Health Services

4.1 Medical Services

The objectives of the Medical Services Department are: To ensure that employees are assigned duties they are physically able to perform. To provide medical care and rehabilitation of the occupationally ill or injured. To provide emergency treatment of serious illnesses or injuries. To encourage employees to maintain their physical and mental health. To assist in maintaining a healthful and safe work environment.

4.2 Occupational Health Monitoring

Pre-placement, periodic, special, and termination examinations including drug screening may be conducted and emergency services are provided. Random drug testing may also be performed. Potential occupational exposures to hazardous situations or agents are investigated on a continuing basis in cooperation with the Responsible Safety Officer. Diagnosis and treatment of non-occupational illness or injury are limited to minor first aid, emergencies, and special situations for which treatment is in the best interest of Pickering Associates, Inc. and the patient. The Company offers confidential counseling for employees to aid in resolving work-related or personal problems.

4.3 Return to Work

Restrictions may be placed on an employee's work pursuant to physical examination, occupational or non-occupational illness, or injury.

4.4 Pregnancy & Workplace Hazards

As soon as an employee learns that she is pregnant, she must inform the Responsible Safety Officer of the expected date of childbirth. A physician or nurse will discuss her work environment with her and will determine whether any change in the environment should be made to ensure her good health and that of her baby.

4.5 Employee Assistance Program

The Company offers confidential assistance in resolving personal problems such as alcoholism, drug abuse, emotional disturbances, and legal, marital, or financial difficulties. Employees may seek this assistance or be referred by supervisors. Classes on topics such as stress management are offered on an as-requested basis.

4.6 Safety Glasses

Appointments with an optometrist to fit safety glasses are available. The glasses are supplied free of charge to employees needing this protection. Employees may bring a recent prescription or have a refraction done here for a nominal cost.

4.7 Occupational Injury/Illness

Treatment is coordinated with outside specialists in accordance with the provisions and requirements of Workers' Compensation laws. Every injury sustained while performing Pickering Associates, Inc. assigned tasks, no matter how minor, must be reported to the employee's supervisor and to the Responsible Safety Officer. If an employee goes to a private off-site doctor about a job-incurred injury or illness, the physician consulted should be informed that the injury or illness is industrial. It is the employee's responsibility to notify the RSO and his/her supervisor of the injury or illness and the treatment received. An occupational injury or illness is one which results from a work accident or from an exposure involving an incident in the work environment. In most cases, the employee will be referred to his/her private physician, a selected specialist, or a hospital emergency room. Standard procedures for ingestion of poisons, eye injuries, burns, cardiac arrest, coma, etc., are followed. In the event that a patient cannot be moved from the site of the injury, primary aid will be rendered by Pickering Associates, Inc. physicians, nurses, firefighters, or ambulance personnel. A physician should be notified of any major accident that occurs at any time at the workplace. When the company physician has been notified, he/she will take the responsibility for appropriate notification of family, relatives, and the President's Office. In the event of an occupational injury or illness that requires care by a specialist, the patient is referred to his/her personal physician or a physician selected from a panel of locally practicing specialists. Medical Services is prepared to provide definitive treatment for minor occupational injuries or illnesses and rehabilitation where appropriate. Diagnosis and treatment such as suturing, splinting, dressing, and analgesia are given routinely when appropriate by the physicians and registered nurses on site. Minor injuries and illnesses not associated with work frequently are treated by the physician or nurse on duty. Patients who present themselves with more severe or chronic health problems are consulted with and referred to their personal physician or transported, if necessary by ambulance, to nearby hospitals for emergency care. No injured or ill persons, regardless of employment status, are denied first aid or referral to medical resources in the community. Pickering Associates, Inc. personnel are advised by the Responsible Safety Officer regarding known personal exposure to radiation. The procedure and urgency of notification and subsequent action by the physician vary in detail depending on the particulars of the exposure or spill. Usually, in the event of contamination by radioactive isotopes or possible activation by high-energy beam, the employee(s) will receive a whole-body count and bioassay of excreta, if indicated. Dose estimates are the joint responsibility of Responsible Safety Officer and Medical Services Departments. Medical Services is prepared to assist in decontamination of personnel when necessary especially of contaminated wounds. Pickering Associates, Inc. has written mutual aid agreements with local hospitals to admit and care for contaminated injured personnel. Employees who are injured severely or become seriously ill at work are transported to Medical Services in the ambulance operated by the Fire Department, except when other

transportation is specifically approved by Medical Services. If necessary, the ambulance is used to transport patients to nearby hospitals or clinics.

4.8 Privacy Notice

Pickering Associates, Inc. should provide the information below to individuals who are asked to complete medical history forms or otherwise supply personal information about themselves. The information on this form is requested for purposes of maintaining a complete medical record on each Pickering Associates, Inc. employee as part of the Occupational Medical Program of the Medical Services Department. Furnishing the requested information is voluntary, but failure to provide such information on pre-employment examination may delay or even prevent medical approval for employment. Supplying information on subsequent examinations is in the best interest of the employee and is intended to protect the health of Pickering Associates, Inc. employees. All information in employee medical records is available only to Medical Services staff. Information from medical records cannot be disseminated outside Medical Services without the written consent of the employee except as required by law; however, the information may be used as a basis for recommendations by the Responsible Safety Officer to various persons in miscellaneous personnel matters such as, but not limited to, consideration for employment, transfer, work assignment, and eligibility for benefits. Individuals have the right to review their own records in accordance with company policies. Information on these policies may be obtained from the Personnel Department or the Responsible Safety Officer.

Chapter 5 - Biological Hazards

5.1 Definitions

By law, an infection control plan must be prepared by every person that handles, stores, uses, processes, or disposes of infectious medical wastes. This infection control plan complies with OSHA requirement, 29 CFR 1910.1030, Blood Borne Pathogens. The plan includes requirements for personal protective equipment, housekeeping, training, and a procedure for reporting exposures. Biological Hazard. The term biological hazard or bio-hazard is taken to mean any viable infectious agent (etiologic agent) that presents a risk, or a potential risk, to the well being of humans. Each supervisor has identified the specific biological hazard associated with your job, and the supervisor will arrange for your training if necessary. Etiologic Agents. The United States Department of Health and Human Services, Public Health Service, Classification of Etiologic Agents on the Basis of Hazard, is the classification system used at Pickering Associates, Inc. for etiologic agents. Medical Wastes/Infectious Wastes. All laboratory waste emanating from human or animal tissues, blood or blood products or fluids; all cultures of tissues or cells of human origin or cultures of etiologic agents; specimens of human or animal parts or tissues removed by surgery, autopsy, or necropsy. Universal Precautions. Refers to a system of infectious disease control that assumes that every direct contact with body fluids is infectious and requires every employee exposed to be protected as though such body fluids were infected with blood-borne pathogens. All infectious/medical material must be handled according to Universal Precautions (OSHA Instruction CPL 2-2.44A)

5.2 General Procedures

The following procedures must be followed by personnel when in medical or biological rooms or laboratories. All supervisors must ensure that their staff is trained in proper work practices, the concept of universal precautions, personal protective equipment, and in proper clean-up and disposal techniques. Resuscitation equipment, pocket masks, resuscitation bags, or other ventilation equipment must be provided to eliminate the need for direct mouth to mouth contact in groups where resuscitation is a part of their responsibilities. Eating, drinking, smoking, applying cosmetics or lip balm, and handling contact lenses are prohibited in work areas where there is a potential for exposure to any health hazard. Food and drink must not be stored in refrigerators, freezers, or cabinets where blood or other potentially infectious material is stored or in other areas of possible contamination. In infectious disease laboratories, the following requirements apply to utility rooms and attics serving these laboratories: Only authorized employees, participating guests, students, and visitors are permitted to enter. All surplus materials and equipment must be kept out of these rooms. Drinking fountains must be the sole source of drinking water for humans. Masks and eye protection are required when contact of mucosal membranes (eyes, mouth or nose) with body fluids is likely to occur (e.g., splashes or aerosolization). According to the level of risk, wearing laboratory or protective clothing may be required for persons entering infectious disease laboratories. Likewise, showers with a germicidal soap may be required before exit. Gowns, aprons, or lab coats must be worn whenever there is a possibility that body fluids could splash on skin or clothing. Gloves must be made of

appropriate disposable material, usually intact latex or vinyl. They must be used in the following circumstances: When the employee has cuts, abraded skin, chapped hands, dermatitis, or similar conditions. During instrumental examination of the oropharynx, gastrointestinal (G.I.) tract, and genitourinary (G.U.) tract. When examining abraded or non-intact skin of a patient with active bleeding. While handling blood or blood products or other body secretions during routine laboratory procedures. Employees must wash their hands immediately, or as soon as possible, after removal of gloves or other personal protective equipment and after hand contact with blood or other potentially infectious materials. All personal protective equipment must be removed immediately upon leaving the work area, and if this equipment is overtly contaminated, it must be placed in an appropriate area or container for storage, washing, decontamination, or disposal. Contaminated laboratory clothing must not be worn in clean areas or outside the building. Only disposable Luer-lok syringes and needles may be used. All procedures involving blood or other potentially infectious agents must be performed in a manner that will minimize splashing, spraying, and aerosolization. Individuals must not work alone on any hazardous operation. All employees working with radiation or radioactive materials are required to receive training.

5.3 Medical Wastes

Medical/infectious waste must be segregated from other waste at the point of origin. Medical/infectious waste, except for sharps (i.e., razor blades, broken glass, needles, etc.) capable of puncturing or cutting, must be contained in double disposable red bags conspicuously labeled with the words "INFECTIOUS WASTE" and "BIO-HAZARD." Used needles or other sharps (razor blades, broken glass, scalpels, etc.) must not be sheared, bent, broken, recapped, or re-sheathed. Infectious sharps must be contained for disposal in leak proof, rigid puncture-resistant containers [available from Pickering Associates, Inc.] Infectious waste contained as described above must be placed in reusable or disposable leak proof bins or barrels that are conspicuously labeled with the words "INFECTIOUS WASTE" and "BIO-HAZARD." These waste barrels are picked up regularly by an outside company licensed to handle infectious wastes. All infectious agents, equipment, or apparatus must be disinfected in an autoclave or otherwise disinfected before being washed or disposed of. Each individual working with infectious bio-hazardous agents is responsible for disinfection and disposal of these agents. Mixed waste that includes biological/infectious waste and radioactive waste must be disinfected by a person trained in radioisotope safety and waste disposal procedures. After disinfection call the Responsible Safety Officer for disposal. Biological wastes that do not contain radioactive or hazardous substances may be disinfected by steam sterilization (autoclave) then disposed of in the regular trash. Liquid bio-hazardous waste may be disposed of in the sewage system following chemical decontamination. Reusable glassware must be decontaminated in sodium hypochlorite (household bleach) solution (1:9) prior to rinsing and acid washing. The glassware must then be sterilized in an autoclave. To minimize the hazard to firefighters or emergency response personnel, at the close of each work day and before the building is closed, all infectious or toxic material must be placed in a refrigerator, placed in an incubator, or autoclaved or otherwise disinfected. Infectious agents must not be placed in an autoclave and left

overnight in anticipation of autoclaving the next day. All laboratory rooms containing infectious substances must have designated separate areas or containers labeled "INFECTIOUS -- TO BE AUTOCLAVED" or "NOT INFECTIOUS -- TO BE CLEANED". All infectious disease work areas, including cabinets, must be prominently marked with the Bio-hazards Warning Symbol. Floors, laboratory benches, and other surfaces in buildings where infectious agents are handled must be disinfected with a suitable germicide, such as 1:9 sodium hypochlorite solution (household bleach) as often as necessary as determined by the supervisor. The surroundings must be disinfected after completion of operations involving planting, pipetting, centrifuging, and similar procedures with infectious agents. Floor drains throughout the building must be flooded with water or disinfectant at least once each week to fill traps and to prevent sewer gases from escaping. Floor drains in new construction must be omitted wherever possible. Water used to mop floors must contain a disinfectant. Wet mopping or the use of vacuum cleaners equipped with high-efficiency filters is the preferred method of cleaning floors. Avoid sweeping when possible. Stock solutions of suitable disinfectants must be maintained in each laboratory. Laboratories must be sprayed with insecticides as often as is necessary to eliminate flies and other insects. Protection against vermin must be provided at all building exterior openings. Infectious agents must not be dumped into the building drainage system without prior disinfection. Mechanical garbage disposal units must not be used to dispose of contaminated wastes. Mechanical disposal units release considerable amounts of aerosol.

5.4 Working with Infectious Agents

All procedures using infectious agents that may generate aerosols must be performed in a ventilated safety cabinet. These procedures include opening test tubes, flasks, and bottles; using pipettes; making dilutions; inoculating; necropsying animals; grinding; blending; opening lyophile tubes; operating a sonic vibrator; and operating a standard table model centrifuge, etc. A safety box or safety shaker tray must be used to house or safeguard all containers of infectious agents placed on shaking machines. A safety centrifuge cabinet or safety centrifuge cup must be used to house or safeguard infectious agents during any centrifuging operation. When centrifuging is performed in a ventilated cabinet, the glove panel must be in place with the glove ports covered. An operating centrifuge creates reverse air currents that may permit an infectious agent to escape from an open cabinet. A respirator must be worn when changing a glove or gloves attached to a cabinet whenever there is any possibility that an infectious aerosol may be present in the cabinet. All pipetting must be carried out with the aid of a rubber bulb or other vacuum assist device. Mouth pipetting is strictly forbidden. Infectious bio-hazardous mixtures must not be prepared by bubbling expiratory air through a liquid with a pipette. Infectious bio-hazardous agents must not be blown out of a pipette. Infectious bio-hazardous agents must not be mixed by pipetting. Contaminated pipettes must be placed horizontally in a pan containing enough suitable disinfectant to allow complete immersion. Contaminated pipettes must not be placed vertically in a cylinder. The pan and pipettes must be disinfected in an autoclave as a unit and replaced in a clean pan with fresh disinfectant. Broth cultures must be taken in a manner that avoids wetting the plug or cap. If the plug or cap is exposed, it must be disposed of in the

proper container or disinfected. Before centrifuging, the tubes must be inspected for cracks and the inside of the trunnion cup must be inspected for rough walls caused by erosion or adhering matter. Bits of glass, if any, must be removed from the rubber cushion. A germicidal solution added between the tube and trunnion cup disinfects the outer surface of both, and also provides an excellent cushion against shocks that might otherwise break the tube. Decanting centrifuge tubes should be avoided. If it must be done, wipe off the outer rim with a disinfectant to prevent the infectious fluid from spinning off as an aerosol. The tube should not be filled to the point where the rim will become wet with culture. Water baths and Warburg baths used to inactivate, incubate, or test infectious agents must contain disinfectant. For cold water baths, 70% propylene glycol is recommended. When a building vacuum line is used, suitable traps or filters must be interposed to ensure that pathogens do not enter the fixed vacuum system. Deep freeze and dry ice chests and refrigerators must be inspected and cleaned periodically to remove any broken ampules, tubes, etc., that may contain infectious agents. Rubber gloves and respiratory protection must be worn during this cleaning. All infectious or toxic agents stored in refrigerators or deep freezers must be properly labeled. All virulent fluid cultures or viable powdered infectious agents in glass vessels must be transported, incubated, and stored in easily handled, non-breakable, leak proof containers that are large enough to contain all the fluid or powder if the glass vessel leaks or breaks. All inoculated Petri plates or other inoculated solid media must be transported and incubated in leak proof pans or other leak proof containers. Care must be exercised in the use of membrane filters to obtain sterile filtrates of infectious materials. Because of the fragility of the membrane and other factors, such filtrates must not be handled as non-infectious until culture or other tests have proved their sterility.

5.5 Cuts

If an employee has a needle stick, cut, or mucous membrane exposure to body fluids he/she must report the incident immediately to the Responsible Safety Officer.

5.6 Blood Exposure

All employees exposed to human blood and blood products must report to the Responsible Safety Officer for information and possible inclusion in the Hepatitis B Immunization Program.

5.7 Experimentation

The Responsible Safety Officer provides oversight and auditing for experimentation with recombinant DNA or an infectious biological hazard. Experimentation of bio-hazardous agents involving animals must meet the strict guidelines set forth in the Animal Welfare Act of 1970. The implementing rules and regulations appear in the Code of Federal

Regulations, Title 9. Any experimentation of bio-hazardous agents with animals must be approved prior to experimentation.

5.8 Infection Control Plan

The purpose of the Infection Control Plan is to protect the health and safety of the persons directly involved in handling the materials, Pickering Associates, Inc. personnel and the general public by ensuring the safe handling, storage, use, processing, and disposal of infectious medical waste. This plan complies with OSHA requirement proposed for 29 CFR 1910.1030, Blood Borne Pathogens. Medical wastes/Infectious wastes: All laboratory waste emanating from human or animal tissues, blood or blood products or fluids; all cultures of tissues or cells of human origin or cultures of etiologic agents; specimens of human or animal parts or tissues removed by surgery, autopsy, or necropsy. Universal precautions: Refers to a system of infectious disease control which assumes that every direct contact with body fluids is infectious and requires every employee exposed to be protected as though such body fluids were infected with blood-borne pathogens. All infectious/medical material must be handled according to Universal Precautions (OSHA Instruction CPL 2-2.44A). The following universal precautions must be taken. 1. Gloves must be made of appropriate disposable material, usually intact latex or vinyl. They must be used: a. when the employee has cuts, abraded skin, chapped hands, dermatitis, or the like. b. during instrumental examination of the oropharynx, gastrointestinal (G.I.) tract, and genitourinary (G.U.) tract. c. when examining abraded or non-intact skin of a patient with active bleeding. d. while handling blood or blood products or other body secretions during routine laboratory procedures. 2. Gowns, aprons, or lab coats must be worn when splashes of body fluid on skin or clothing are possible. 3. Mask and eye protection are required when contact of mucosal membranes (eyes, mouth or nose) with body fluids is likely to occur (e.g. splashes or aerosolization). 4. Resuscitation equipment, pocket masks, resuscitation bags, or other ventilation equipment must be provided to eliminate the need for direct mouth to mouth contact. (This statement is required for groups where resuscitation is a part of their responsibility such as a Fire Department or Police or Medical Emergency Services). 5. Phlebotomy: Gloves must be available for use by phlebotomists. 6. Pipetting: All pipetting must be carried out with the aid of a rubber bulb or other vacuum assist device. Mouth pipetting is strictly forbidden.

5.9 Waste Disposal Plan

1. Medical/Infectious waste must be segregated from other waste at the point of origin.
2. Medical/Infectious waste, except for sharps (e.g. razor blades, broken glass, needles, etc.) capable of puncturing or cutting must be contained in double disposable red bags conspicuously labeled with the words, "INFECTIOUS WASTE -- BIOHAZARD."
3. Infectious sharps must be contained for disposal in leak proof, rigid puncture resistant containers (available from Pickering Associates, Inc.).
4. Infectious waste thus contained as described in procedures 2 and 3 above must be placed in reusable or disposable leak proof bins or barrels which must be conspicuously labeled

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with the words, "INFECTIOUS WASTE -- BIO-HAZARD." These waste barrels are be picked up regularly by an outside company licensed to handle infectious wastes. 5. Mixed waste that includes biological/infectious waste and radioactive waste must be disinfected by a person trained in radioisotope safety and waste disposal procedures. After disinfection call the Responsible Safety Officer for disposal. 6. Spills/Disinfectants: a solution of sodium hypochlorite (household bleach) diluted 1:9 with water must be used to disinfect, following initial clean-up of a spill with a chemical germicide approved as a hospital disinfectant. Spills must be cleaned up immediately. 7. After removing gloves, and/or after contact with body fluids, hands and other skin surfaces must be washed thoroughly and immediately with soap or other disinfectant in hot water. 8. Other biological wastes that do not contain radioactive or hazardous substances may be disinfected by steam sterilization (autoclave) and then disposed of in the regular trash. 9. Liquid bio-hazard waste may be disposed of in the sewage system following chemical decontamination. 10. Reusable glassware must be decontaminated in sodium hyperchlorite (household bleach) solution (1:9) prior to rinsing and acid washing. Then the glassware must be sterilized in an autoclave. All supervisors must ensure that their staff is trained in proper work practices, the concept of universal precautions, personal protective equipment, and in proper clean-up and disposal techniques.

5.10 Bloodborne Pathogens

(a) **Scope and Application.** This section applies to all occupational exposure to blood or other potentially infectious materials as defined by subsection (b) of this section.

EXCEPTION: This regulation does not apply to the construction industry.

(b) **Definitions.** For purposes of this section, the following shall apply:

"Biological Cabinet" means a device enclosed except for necessary exhaust purposes on three sides and top and bottom, designed to draw air inward by means of mechanical ventilation, operated with insertion of only the hands and arms of the user, and in which virulent pathogens are used. Biological cabinets are classified as:

(1) Class I: A ventilated cabinet for personnel protection with an un-recirculated inward airflow away from the operator and high-efficiency particulate air (HEPA) filtered exhaust air for environmental protection.

(2) Class II: A ventilated cabinet for personnel, product, and environmental protection having an open front with inward airflow for personnel protection, HEPA filtered laminar airflow for product protection, and HEPA filtered exhaust air for environmental protection.

(3) Class III: A total enclosed, ventilated cabinet of gas-tight construction. Operations in the cabinet are conducted through attached protective gloves. "Blood" means human blood, human blood components, and products made from human blood.

"Bloodborne Pathogens" means pathogenic microorganisms that are present in human blood and can cause disease in humans. These pathogens include, but are not limited to, hepatitis B virus (HBV), hepatitis C Virus (HCV) and human immunodeficiency virus (HIV).

"Chief" means the Chief of the Division of Occupational Safety and Health of the State Department of Industrial Relations or designated representative.

"Clinical Laboratory" means a workplace where diagnostic or other screening procedures are performed on blood or other potentially infectious materials.

"Contaminated" means the presence or the reasonably anticipated presence of blood or other potentially infectious materials on a surface or in or on an item.

"Contaminated Laundry" means laundry which has been soiled with blood or other potentially infectious materials or may contain sharps.

"Decontamination" means the use of physical or chemical means to remove, inactivate, or destroy bloodborne pathogens on a surface or item to the point where they are no longer capable of transmitting infectious particles and the surface or item is rendered safe for handling, use, or disposal. Decontamination includes procedures regulated by Health and Safety Code Section 118275.

"Engineering Controls" means controls (e.g., sharps disposal containers, needleless systems and sharps with engineered sharps injury protection) that isolate or remove the bloodborne pathogens hazard from the workplace.

"Engineered Sharps Injury Protection" means either:

(1) A physical attribute built into a needle device used for withdrawing body fluids, accessing a vein or artery, or administering medications or other fluids, which effectively reduces the risk of an exposure incident by a mechanism such as barrier creation, blunting, encapsulation, withdrawal or other effective mechanisms; or

(2) A physical attribute built into any other type of needle device, or into a non-needle sharp, which effectively reduces the risk of an exposure incident.

"Exposure Incident" means a specific eye, mouth, other mucous membrane, non-intact skin, or parenteral contact with blood or other potentially infectious materials that results from the performance of an employee's duties.

"Hand washing Facilities" means a facility providing an adequate supply of running potable water, soap and single use towels or hot air drying machines.

"HBV" means hepatitis B virus.

"HCV" means hepatitis C virus.

"HIV" means human immunodeficiency virus.

"Licensed Healthcare Professional" is a person whose licensed scope of practice includes an activity which this section requires to be performed by a licensed healthcare professional.

"Needle" or "Needle Device" means a needle of any type, including, but not limited to, solid and hollow-bore needles.

"Needleless system" means a device that does not utilize needles for:

- (1) The withdrawal of body fluids after initial venous or arterial access is established;
- (2) The administration of medication or fluids; and
- (3) Any other procedure involving the potential for an exposure incident.

"NIOSH" means the Director of the National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, or designated representative.

"Occupational Exposure" means reasonably anticipated skin, eye, mucous membrane, or parenteral contact with blood or other potentially infectious materials that may result from the performance of an employee's duties.

"One-Hand Technique" means procedure wherein the needle of a reusable syringe is capped in a sterile manner during use. The technique employed shall require the use of only the hand holding the syringe so that the free hand is not exposed to the uncapped needle.

"OPIM" means other potentially infectious materials.

"Other Potentially Infectious Materials" means:

- (1) The following human body fluids: semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, amniotic fluid, saliva in dental procedures, any other body fluid that is visibly contaminated with blood such as saliva or vomitus, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids such as emergency response;
- (2) Any unfixed tissue or organ (other than intact skin) from a human (living or

dead); and

(3) Any of the following, if known or reasonably likely to contain or be infected with HIV, HBV, or HCV:

- (A) Cell, tissue, or organ cultures from humans or experimental animals;
- (B) Blood, organs, or other tissues from experimental animals; or
- (C) Culture medium or other solutions.

"Parenteral contact" means piercing mucous membranes or the skin barrier through such events as needlesticks, human bites, cuts, and abrasions.

"Personal Protective Equipment" is specialized clothing or equipment worn or used by an employee for protection against a hazard. General work clothes (e.g., uniforms, pants, shirts or blouses) not intended to function as protection against a hazard are not considered to be personal protective equipment.

"Production Facility" means a facility engaged in industrial-scale, large-volume or high concentration production of HIV, HBV or HCV. "Regulated Waste" means any of the following:

- (1) Liquid or semi-liquid blood or OPIM;
 - (2) Contaminated items that:
 - (A) Contain liquid or semi-liquid blood, or are caked with dried blood or OPIM;
- and
- (B) Are capable of releasing these materials when handled or compressed.
- (3) Contaminated sharps.
 - (4) Pathological and microbiological wastes containing blood or OPIM.
 - (5) Regulated Waste includes "medical waste" regulated by Health and Safety Code Sections 117600 through 118360.

"Research Laboratory" means a laboratory producing or using research-laboratory-scale amounts of HIV, HBV or HCV. Research laboratories may produce high concentrations of HIV, HBV or HCV but not in the volume found in production facilities.

"Sharp" means any object used or encountered in the industries covered by subsection (a) that can be reasonably anticipated to penetrate the skin or any other part of the body, and to result in an exposure incident, including, but not limited to, needle devices, scalpels, lancets, broken glass, broken capillary tubes, exposed ends of dental wires and dental knives, drills and burs.

"Sharps Injury" means any injury caused by a sharp, including, but not limited to, cuts, abrasions, or needlesticks.

"Sharps Injury Log" means a written or electronic record satisfying the requirements of subsection (c)(2).

"Source Individual" means any individual, living or dead, whose blood or OPIM

may be a source of occupational exposure to the employee. Examples include, but are not limited to, hospital and clinical patients; clients in institutions for the developmentally disabled; trauma victims; clients of drug and alcohol treatment facilities; residents of hospices and nursing homes; human remains; and individuals who donate or sell blood or blood components.

"Universal Precautions" is an approach to infection control. According to the concept of Universal Precautions, all human blood and certain human body fluids are treated as if known to be infectious for HIV, HBV or HCV, and other bloodborne pathogens.

"Work Practice Controls" means controls that reduce the likelihood of exposure by defining the manner in which a task is performed (e.g., prohibiting recapping of needles by a two-handed technique and use of patient-handling techniques).

(c) Exposure Response, Prevention and Control.

(1) Exposure Control Plan.

(A) Each company having an employee(s) with occupational exposure as defined by subsection (b) of this section shall establish implement and maintain an effective Exposure Control Plan which is designed to eliminate or minimize employee exposure.

(B) The Exposure Control Plan shall be in writing and shall contain at least the following elements:

1. The exposure determination required by subsection (c)(3);
2. The schedule and method of implementation for each of the applicable subsections:

(d) Methods of Compliance,

(e) HIV, HBV and HCV Research Laboratories and Production Facilities,

(f) Hepatitis B Vaccination and Post-exposure Evaluation and Follow-up,

(g) Communication of Hazards to Employees, and

(h) Recordkeeping, of this standard;

3. The procedure for the evaluation of circumstances surrounding exposure incidents as required by subsection (f)(3)(A).

By July 1, 1999, the Exposure Control Plan shall additionally contain the following elements required by subsections (c)(1)(B) 4. through 8.:

4. An effective procedure for gathering the information required by the Sharps Injury Log.

5. An effective procedure for periodic determination of the frequency of use of the types and brands of sharps involved in the exposure incidents documented on the Sharps Injury Log;

NOTE: Frequency of use may be approximated by any reasonable and effective method.

6. An effective procedure for identifying currently available engineering controls, and selecting such controls, where appropriate, for the procedures performed by employees in their respective work areas or departments;

7. An effective procedure for documenting patient safety determinations made pursuant to Exception 2. of subsection (d)(3)(A); and

8. An effective procedure for obtaining the active involvement of employees in reviewing and updating the exposure control plan with respect to the procedures performed by employees in their respective work areas or departments.

(C) Each company shall ensure that a copy of the Exposure Control Plan is accessible to employees in accordance with Section 3204(e).

(D) The Exposure Control Plan shall be reviewed and updated at least annually and whenever necessary as follows:

1. To reflect new or modified tasks and procedures which affect occupational exposure;

2. By July 1, 1999, if sharps are used in the company's place of employment, to reflect progress in implementing the use of needleless systems and sharps with engineered sharps injury protection.

3. To include new or revised employee positions with occupational exposure;

4. To review and evaluate the exposure incidents which occurred since the previous update; and

5. To review and respond to information indicating that the Exposure Control Plan is deficient in any area.

(E) The Exposure Control Plan shall be made available to the Chief or NIOSH or their respective designee upon request for examination and copying.

(2) Sharps Injury Log

The company shall establish and maintain a Sharps Injury Log, which is a record of each exposure incident involving a sharp. The exposure incident shall be recorded on the log within 14 working days of the date the incident is reported to the company. The information recorded shall include the following information, if known or reasonably available:

(A) Date and time of the exposure incident;

(B) Type and brand of sharp involved in the exposure incident;

(C) By July 1, 1999, a description of the exposure incident which shall include:

1. Job classification of the exposed employee;

2. Department or work area where the exposure incident occurred;

3. The procedure that the exposed employee was performing at the time of the incident;

4. How the incident occurred;

5. The body part involved in the exposure incident;

6. If the sharp had engineered sharps injury protection, whether the protective mechanism was activated, and whether the injury occurred before the protective mechanism was activated, during activation of the mechanism or after activation of the mechanism, if applicable;

7. If the sharp had no engineered sharps injury protection, the injured

employee's opinion as to whether and how such a mechanism could have prevented the injury; and

8. The employee's opinion about whether any other engineering, administrative or work practice control could have prevented the injury.

(3) Exposure Determination.

(A) Each company who has an employee(s) with occupational exposure as defined by subsection (b) of this section shall prepare an exposure determination. This exposure determination shall contain the following:

1. A list of all job classifications in which all employees in those job classifications have occupational exposure;
2. A list of job classifications in which some employees have occupational exposure; and
3. A list of all tasks and procedures or groups of closely related task and procedures in which occupational exposure occurs and that are performed by employees in job classifications listed in accordance with the provisions of subsection (c)(3)(A)2. of this standard.

(B) This exposure determination shall be made without regard to the use of personal protective equipment.

(d) Methods of Compliance.

(1) General. Universal precautions shall be observed to prevent contact with blood or OPIM. Under circumstances in which differentiation between body fluid types is difficult or impossible, all body fluids shall be considered potentially infectious materials.

(2) Engineering and Work Practice Controls - General Requirements.

(A) Engineering and work practice controls shall be used to eliminate or minimize employee exposure.

(B) Engineering controls shall be examined and maintained or replaced on a regular schedule to ensure their effectiveness.

(C) Work practice controls shall be evaluated and updated on a regular schedule to ensure their effectiveness.

(D) All procedures involving blood or OPIM shall be performed in such a manner as to minimize splashing, spraying, spattering, and generation of droplets of these substances.

(3) Engineering and Work Practice Controls--Specific Requirements.

(A) Needleless Systems, Needle Devices and Non-Needle Sharps. By July 1, 1999, the company shall comply with the following requirements:

1. Needleless Systems. Needleless systems shall be used for:

- a. Withdrawal of body fluids after initial venous or arterial access is established;
- b. Administration of medications or fluids; and
- c. Any other procedure involving the potential for an exposure incident for which a needleless system is available as an alternative to the use of needle devices.

2. Needle Devices. If needleless systems are not used, needles with engineered sharps injury protection shall be used for:

- a. Withdrawal of body fluids;

- b. Accessing a vein or artery;
 - c. Administration of medications or fluids; and
 - d. Any other procedure involving the potential for an exposure incident for which a needle device with engineered sharps injury protection is available.
3. Non-Needle Sharps. If sharps other than needle devices are used, these items shall include engineered sharps injury protection.

EXCEPTIONS: The following exceptions apply to the engineering controls required by subsection (d)(3)(A):

- 1. Market Availability. The engineering control is not required if it is not available in the marketplace.
- 2. Patient Safety. The engineering control is not required if a licensed healthcare professional directly involved in a patient's care determines, in the reasonable exercise of clinical judgment, that use of the engineering control will jeopardize the patient's safety or the success of a medical, dental or nursing procedure involving the patient. The determination shall be documented according to the procedure required by (c)(1)(B)6.
- 3. Safety Performance. The engineering control is not required if the company can demonstrate by means of objective product evaluation criteria that the engineering control is not more effective in preventing exposure incidents than the alternative used by the company.
- 4. Availability of Safety Performance Information. The engineering control is not required if the company can demonstrate that reasonably specific and reliable information is not available on the safety performance of the engineering control for the company's procedures, and that the company is actively determining by means of objective product evaluation criteria whether use of the engineering control will reduce the risk of exposure incidents occurring in the company's workplace.

(B) Prohibited Practices.

- 1. Shearing or breaking of contaminated needles and other contaminated sharps is prohibited.
- 2. Contaminated sharps shall not be bent, recapped, or removed from devices.

EXCEPTION: Contaminated sharps may be bent, recapped or removed from devices if the procedure is performed using a mechanical device or a one-handed technique, and the company can demonstrate that no alternative is feasible or that such action is required by a specific medical or dental procedure.

- 3. Sharps that are contaminated with blood or OPIM shall not be stored or processed in a manner that requires employees to reach by hand into the containers where these sharps have been placed.
- 4. Disposable sharps shall not be reused.
- 5. Broken Glassware. Broken glassware which may be contaminated shall not be picked up directly with the hands. It shall be cleaned up using mechanical means, such as a brush and dust pan, tongs, or forceps.

6. The contents of sharps containers shall not be accessed unless properly reprocessed or decontaminated.
 7. Sharps containers shall not be opened, emptied, or cleaned manually or in any other manner which would expose employees to the risk of sharps injury.
 8. Mouth pipetting/suctioning of blood or OPIM is prohibited.
 9. Eating, drinking, smoking, applying cosmetics or lip balm, and handling contact lenses are prohibited in work areas where there is a reasonable likelihood of occupational exposure.
 10. Food and drink shall not be kept in refrigerators, freezers, shelves, cabinets or on countertops or bench tops where blood or OPIM are present.
- (C) Requirements for Handling Contaminated Sharps.

1. All procedures involving the use of sharps in connection with patient care, such as withdrawing body fluids, accessing a vein or artery, or administering vaccines, medications or fluids, shall be performed using effective patient-handling techniques and other methods designed to minimize the risk of a sharps injury.
2. Immediately or as soon as possible after use, contaminated sharps shall be placed in containers meeting the requirements of subsection (d)(3)(D) as applicable.
3. At all time during the use of sharps, containers for contaminated sharps shall be:
 - a. Easily accessible to personnel and located as close as is feasible to the immediate area where sharps are used or can be reasonably anticipated to be found (e.g., laundries);
 - b. Maintained upright throughout use, where feasible; and
 - c. Replaced as necessary to avoid overfilling.

(D) Sharps Containers for Contaminated Sharps.

1. All sharps containers for contaminated sharps shall be:
 - a. Rigid;
 - b. Puncture resistant;
 - c. Leak proof on the sides and bottom;
 - d. Portable, if portability is necessary to ensure easy access by the user as required by subsection (d)(3)(C)3.a.; and
 - e. Labeled in accordance with subsection (g)(1)(A)(2).
2. If discarded sharps are not to be reused, the sharps container shall also be closeable and sealable so that when sealed, the container is leak resistant and incapable of being reopened without great difficulty.

(E) Regulated Waste.

1. General.

Handling, storage, treatment and disposal of all regulated waste shall be in accordance with Health and Safety Code Chapter 6.1, Sections 117600 through 118360, and other applicable regulations of the United States, the State, and political subdivisions of the State.

2. Disposal of Sharps Containers.

When any container of contaminated sharps is moved from the area of use for the purpose of disposal, the container shall be:

- a. Closed immediately prior to removal or replacement to prevent spillage or protrusion of contents during handling, storage, transport, or shipping; and
- b. Placed in a secondary container if leakage is possible. The second container shall be:
 - i. Closable;
 - ii. Constructed to contain all contents and prevent leakage during handling, storage, transport, or shipping; and
 - iii. Labeled according to subsection (g)(1)(A) of this section.

3. Disposal of Other Regulated Waste. Regulated waste not consisting of sharps shall be disposed of in containers which are:

- a. Closable;
- b. Constructed to contain all contents;
- c. Labeled and color-coded in accordance with subsection (g)(1)(A) of this section; and
- d. Closed prior to removal to prevent spillage or protrusion of contents during handling, storage, transport, or shipping.

4. Outside Contamination. If outside contamination of a container of regulated waste occurs, it shall be placed in a second container. The second container shall be:

- a. Closable;
- b. Constructed to contain all contents and prevent leakage of fluids during handling, storage, transport or shipping;
- c. Labeled and color-coded in accordance with subsection (g)(1)(A) of this section; and
- d. Closed prior to removal to prevent spillage or protrusion of contents during handling, storage, transport, or shipping.

(F) Handling Specimens of Blood or OPIM.

Specimens of blood or OPIM shall be placed in a container which prevents leakage during collection, handling, processing, storage, transport, or shipping.

1. The container for storage, transport, or shipping shall be labeled or color-coded according to subsection (g)(1)(A), and closed prior to being stored, transported, or shipped. When a facility utilizes Universal Precautions in the handling of all specimens, the labeling/color-coding of specimens is not necessary provided containers are recognizable as containing specimens. This exemption only applies while such specimens/containers remain within the facility. Labeling or color-coding in accordance with subsection (g)(1)(A) is required when such specimens/containers leave the facility.

2. If outside contamination of the primary container occurs, the primary container shall be placed within a second container which prevents leakage during collection, handling, processing, storage, transport, or shipping and is labeled or color-coded according to the requirements of this standard.

3. If the specimen could puncture the primary container, the primary container shall be placed within a secondary container which is puncture-resistant in addition to the above characteristics.

(G) Servicing or Shipping Contaminated Equipment.

Equipment which may become contaminated with blood or OPIM shall be examined

prior to servicing or shipping and shall be decontaminated as necessary, unless the company can demonstrate that decontamination of such equipment or portions of such equipment is not feasible.

1. A readily observable label in accordance with subsection (g)(1)(A)8. shall be attached to the equipment stating which portions remain contaminated.

2. Information concerning all remaining contamination shall be conveyed to all affected employees, the servicing representative, and/or the manufacturer, as appropriate, prior to handling, servicing, or shipping so that appropriate precautions will be taken.

(H) Cleaning and Decontamination of the Worksite.

1. General Requirements.

a. Companies shall ensure that the worksite is maintained in a clean and sanitary condition.

b. Companies shall determine and implement an appropriate written schedule for cleaning and decontamination of the worksite.

c. The method of cleaning or decontamination used shall be effective and shall be appropriate for the:

i. Location within the facility;

ii. Type of surface or equipment to be treated;

iii. Type of soil or contamination present; and

iv. Tasks or procedures being performed in the area.

d. All equipment and environmental and work surfaces shall be cleaned and decontaminated after contact with blood or OPIM no later than at the end of the shift. Cleaning and decontamination of equipment and work surfaces is required more often as specified below.

2. Specific Requirements.

a. Contaminated Work Surfaces. Contaminated work surfaces shall be cleaned and decontaminated immediately or as soon as feasible when:

i. Surfaces become overtly contaminated;

ii. There is a spill of blood or OPIM;

iii. Procedures are completed; and

iv. At the end of the work shift if the surface may have become contaminated since the last cleaning.

b. Receptacles. All bins, pails, cans, and similar receptacles intended for reuse which have a reasonable likelihood for becoming contaminated with blood or OPIM shall be inspected and decontaminated on a regularly scheduled basis and cleaned and decontaminated immediately or as soon as feasible upon visible contamination.

c. Protective Coverings. Protective coverings, such as plastic wrap, aluminum foil, or imperviously-backed absorbent paper used to cover equipment and environmental surfaces, shall be removed and replaced as soon as feasible when they become overtly contaminated or at the end of the workshift if they may have become contaminated during the shift.

(I) Hygiene.

1. Companies shall provide hand washing facilities which are readily accessible to employees.

2. When provision of hand washing facilities is not feasible, the company shall provide either an appropriate antiseptic hand cleanser in conjunction with clean cloth/paper towels or antiseptic towelettes. When antiseptic hand cleansers or towelettes are used, hands shall be washed with soap and running water as soon as feasible.

3. Companies shall ensure that employees wash their hands immediately or as soon as feasible after removal of gloves or other personal protective equipment.

4. Companies shall ensure that employees wash hands and any other skin with soap and water, or flush mucous membranes with water immediately or as soon as feasible following contact of such body areas with blood or OPIM.

(J) Laundry.

1. Contaminated laundry shall be handled as little as possible with a minimum of agitation.

a. Contaminated laundry shall be bagged or containerized at the location where it was used and shall not be sorted or rinsed in the location of use.

b. Contaminated laundry shall be placed and transported in bags or containers labeled or color-coded in accordance with subsection (g)(1)(A) of this standard. When a facility utilizes Universal Precautions in the handling of all soiled laundry, alternative labeling or color-coding is sufficient if it permits all employees to recognize the containers as requiring compliance with Universal Precautions.

c. Whenever contaminated laundry is wet and presents a reasonable likelihood of soaking through or leakage from the bag or container, the laundry shall be placed and transported in bags or containers which prevent soak-through and/or leakage of fluids to the exterior.

2. The company shall ensure that employees who have contact with contaminated laundry wear protective gloves and other appropriate personal protective equipment.

3. When a facility ships contaminated laundry off-site to a second facility which does not utilize Universal Precautions in the handling of all laundry, the facility generating the contaminated laundry must place such laundry in bags or containers which are labeled or color-coded in accordance with subsection (g)(1)(A).

(4) Personal Protective Equipment

(A) Provision. Where occupational exposure remains after institution of engineering and work practice controls, the company shall provide, at no cost to the employee, appropriate personal protective equipment such as, but not limited to, gloves, gowns, laboratory coats, face shields or masks and eye protection, and mouthpieces, resuscitation bags, pocket masks, or other ventilation devices. Personal protective equipment will be considered "appropriate" only if it does not permit blood or OPIM to pass through to or reach the employee's work clothes, street clothes, undergarments, skin, eyes, mouth, or other mucous membranes under normal conditions of use and for the duration of time which the protective equipment will be used.

(B) Use. The company shall ensure that the employee uses appropriate personal

protective equipment unless the company shows that the employee temporarily and briefly declined to use personal protective equipment when, under rare and extraordinary circumstances, it was the employee's professional judgment that in the specific instance its use would have prevented the delivery of health care or public safety services or would have posed an increased hazard to the safety of the worker or co-worker. When the employee makes this judgment, the circumstances shall be investigated and documented in order to determine whether changes can be instituted to prevent such occurrences in the future. The company shall encourage employees to report all such instances without fear of reprisal.

(C) Accessibility. The company shall ensure that appropriate personal protective equipment in the appropriate sizes is readily accessible at the worksite or is issued to employees. Hypoallergenic gloves, glove liners, powderless gloves, or other similar alternatives shall be readily accessible to those employees who are allergic to the gloves normally provided.

(D) Cleaning, Laundering, and Disposal. The company shall clean, launder, and dispose of personal protective equipment required by subsections (d) and (e) of this standard, at no cost to the employee.

(E) Repair and Replacement. The company shall repair or replace personal protective equipment as needed to maintain its effectiveness, at no cost to the employee.

(F) Removal

1. If a garment(s) is penetrated by blood OPIM, the garment(s) shall be removed immediately or as soon as feasible.
2. All personal protective equipment shall be removed prior to leaving the work area.
3. When personal protective equipment is removed it shall be placed in an appropriately designated area or container for storage, washing, decontamination or disposal.

(G) Gloves. Gloves shall be worn when it can be reasonably anticipated that the employee may have hand contact with blood, OPIM, mucous membranes, and non-intact skin; when performing vascular access procedures except as specified in subsection (d)(4)(G)4.; and when handling or touching contaminated items or surfaces. These requirements are in addition to the provisions of Section 3384.

1. Disposable (single use) gloves such as surgical or examination gloves, shall be replaced as soon as practical when contaminated or as soon as feasible if they are torn, punctured, or when their ability to function as a barrier is compromised.
2. Disposable (single use) gloves shall not be washed or decontaminated for re-use.
3. Utility gloves may be decontaminated for re-use if the integrity of the glove is not compromised. However, they must be discarded if they are cracked, peeling, torn, punctured, or exhibit other signs of deterioration or when their ability to function as a barrier is compromised.
4. If an company in a volunteer blood donation center judges that routine gloving for all phlebotomies is not necessary then the company shall:

- a. Periodically reevaluate this policy;
- b. Make gloves available to all employees who wish to use them for phlebotomy;
- c. Not discourage the use of gloves for phlebotomy; and
- d. Require that gloves be used for phlebotomy in the following circumstances:
 - i. When the employee has cuts, scratches, or other breaks in his or her skin;
 - ii. When the employee judges that hand contamination with blood may occur, for example, when performing phlebotomy on an uncooperative source individual; and
 - iii. When the employee is receiving training in phlebotomy.

(H) Masks, Eye Protection, Face Shields, and Respirators.

1. Masks in combination with eye protection devices, such as goggles or glasses with solid side shields, or chin-length face shields, shall be worn whenever splashes, spray, spatter, or droplets of blood OPIM may be generated and eye, nose, or mouth contamination can be reasonably anticipated. These requirements are in addition to the provisions of Section 3382.
2. Where respiratory protection is used, the provisions of Sections 5144 and 5147 are required as applicable.

NOTE: Surgical masks are not respirators.

(I) Gowns, Aprons, and Other Protective Body Clothing.

1. Appropriate protective clothing such as, but not limited to, gowns, aprons, lab coats, clinic jackets, or similar outer garments shall be worn in occupational exposure situations. The type and characteristics will depend upon the task and degree of exposure anticipated. These requirements are in addition to the provisions of Section 3383.
2. Surgical caps or hoods and/or shoe covers or boots shall be worn in instances when gross contamination can reasonably be anticipated (e.g., autopsies, orthopaedic surgery). These requirements are in addition to the provisions of Section 3383.

(e) HIV, HBV and HCV Research Laboratories and Production Facilities.

(1) General.

This subsection applies in addition to the other requirements of this section to research laboratories and production facilities engaged in the culture, production, concentration, experimentation, and manipulation of HIV, HBV and HCV.

EXCEPTION: This subsection does not apply to clinical or diagnostic laboratories engaged solely in the analysis of blood, tissues, or organs.

(2) Research laboratories and production facilities shall meet the following criteria:

(A) Standard Microbiological Practices. All regulated waste shall either be incinerated or decontaminated by a method such as autoclaving known to

effectively destroy bloodborne pathogens. Such methods are further specified in Health and Safety Code Section 118215.

(B) Special Practices.

1. Laboratory doors shall be kept closed when work involving HIV, HBV or HCV is in progress.
2. Contaminated materials that are to be decontaminated at a site away from the work area shall be placed in a durable, leak proof, labeled or color-coded container that is closed before being removed from the work area.
3. Access to the work area shall be limited to authorized persons. Written policies and procedures shall be established whereby only persons who have been advised of the potential biohazard, who meet any specific entry requirements, and who comply with all entry and exit procedures shall be allowed to enter the work areas and animal rooms.
4. When OPIM or infected animals are present in the work area or containment module, a hazard warning sign incorporating the universal biohazard symbol shall be posted on all access doors. The hazard warning sign shall comply with subsection (g)(1)(B) of this standard.
5. All activities involving OPIM shall be conducted in biological safety cabinets or other physical-containment devices within the containment module. No work with OPIM shall be conducted on the open bench.
6. Laboratory coats, gowns, smocks, uniforms, or other appropriate protective clothing shall be used in the work area and animal rooms. Protective clothing shall not be worn outside of the work area and shall be decontaminated before being laundered.
7. Special care shall be taken to avoid skin contact with OPIM. Gloves shall be worn when handling infected animals and when making hand contact with OPIM is unavoidable.
8. Before disposal, all waste from work areas and from animal rooms shall either be incinerated or decontaminated by a method such as autoclaving known to effectively destroy bloodborne pathogens.
9. Vacuum lines shall be protected with liquid disinfectant traps and HEPA filters or filters of equivalent or superior efficiency and which are checked routinely and maintained or replaced as necessary.
10. Hypodermic needles and syringes shall be used only for parenteral injection and aspiration of fluids from laboratory animals and diaphragm bottles. Only needle-locking syringes or disposable syringe-needle units (i.e., the needle is integral to the syringe) shall be used for the injection or aspiration of OPIM. Extreme caution shall be used when handling needles and syringes. A needle shall not be bent, sheared, replaced in the sheath or guard, or removed from the syringe following use. The needle and syringe shall be promptly placed in a puncture-resistant container and autoclaved or decontaminated before reuse or disposal.
11. All spills shall be immediately contained and cleaned up by appropriate professional staff or others properly trained and equipped to work with potentially concentrated infectious materials.
12. A spill or accident that results in an exposure incident shall be

immediately reported to the laboratory director or other responsible person.

13. Written biosafety procedures shall be prepared and adopted into the Exposure Control Plan of subsection (c)(1). Personnel shall be advised of potential hazards, shall be required to read instructions on practices and procedures, and shall be required to follow them.

(C) Containment Equipment.

1. Certified biological safety cabinets (Class I, II, or III) or other appropriate combinations of personal protection or physical containment devices, such as special protective clothing, respirators, centrifuge safety cups, sealed centrifuge rotors, and containment caging for animals, shall be used for all activities with OPIM that pose a threat of exposure to droplets, splashes, spills, or aerosols.

2. Biological safety cabinets shall be certified by the company that they meet manufacturers' specifications when installed, whenever they are moved and at least annually.

(3) HIV, HBV and HCV research laboratories shall meet the following criteria:

(A) Each laboratory shall contain a facility for hand washing and an eye wash facility which is readily available within the work area.

(B) An autoclave for decontamination of regulated waste shall be available.

NOTE: Treatment of medical waste should meet the requirements of Health and Safety Code Section 118215.

(4) HIV, HBV and HCV production facilities shall meet the following criteria:

(A) The work areas shall be separated from areas that are open to unrestricted traffic flow within the building. Passage through two sets of doors shall be the basic requirement for entry into the work area from access corridors or other contiguous areas. Physical separation of the high-containment work area from access corridors or other areas or activities may also be provided by a double-doored clothes-change room (showers may be included), airlock, or other access facility that requires passing through two sets of doors before entering the work area.

(B) The surfaces of doors, walls, floors and ceilings in the work area shall be water resistant so that they can be easily cleaned. Penetrations in these surfaces shall be sealed or capable of being sealed to facilitate decontamination.

(C) Each work area shall contain a sink for washing hands and a readily available eye wash facility. The sink shall be foot, elbow, or automatically operated and shall be located near the exit door of the work area.

(D) Access doors to the work area or containment module shall be self-closing.

(E) An autoclave for decontamination of regulated waste shall be available within or as near as possible to the work area.

NOTE: Treatment of medical waste should meet the requirements of Health and Safety Code Section 118215.

(F) A ducted exhaust-air ventilation system shall be provided. This system shall create directional airflow that draws air into the work area through the entry area. The exhaust air shall not be recirculated to any other area of the building, shall be discharged to the outside, and shall be dispersed away from occupied areas and air intakes. The proper direction of the airflow shall be verified (i.e., into the work area). The ventilation system shall conform to the requirements of Article 107.

(5) Training Requirements.

Training requirements for employees in HIV, HBV and HVC research laboratories and HIV, HBV and HVC production facilities are specified in subsection (g)(2) and they shall receive in addition the following initial training:

(A) The company shall assure that employees demonstrate proficiency in standard microbiological practices and techniques and in the practices and operations specific to the facility before being allowed to work with HIV, HBV or HCV.

(B) The company shall assure that employees have prior experience in the handling of human pathogens or tissue cultures before working with HIV or HBV.

(C) The company shall provide a training program to employees who have no prior experience in handling human pathogens. Initial work activities shall not include the handling of infectious agents. A progression of work activities shall be assigned as techniques are learned and proficiency is developed. The company shall assure that employees participate in work activities involving infectious agents only after proficiency has been demonstrated.

(f) Hepatitis B Vaccination and Post-exposure Evaluation and Follow-up.

(1) General.

(A) The company shall make available the hepatitis B vaccine and vaccination series to all employees who have occupational exposure, and post-exposure evaluation and follow-up to all employees who have had an exposure incident. When an company is also acting as the evaluating health care professional, the company shall advise an employee following an exposure incident that the employee may refuse to consent to post-exposure evaluation and follow-up from the company-healthcare professional. When consent is refused, the company shall make immediately available to exposed employees a confidential medical evaluation and follow-up from a healthcare professional other than the exposed employee's company.

EXCEPTION: Designated first aid providers who have occupational exposure are not required to be offered pre-exposure hepatitis B vaccine if the following conditions exist:

1. The primary job assignment of such designated first aid providers is not the rendering of first aid.

a. Any first aid rendered by such persons is rendered only as a collateral duty responding solely to injuries resulting from workplace incidents, generally at the location where the incident occurred.

b. This exception does not apply to designated first aid providers who render assistance on a regular basis, for example, at a first aid station, clinic, dispensary, or other location where injured employees routinely go for such

assistance, and emergency or public safety personnel who are expected to render first aid in the course of their work.

2. The company's Exposure Control Plan, subsection (c)(1), shall specifically address the provision of hepatitis B vaccine to all unvaccinated first aid providers who have rendered assistance in any situation involving the presence of blood OPIM (regardless of whether an actual exposure incident, as defined by subsection (b), occurred) and the provision of appropriate post-exposure evaluation, prophylaxis and follow-ups for those employees who experience an exposure incident as defined in subsection (b), including:

a. Provisions for a reporting procedure that ensures that all first aid incidents involving the presence of blood or OPIM, shall be reported to the company before the end of work shift during which the first aid incident occurred.

i. The report must include the names of all first aid providers who rendered assistance, regardless of whether personal protective equipment was used and must describe the first aid incident, including time and date.

A. The description must include a determination of whether or not, in addition to the presence of blood or OPIM, an exposure incident, as defined in subsection (b), occurred.

B. This determination is necessary in order to ensure that the proper post-exposure evaluation, prophylaxis and follow-up procedures required by subsection (f)(3) are made available immediately if there has been an exposure incident, as defined in subsection (b).

ii. The report shall be recorded on a list of such first aid incidents. It shall be readily available to all employees and shall be provided to the Chief upon request.

b. Provision for the bloodborne pathogens training program, required by subsection (g)(2), for designated first aiders to include the specifics of the reporting requirements of subsection (f)(3) and of this exception.

c. Provision for the full hepatitis B vaccination series to be made available as soon as possible, but in no event later than 24 hours, to all unvaccinated first aid providers who have rendered assistance in any situation involving the presence of blood or OPIM regardless of whether or not a specific exposure incident, as defined by subsection (b), has occurred.

3. The company must implement a procedure to ensure that all of the provisions of subsection 2. of this exception are complied with if pre-exposure hepatitis B vaccine is not to be offered to employees meeting the conditions of subsection 1. of this exception.

(B) The company shall ensure that all medical evaluations and procedures including the hepatitis B vaccine and vaccination series and post-exposure evaluation and follow-up, including prophylaxis, are:

1. Made available at no cost to the employee;
2. Made available to the employee at a reasonable time and place;
3. Performed by or under the supervision of a licensed physician or by or under

the supervision of another licensed healthcare professional; and

4. Provided according to recommendations of the U.S. Public Health Service current at the time these evaluations and procedures take place, except as specified by this subsection (f).

(C) The company shall ensure that all laboratory tests are conducted by an accredited laboratory at no cost to the employee.

(2) Hepatitis B Vaccination.

(A) Hepatitis B vaccination shall be made available after the employee has received the training required in subsection (g)(2)(G)9. and within 10 working days of initial assignment to all employees who have occupational exposure unless the employee has previously received the complete hepatitis B vaccination series, antibody testing has revealed that the employee is immune, or the vaccine is contraindicated for medical reasons.

(B) The company shall not make participation in a prescreening program a prerequisite for receiving hepatitis B vaccination.

(C) If the employee initially declines hepatitis B vaccination but at a later date while still covered under the standard decides to accept the vaccination, the company shall make available hepatitis B vaccination at that time.

(D) The company shall assure that employees who decline to accept hepatitis B vaccination offered by the company sign the statement in Appendix A.

(E) If a routine booster dose(s) of hepatitis B vaccine is recommended by the U.S. Public Health Service at a future date, such booster dose(s) shall be made available in accordance with section (f)(1)(B).

(3) Post-exposure Evaluation and Follow-up.

Following a report of an exposure incident, the company shall make immediately available to the exposed employee a confidential medical evaluation and follow-up, including at least the following elements:

(A) The company shall document the route(s) of exposure, and the circumstances under which the exposure incident occurred;

(B) The company shall identify and document the source individual, unless the company can establish that identification is infeasible or prohibited by state or local law;

1. The source individual's blood shall be tested as soon as feasible and after consent is obtained in order to determine HBV, HCV and HIV infectivity. If consent is not obtained, the company shall establish that legally required consent cannot be obtained. When the source individual's consent is not required by law, the source individual's blood, if available, shall be tested and the results documented.

2. When the source individual is already known to be infected with HBV, HCV or HIV, testing for the source individual's known HBV, HCV or HIV status need not be repeated.

3. Results of the source individual's testing shall be made available to the exposed employee, and the employee shall be informed of applicable laws and regulations concerning disclosure of the identity and infectious status of the source individual.

(C) The company shall provide for collection and testing of the employee's

blood for HBV, HCV and HIV serological status;

1. The exposed employee's blood shall be collected as soon as feasible and tested after consent is obtained.
2. If the employee consents to baseline blood collection, but does not give consent at that time for HIV serologic testing, the sample shall be preserved for at least 90 days. If, within 90 days of the exposure incident, the employee elects to have the baseline sample tested, such testing shall be done as soon as feasible.
3. Additional collection and testing shall be made available as recommended by the U.S. Public Health Service.

(D) The company shall provide for post-exposure prophylaxis, when medically indicated, as recommended by the U.S. Public Health Service;

(E) The company shall provide for counseling and evaluation of reported illnesses.

(4) Information Provided to the Healthcare Professional.

(A) The company shall ensure that the healthcare professional responsible for the employee's hepatitis B vaccination is provided a copy of this regulation.

(B) The company shall ensure that the healthcare professional evaluating an employee after an exposure incident is provided the following information:

1. A copy of this regulation;
2. A description of the exposed employee's duties as they relate to the exposure incident;
3. Documentation of the route(s) of exposure and circumstances under which exposure occurred, as required by subsection (f)(3)(A);
4. Results of the source individual's blood testing, if available; and
5. All medical records relevant to the appropriate treatment of the employee including vaccination status which are the company's responsibility to maintain, as required by subsection (h)(1)(B)2.

(5) Healthcare Professional's Written Opinion.

The company shall obtain and provide the employee with a copy of the evaluating healthcare professional's written opinion within 15 days of the completion of the evaluation.

(A) The healthcare professional's written opinion for hepatitis B vaccination shall be limited to whether hepatitis B vaccination is indicated for an employee, and if the employee has received such vaccination.

(B) The healthcare professional's written opinion for post-exposure evaluation and follow-up shall be limited to the following information:

1. That the employee has been informed of the results of the evaluation; and
2. That the employee has been told about any medical conditions resulting from exposure to blood or OPIM which require further evaluation or treatment.

(C) All other findings or diagnoses shall remain confidential and shall not be included in the written report.

(6) Medical Recordkeeping.

Medical records required by this standard shall be maintained in accordance with subsection (h)(1) of this section.

(g) Communication of Hazards to Employees.

(1) Labels and Signs.

(A) Labels.

1. Warning labels shall be affixed to containers of regulated waste, refrigerators and freezers containing blood or OPIM, and other containers used to store, transport or ship blood or OPIM, except as provided in subsection (g)(1)(A)5., 6. and 7.

NOTE: Other labeling provisions such as Health and Safety Code Sections 118275 through 118320 may be applicable.

2. Labels required by this section shall include any of the following legends as required by Section 3341: BIOHAZARD

Or in the case of regulated waste the legend:

BIOHAZARDOUS WASTE or SHARPS WASTE

as described in Health and Safety Code Sections 118275 through 118320.

3. These labels shall be fluorescent orange or orange-red or predominantly so, with lettering and symbols in a contrasting color.

4. Labels required by subsection (g)(1)(A) shall either be an integral part of the container or shall be affixed as close as feasible to the container by string, wire, adhesive, or other method that prevents their loss or unintentional removal.

5. Red bags or red containers may be substituted for labels except for sharp containers or regulated waste red bags. Bags used to contain regulated waste shall be color-coded red and shall be labeled in accordance with subsection (g)(1)(A)2. Labels on red bags or red containers do not need to be color-coded in accordance with subsection (g)(1)(A)3.

6. Containers of blood, blood components, or blood products that are labeled as to their contents and have been released for transfusion or other clinical use are exempted from the labeling requirements of subsection (g).

7. Individual containers of blood or OPIM that are placed in a labeled container during storage, transport, shipment or disposal are exempted from the labeling requirement.

8. Labels required for contaminated equipment shall be in accordance with this subsection and shall also state which portions of the equipment remain contaminated.

9. Regulated waste that has been decontaminated need not be labeled or color-coded.

(B) Signs.

1. The company shall post signs at the entrance to work areas specified in subsection (e), HIV, HBV and HCV Research Laboratory and Production Facilities, which shall bear the following legend:

BIOHAZARD

(Name of the Infectious Agent)

(Special requirements for entering the area)

(Name, telephone number of the laboratory director or other responsible person.)

2. These signs shall be fluorescent orange-red or predominantly so, with lettering and symbols in a contrasting color, and meet the requirements of Section 3340.

(2) Information and Training.

(A) Companies shall ensure that all employees with occupational exposure participate in a training program which must be provided at no cost to the employee and during working hours.

(B) Training shall be provided as follows:

1. At the time of initial assignment to tasks where occupational exposure may take place;

2. At least annually thereafter.

(C) For employees who have received training on bloodborne pathogens in the year preceding the effective date of the standard, only training with respect to the provisions of the standard which were not included need be provided.

(D) Annual training for all employees shall be provided within one year of their previous training.

(E) Companies shall provide additional training when changes such as introduction of new engineering, administrative or work practice controls, modification of tasks or procedures or institution of new tasks or procedures affect the employee's occupational exposure. The additional training may be limited to addressing the new exposures created.

(F) Material appropriate in content and vocabulary to educational level, literacy, and language of employees shall be used.

(G) The training program shall contain at a minimum the following elements:

1. Copy and Explanation of Standard. An accessible copy of the regulatory text of this standard and an explanation of its contents;

2. Epidemiology and Symptoms. A general explanation of the epidemiology and symptoms of bloodborne diseases;

3. Modes of Transmission. An explanation of the modes of transmission of bloodborne pathogens;

4. Company's Exposure Control Plans. An explanation of the company's exposure control plan and the means by which the employee can obtain a copy of the written plan;

5. Risk Identification. An explanation of the appropriate methods for recognizing tasks and other activities that may involve exposure to blood and OPIM;

6. Method of Compliance. An explanation of the use and limitations of methods that will prevent or reduce exposure including appropriate engineering controls, administrative or work practice controls and personal protective equipment;

7. Decontamination and Disposal. Information on the types, proper use, location, removal, handling, decontamination and disposal of personal protective equipment;

8. Personal Protective Equipment. An explanation of the basis for selection of

personal protective equipment;

9. Hepatitis B Vaccination. Information on the hepatitis B vaccine, including information on its efficacy, safety, method of administration, the benefits of being vaccinated, and that the vaccine and vaccination will be offered free of charge;

10. Emergency. Information on the appropriate actions to take and persons to contact in an emergency involving blood or OPI_m;

11. Exposure Incident. An explanation of the procedure to follow if an exposure incident occurs, including the method of reporting the incident the medical follow-up that will be made available and the procedure for recording the incident on the Sharps Injury Log

12. Post-Exposure Evaluation and Follow-up. Information on the post-exposure evaluation and follow-up that the company is required to provide for the employee following an exposure incident;

13. Signs and Labels. An explanation of the signs and labels and/or color coding required by subsection (g)(1); and

14. Interactive Questions and Answers. An opportunity for interactive questions and answers with the person conducting the training session.

NOTE: Additional training is required for employees of HIV, HBV and HCV Research Laboratories and Production Facilities, as described in subsection (e)(5).

(H) The person conducting the training shall be knowledgeable in the subject matter covered by the elements contained in the training program as it relates to the workplace that the training will address.

(h) Recordkeeping.

(1) Medical Records.

(A) The company shall establish and maintain an accurate record for each employee with occupational exposure, in accordance with Section 3204.

(B) This record shall include:

1. The name and social security number of the employee;
2. A copy of the employee's hepatitis B vaccination status including the dates of all the hepatitis B vaccinations and any medical records relative to the employee's ability to receive vaccination as required by subsection (f)(2);
3. A copy of all results of examinations, medical testing, and follow-up procedures as required by subsection (f)(3);
4. The company's copy of the healthcare professional's written opinion as required by subsection (f)(5); and
5. A copy of the information provided to the healthcare professional as required by subsections (f)(4)(B)2., 3. and 4.

(C) Confidentiality. The company shall ensure that employee medical records required by subsection (h)(1) are:

1. Kept confidential; and
2. Not disclosed or reported without the employee's express written consent to any person within or outside the workplace except as required by this section or as may be required by law.

(D) The company shall maintain the records required by subsection (h)(1) for at least the duration of employment plus 30 years in accordance with Section 3204.

(2) Training Records.

(A) Training records shall include the following information:

1. The dates of the training sessions;
2. The contents or a summary of the training sessions;
3. The names and qualifications of persons conducting the training; and
4. The names and job titles of all persons attending the training sessions.

(B) Training records shall be maintained for 3 years from the date on which the training occurred.

(3) Sharps Injury Log.

The Sharps Injury Log shall be maintained 5 years from the date the exposure incident occurred.

(4) Availability.

(A) The company shall ensure that all records required to be maintained by this section shall be made available upon request to the Chief and NIOSH for examination and copying.

(B) Employee training records required by this subsection shall be provided upon request for examination and copying to employees, to employee representatives, to the Chief, and to NIOSH.

(C) Employee medical records required by this subsection shall be provided upon request for examination and copying to the subject employee, to anyone having written consent of the subject employee, to the Chief, and to NIOSH in accordance with Section 3204.

(D) The Sharps Injury Log required by subsection (c)(2) shall be provided upon request for examination and copying to employees, to employee representatives, to the Chief, to the Department of Health Services, and to NIOSH.

(5) Transfer of Records.

(A) The company shall comply with the requirements involving transfer of records set forth in Section 3204.

(B) If the company ceases to do business and there is no successor company to receive and retain the records for the prescribed period, the company shall notify NIOSH, at least three months prior to their disposal and transmit them to the NIOSH, if required by the NIOSH to do so, within that three month period.

Chapter 6 - Safety Training

6.1 Safety Training

Pickering Associates, Inc. policy and federal law require that Pickering Associates, Inc. staff, participating guests, and visitors receive appropriate health and safety training. Managers are responsible for ensuring that employees and guests under their supervision receive this training so they are fully informed about possible occupational health hazards and know how to work safely. Training must include Pickering Associates, Inc.'s health and safety orientation for new employees plus any additional training specific to the nature of hazards on the job; employees must complete this training before they can work unsupervised. All new employees must attend the new employee orientation within the first month of employment. OSHA and other federal regulations spell out several specific health and safety training requirements for special hazards. These include, but are not limited to, radiation safety, hazard communication for exposure to hazardous substances, asbestos exposure, respirator use, hearing conservation, laser safety, confined space hazards, and certification for using material in moving equipment such as forklifts and overhead cranes. Employees who do hazardous work, such as working with high-voltage power supplies, or who are members of building emergency teams are required to have CPR and First Aid certification. Managers should identify training needs for the job classifications for which they are responsible. Please refer to specific chapters in this manual for further information on training requirements. Consult with the Responsible Safety Officer staff about other training needs and requirements. Training not provided by Responsible Safety Officer, such as on-the-job training, is the responsibility of line management. This includes information on procedural changes or system modifications that impact safety. Responsible Safety Officer provides several health and safety training courses, technical assistance on training needs, and resources to help supervisors fulfill their training responsibilities. An announcement describing health and safety courses offered by Responsible Safety Officer is distributed quarterly. Educational resources such as fact sheets, hazard summaries, and other written materials, as well as videos and slide shows, are available from Responsible Safety Officer. Supervisors can get a catalog from Responsible Safety Officer describing audio-visual materials that may be used to supplement safety training programs. ALL health and safety training must be documented. Supervisors must note the participants' names and employee numbers, topics discussed, instructor(s), and date. Supervisors are responsible for maintaining training records. A copy of this information should be sent to the Responsible Safety Officer training/education coordinator for inclusion in Pickering Associates, Inc.'s training data base.

Chapter 7 - Drug and Alcohol Free Workplace

DRUG AND ALCOHOL FREE WORKPLACE

7.1 Purpose

Pickering Associates, Inc. recognizes the problems which drug abuse have created in the construction industry and the need to develop drug abuse prevention programs. Accordingly, in order to enhance the safety of the workplace and to maintain a drug-free environment, **Pickering Associates, Inc.** has amended its Drug and Alcohol Prevention Program to comply with Federal Regulations. **Pickering Associates, Inc.** intends to abide by all future Federal Regulation and amendments, and specific requirements as determined by our customers.

7.2 Scope

This revised Drug and Alcohol Prevention Program is effective on January 1, 2003. The provisions of this Drug and Alcohol Prevention Program are **applicable to all employees of Pickering Associates, Inc.**

Implementation and continued enforcement of the Drug and Alcohol Prevention Program is subject to appropriate local, state, and federal laws as well as any collective bargaining agreements, and customer requirements.

Any special customer requirements not included in this policy will be adopted and enforced as required by that customer.

7.3 General Provisions

It is the intent of **Pickering Associates, Inc.** to provide a drug free working environment by maintaining a strong drug and alcohol prevention program as part of our safety program which ensures that all employees are healthy and fit for work, including job site, management, shop, and clerical personnel.

7.4 Employee Assistance Program

The use, possession, transfer or sale of illegal drugs, narcotics, or other unlawful substances is absolutely prohibited and may be considered grounds for termination of employment. When discussed with management, employees experiencing problems prior to being identified through a positive drug test will be referred to an **EAP (Employee's Assistance Program)** for assistance. Refusal to enter treatment may result in termination.

7.5 Program Requirements (Minimum)

The following elements form the basic minimum requirements for this program. Details of these and other requirements are outlined in the Procedures section of this policy.

7.6 Pre-Employment

Testing of potential new hires for the presence of drugs will be required at the sole discretion of Pickering Associates, Inc.'s management.

7.7 Reasonable Suspicion

Employees who exhibit through identification of abnormal job performance or behaviors which suggest that drug or alcohol abuse may be a factor, may be requested to test for the presence of alcohol or drug test.

7.8 Random Testing

All employees will undergo unannounced drug testing based on a computerized random selection process.

7.9 Post Accident Testing

Will involve any employee in an accident or contributing to an accident as defined in this policy.

7.10 Abstinence Monitoring

All employees who receive some form of rehabilitation may be required to undergo a drug test.

ON-THE-JOB USE, POSSESSION OR SALE OF DRUGS OR ALCOHOL

7.11 Alcohol

Being under the influence of alcohol by any employee while performing company business or at any **customer** location is prohibited to the extent that such use or influence may affect the safety of co-workers or members of the public, the employee's job performance, or the safe or efficient operation of the company facility.

Except as permitted by company facility management, consumption of alcohol on

company property or job site is prohibited.

7.12 Legal Drugs

Except as provided below, the use or being under the influence of any legally obtained drug by any employee while performing company business or while at a company or **customer** facility is prohibited to the extent such use or influence may affect the safety of co-workers or members of the public, the employee's job performance, or the safe or efficient operation of the company.

An employee may continue to work, even though under the influence of a **legal drug** if management has determined, after consulting with the Medical Department and Employee Relations, that the employee does not pose a threat to his or her own safety or the safety of their co-workers and that the employee's job performance is not significantly affected by the legal drug. Otherwise, the employee may be required to take a leave of absence or comply with other appropriate action determined by Management.

7.13 Illegal Drugs

The use, sale, purchase, transfer or possession of an illegal drug by an employee while at a company or **customer** facility or while performing company business is prohibited. The presence in detectable amount of any illegal drug in an employee while performing company business or while in a customer or company facility is prohibited.

7.14 Disciplinary Action

Violation of the Policy can result in disciplinary action, up to and including termination, even for a first offense. An individual will not be hired if he/she fails the drug screening.

7.15 Customer or Owner Requirements

It is understood that **Pickering Associates, Inc.'s "customers"** may, under the provisions of the contract, retain the right to search employees and their belongings for drugs, controlled substances, alcohol, or firearms while on the customer's property.

SEARCHES

7.16 Scope and Process

a. Searches of an employee and their personal property may be conducted when there is Reasonable Suspicion that the employee is impaired from performing

his/her job or: in an "Unfit Condition"; and "Incident on duty"; "Post Accident", "Reasonable Suspicion", or when management believes the possession of alcohol or drugs may be occurring in violation of the company policy or **customer's policy**.

b. Searches and/or screening of employees and their personal property may otherwise be conducted who contributed to an accident or where there is Reasonable Suspicion to believe that the accident resulted from drug abuse.

c. The company may conduct unannounced searches for illegal drugs or alcohol in company **or customer** facilities or on job sites. Employees are expected to cooperate in the conducting of such searches.

d. An employee's consent to a search is required as a condition of employment and the employee's refusal to consent may result in disciplinary action, including termination, even for a first refusal.

e. Searches of company facilities and property can be conducted at any time and do not have to be based on Reasonable Suspicion.

f. Searches of clothing and personal effects will be conducted under the direct supervision of management accompanied by a witness. when **on a customer's property**, notify the customer representative prior to beginning the search so that their designated representative or Security personnel may observe.

7.17 Procedures for Handling Seized Property

a. A receipt should be given for seized property.

b. If not already involved, the customer representative or security personnel should be notified in order to communicate, as appropriate, with local law enforcement authorities concerning identification of the material seized and possible prosecution.

c. Seized items should be retained in a locked cabinet under the exclusive control of a designated management employee.

d. If possession is transferred, a chain of custody should be established.

e. Seized property may turn out after the investigation to be property that properly was in the employee's possession. In such cases, the property should be returned and a receipt obtained. If the property represents a violation of the Policy, the employee will be prohibited from working at the customers facility in the future.

7.18 Disposition of Uncooperative Employees

Employees who refuse to cooperate with the search procedures will not be forced to

comply, but will be informed that failure to comply will be grounds for removal for the customer's premises. Those employees who refuse the search procedures will not be granted admittance to the customer's facilities in the future.

7.19 Voluntary Rehabilitation

An employee who voluntarily seeks rehabilitation for a drug or alcohol abuse problem prior to a situation requiring testing based upon Reasonable Suspicion and who cooperates with the Company with regard to treatment, may not be necessarily subject to disciplinary action. Pursuant to State law, employees who seek voluntary rehabilitation are to be allowed a reasonable leave without pay.

The employee is responsible for arranging entrance into a recognized rehabilitation program. When arrangements have been made, a "Notice of Disability" signed by the attending physician must be given to the Safety Coordinator. The employee will then be granted a leave of absence in accordance with Company Policy and State regulations.

It should be fully understood, however, that continued or renewed drug or alcohol abuse after commencement of treatment may result in appropriate disciplinary action, up to and including discharge.

All information in connection with this voluntary program will be treated in as confidential a manner as possible.

7.20 Contract Personnel

The policy provisions stated in all sections above are applicable to contract personnel. Violation of these provisions or refusal to cooperate with implementation of the policy can result in the company's barring contract personnel from company facilities or participating in company operations.

7.21 Employee's Reporting Requirements – Legal Drugs

For certain job positions, an employee's use of a legal drug can pose a significant risk to the safety of the employee or others. Employees who feel or have been informed that the use of a legal drug may present a safety risk are to report such drug use to the Personnel Department to determine job related consequences. Supervision who is aware of such a situation are to instruct the employee to report to the Personnel Department.

7.22 Definitions

"Under the influence" means, for the purposes of this policy, that the employee is

affected by a drug or alcohol or the combination of a drug and alcohol in any detectable manner. the symptoms of influence are not confined to those consistent with misbehavior, nor to obvious impairment of physical or mental ability, such as slurred speech or difficulty in maintaining balance. A determination of influence can be established by a professional opinion, a scientifically valid test and, in some cases such as alcohol, by a layperson's opinion.

"Illegal drug" means any drug; (a) which is not legally obtained, or (b) which is legally obtainable but has not been legally obtained. The term includes prescribed drugs not legally obtained and prescribed drugs not being used for prescribed purposes. It also includes marijuana.

PROCEDURES

7.23 Education and Training

1. **All employees** will be advised in writing of **Pickering Associates, Inc.'s** Drug and Alcohol Prevention Program. The information given will cover reasons for the program, the actual policy and procedure for implementation along with information on how to enroll in the Employee Assistance Program.

All employees, at the time of assignment to any customer facility, will be provided with a copy of the Program for review.

2. **All supervisory personnel** will be trained in the following areas:
- a. One session lasting 2 to 4 hours in length, of training on the specific, contemporaneous physical, behavioral, and performance indicators of possible drug use.
 - b. Drug abuse recognition, signs, and symptoms.
 - c. Company policy and procedure in response to implementation and the handling of employees who appear to be under the influence of prohibited drugs.
 - d. Documenting observations and impressions of persons who may be under the influence of prohibited drugs.

7.24 Notification

1. When an employee is observed in an "Unfit Condition" such as any of those specified in this policy that requires further investigation, testing, or searches, this "Condition" shall be immediately reported by the employee's supervisor to the supervisor's manager and the Safety Coordinator.

2. While at a **customer facility**, the designated company representative must also be notified.

3. Upon notification from the employee's supervisor to the supervisor's manager and/or the Safety Coordinator, appropriate action as outlined in this policy is to be taken, i.e., testing of the employee, implementing search procedures, etc.

TYPES OF DRUG TESTING

7.25 Pre-Employment Testing – If Required

1. A pre-employment drug test may be conducted on all individuals who meet the criteria for employment.

The company will maintain pre-employment screening practices designed to prevent hiring individuals who use illegal drugs or individuals whose use of legal drugs or alcohol indicates a potential for impaired or unsafe job performance.

All applicants or newly hired employees will undergo a drug screen at a predetermined medical facility. **Pickering Associates, Inc.** will pay each applicant or employee who takes and passes the drug screen test for all the time it takes to undergo the drug screen up to a maximum of two hours travel time plus lab time.

2. Applicants not passing the drug screen will not be placed on the **Pickering Associates, Inc.** payroll or receive any compensation. Employees not passing the drug screen will be removed from the **Pickering Associates, Inc.** payroll. **Pickering Associates, Inc.** will pay the cost for administering the drug screen.

All applicants will be informed of the 48 - 96 hours of delay prior to joining the work force to obtain the results of the drug test.

3. A sufficient amount of a sample shall be taken to allow for an initial test and a confirmation test. The initial test will be by Enzyme Multiplied Immunoassay Technique (EMIT). In the event a question or positive result arises from the initial test, a confirmation test must be utilized before action will be taken against an employee or applicant. The confirmation test will be by Gas Chromatography - Mass Spectrometry (GC/MS).

Pre-employment job applicants who test positive do not have the option to have to be retested a second time at the expense of **Pickering Associates, Inc.**

Testing standards for both the initial test and the confirmation test will be those established by the National Institute of Drug Abuse (NIDA). Confirmed positive samples will be retained by the testing laboratory in secured long term frozen storage for a minimum of one year. Handling and transportation of each sample will be

documented through strict chain of custody procedures.

4. **Pickering Associates, Inc.** employees will be required to meet any special requirements imposed by the Customer's Substance Abuse policy prior to being assigned to that job.

7.26 Unfit Condition

1. All supervisory personnel will be trained in the recognizing the specific, contemporaneous physical, behavioral, and performance indicators of possible drug or alcohol abuse.

2. The decision to test an employee for alcohol and drugs while on duty will be done by a meeting of the employee's supervisor and at least one other supervisor and the Safety Coordinator. While at a **customer facility**, the designated company representative must also be notified.

3. The search procedure shall be initiated as part of any observation as an integral part of the screening process. (SEE Search Procedures).

4. The employee shall be escorted to a designated "off-site" medical facility for actual screening.

5. The employee will be excluded from further work at the **customer's facility** pending the outcome of the test results.

7.27 Incident on Duty

1. The decision to test an employee for alcohol and drugs while on duty will be done by a meeting of the employee's supervisor and at least one other supervisor and the Safety Coordinator. While at a **customer facility**, the decision to test must be made in conjunction with their designated representative.

2. Any employee refusing to submit to the alcohol and drug test will be immediately suspended from all work responsibilities without pay until all requested tests are completed; for a period not to exceed five (5) working days. If the employee chooses not to submit to the drug and alcohol screen during the five (5) day period, the employee may be considered to have voluntarily terminated employment.

3. The employee will be excluded from further work at the **customer's facility** pending the outcome of the test results.

7.28 Reasonable Suspicion Testing

1. **Pickering Associates, Inc.** will drug test an employee for drugs and alcohol when there is Reasonable Suspicion to believe the employee is using a prohibited drug or under the influence of alcohol.
2. A decision to test will be based on specific contemporaneous physical, behavioral, or performance indicators of probable drug use such as:
 - a. Discovery of an employee in possession of drugs or alcohol while on duty;
 - b. Sudden change in work performance;
 - c. Sudden change in attitude;
 - d. Minor, yet consistent avoidable accidents;
 - e. Observations of extreme behaviors, i.e.; slurred speech; uneven gait; mood swings; violent outbursts of temper.
 - f. Excessive Absenteeism;
 - g. Pattern of consistent tardiness;
 - h. Disappearing/missing from designated work site without the supervisor aware of whereabouts;
 - i. Consistently in areas where employees should not be or has reason to be.
3. Before an employee is asked to test for Reasonable Suspicion, two of the company's supervisors will substantiate and concur in the decision to request a drug test. One of the two supervisors must have observed the behavior. The two supervisors may concur by telephone.
4. When a negative test result is received, the employee will be put back to work.
5. When a confirmed positive test result is received, the employee will be advised in writing of his/her termination of employment. The written notification will include the reason for the termination, the conditions under which rehire could be considered and specific recommendation to seek professional assistance.
6. Any employee refusing to submit to the alcohol and drug test will be suspended from all work responsibilities without pay until all requested tests are completed; for a period not to exceed five (5) working days. If the employee chooses not to submit to the drug and alcohol screen during the five (5) day period, the employee may be considered to have voluntarily terminated employment.
7. See specific requirements of Customer Substance Abuse policies, which will be distributed as appendices to this Drug and Alcohol Prevention Program.

7.29 Random Testing

1. Random testing; When required by Customer, State, or Federal mandate:

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applies to all employees including supervisors, as well as those who just supervise such performance by others.

2. **Pickering Associates, Inc.** will random test fifty percent (50%) of all employees annually.

3. The tests will be conducted once a month in order to be spaced throughout the year.

4. To assure that the selection process for random testing is indeed random, all employees will be placed in a common selection pool

5. When a confirmed positive test result is received the employee will be advised in writing of his/her termination of employment.

The written notification will include the reason for the termination, the conditions under which rehire could be considered, and the specific recommendations to seek professional assistance.

6. See specific requirements of Customer Substance Abuse policies, which will be distributed as appendices to this Drug and Alcohol Prevention Program.

7.30 Post Accident Testing

1. Employees whose performance either contributed to an accident or cannot be completely discounted as a contributing factor to the accident will be tested for drugs and alcohol. The employee will be tested as soon as possible, but no later than 32 hours after the accident or incident.

2. An accident is defined as:

An event that involves mechanical failure or damage to our equipment or that of our customer, a death or personal injury, or vehicle accident.

An event that is significant in the judgment of our customer, or **Pickering Associates, Inc.** even if it does not meet the criteria of paragraph (a).

3. When a negative test result is received, the employee will be put back to work after an appropriate medical release to return to work.

4. When a confirmed positive test is received, the employee will be advised in writing of his/her termination of employment. The written notification will include the reason for the termination, the conditions under which rehire could be considered, and the specific recommendation to seek professional assistance.

5. See specific requirements of Customer Substance Abuse policies, which will be distributed as appendices to this Drug and Alcohol Prevention Program.

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7.31 Abstinance Monitoring

1. When an employee who has been identified as a user or has requested treatment, **Pickering Associates, Inc.** may require monitoring of the employee's abstinence for at least one (1) year post treatment. The employee will be monitored weekly by the Employee Assistance Program.
2. When a negative test result is received, the employee will continue to work as usual.
3. When a confirmed positive test result is received, the employee will be advised in writing of his/her termination of employment. The written notification will include the reason for the termination, the conditions under which rehire could be considered and the specific recommendation to seek professional assistance.

7.32 Alcohol and Drug Screening for Safety Sensitive Jobs

Screening tests shall be conducted for the presence of alcohol and, at minimum, the five prohibited drugs listed below for all "Safety or Environmentally Sensitive Jobs."

These drugs are also listed under Part 199 of DOT.

"Safety or Environmentally Sensitive Jobs" is defined as "Those jobs where inattention to job duties or slow or inappropriate responses to operating conditions can create or aggravate emergency situations which could result in disabling injuries, loss of life, significant property damage, environmental damage or violation of environmental regulations."

7.33 Prohibited Drugs

Testing under Part 199 is currently limited to the following drugs:

1. Cannabinoids (Marijuana, Hashish);
2. Benzoyllecgonine (Cocaine);
3. Opiates (Heroin, Morphine, Codeine);
4. Amphetamines; and
5. Phencyclidine (PCP).

7.34 Federal Drug Screen Limits fro Illicit Drugs

CLASS SCREENED METHOD DRUG CONFIRMATION
CUTOFF METHOD CUTOFF

AMPHETAMINES IA 1000 ng/ml Amphetamine GC/MS 500 ng/ml
(Amphetamine/Methamphetamine) Methamphetamine GC/MS 500 ng/ml

OPIATES IA 300 ng/ml Codeine GC/MS 300 ng/ml (morphine/Codeine) Morphine
GC/MS 300 ng/ml

COCAINE IA 300 ng/ml Benzoylecgonine GC/MS 150 ng/ml (Cocaine Metabolites)

PHENCYCLIDINE IA 25 ng/ml Phencyclidine GC/MS 25 ng/ml (PCP)

CANNBINOIDS IA 10 ng/ml THC-COOH GC/MS 15 ng/ml

ALCOHOL* .080 BAC *

*Customer Policy if more stringent, i.e. UNOCAL .050% BAC (Blood Alcohol Concentration).

The illicit Drug Screen includes confirmations.

Specimen requirements: 90 ml urine.

7.35 Customer Requirements

See applicable appendix when customer policy is more stringent.

7.36 Positive Test Result or Refusal to Test

1. If an employee refuses to test for drugs or tests positive, and the MRO determines that prohibited drug use was the cause, that employee will be terminated. **Pickering Associates, Inc.** will not rehire that individual until he/she has:

- a. Successfully completed a rehabilitation program as deemed by the Employee Assistance Program;
- b. Has been recommended for return to duty by Medical Review Officer (MRO); and
- c. Has passed a drug test.

7.37 Re-Employment

An applicant who has previously worked for a "covered contractor" (a contractor who is required by a customer to comply with DOT Drug Testing) and was previously drug screened is required to re-test only if 45 or more days have elapsed since he/she

last worked for the company, or another "covered contractor."

7.38 Employee Assistance Program

1. **Pickering Associates, Inc.** will contract for the provisions of Employee Assistance Program (EAP) services as part of the company's Drug and Alcohol Prevention Program. As stated above in section 4 of this chapter. When discussed with management, employees experiencing problems prior to being identified through a positive drug test will be referred to an **EAP (Employee's Assistance Program)** for assistance. Refusal to enter treatment may result in termination. This program is to provide reasonable assistance to employees who demonstrate a desire to become drug free. The ultimate responsibility to be drug free rests with the individual employee at his/her expense.

2. See "Appendix A" for EAP listing.

7.39 The Testing for Drugs

1. The collection of Employee's urine specimen will be conducted under the procedures required by the mandatory guidelines for Federal Workplace Drug Testing Programs. These procedures allow for individual privacy. The person at each collection site will take every precaution to ensure that each sample is not tampered with during the collection procedure. The specimen collection will follow strict chain of custody and security procedures.

- a. Photo identification (e.g., driver's license) must be presented at the collection site.
- b. Employees will be required to wash and dry their hands prior to providing specimens.
- c. Employees will be asked to remove unnecessary outer garments (e.g., coats or jackets). All personal belongings such as purses or briefcases will remain with the outer garments.
- d. The collection site person working with the employees will be of the same gender.
- e. The specimen will be provided in the privacy of a stall or otherwise partitioned area that allows for individual privacy.
- f. After handing the specimen bottle to the collector, the employee should make sure that his/her specimen is in full view until it is sealed and labeled. This protects the employee from wrong labeling or tampering with the specimens.

- g. If the collection site person has reason to believe that an employee may have altered or substituted the specimen, a higher level supervisor will be notified. Should the employee actually tamper, adulterate, or in any other way attempt to dilute his/her specimen he/she will be terminated from employment.
- h. The employee will be asked to initial the identification label on the specimen bottle (identified by his/her name) for the purpose of certifying that it is that employee's.
- i. The employee will be asked to sign the permanent record book next to the information identifying his/her specimen, certifying that the specimen identified as having been collected from his/her is, in fact, the specimen he/she provided.
- j. If after laboratory analysis, the specimen is found to contain traces of a prohibited drug, the results will be disclosed only to the MRO. Prior to making a final decision, the MRO will verify a positive test result by giving the employee an opportunity to discuss the test results and submit medical documentation of legally prescribed medications.

7.40 Drug Testing Laboratory

1. The drug testing laboratory will be NIDA certified and approved by the Department of Health and Human Services as required under the DOT procedures.
2. The drug testing laboratory will permit unannounced inspections, including examinations or records at any time.

7.41 Recordkeeping

1. The following records shall be kept for specified length of time:

Records that demonstrate the collection process will be kept for at least three (3) years. Records of employee drug test results that show a failed drug test, and the type of test failed (e.g., Post Accident, Random) and records which demonstrate rehabilitation, if any, will be kept for at least five (5) years. These records will include the following information:

- a. The functions performed by employees who failed a drug test.
- b. The prohibited drugs which were used by the employees who failed a drug test.

- c. The disposition of employees who failed a drug test (e.g., terminated).
 - d. The age of each employee who failed a drug test.
- C. Records of negative drug test results will be kept for one (1) year.
- D. A record of the number of employees tested, by type of test (e.g., Random, Reasonable Suspicion) will be kept for at least five (5) years.
- E. Records confirming that supervisors and managers have been trained will be kept for at least three (3) years.
- F. Records must be maintained for the life of the equipment for employees tested under D.O.T. regulations.
2. Records concerning collection and testing are covered under the Privacy Act, 5 U.S.C. 522 A. Employee records will be maintained and used with the highest regard for privacy.
- A. Any employee, upon written request, has access to any records relating to his/her drug tests.
- B. The results of a drug test will not be disclosed without the employee's prior written consent, unless it is to:
- a. Employee's Medical Review Officer (MBO);
 - b. The administrator of any Employee Assistance Program in which the employee is receiving counseling or treatment or is otherwise participating; or
 - c. A management official having authority to **advise** personnel action against the employee.
3. To maintain confidentiality, written records will be stored in locked containers. These records will not be a part of an employee's personnel records.
4. **Pickering Associates, Inc.** will not release the employee's rehabilitation or drug test records to a subsequent company unless the employee gives his/her written consent.

7.42 Retention of Samples

Specimen samples which yield positive test results on confirmation will be retained by the laboratory in properly secured, long term, frozen storage for at least one (1) year. If within the one (1) year period the laboratory has not received a proper written request, the specimen sample may be discarded.

7.43 Retesting

If the Medical Review Officer (MRO) determines there is no legitimate medical explanation for a confirmed positive test result other than the unauthorized use of a prohibited drug, the original sample may be retested if the employee makes a written request for retesting within sixty (60) days of the receipt of the final test result from the MRO. The cost of shipment and re-analysis of the sample will be borne by the employee. The employee will be reimbursed for such expense if the retest is negative.

7.44 Medical Review Officer

- A. **Pickering Associates, Inc.** will contract for the provisions of MRO services as part of its Drug and Alcohol Prevention Program.
- B. The MRO will be a licensed physician with knowledge of drug abuse disorders.
- C. The MRO will be responsible for the following:
 1. Review the results of drug testing before they are reported to **Pickering Associates, Inc.**.
 2. Review and interpret each confirmed positive test result to determine if there is an alternative medical explanation for the positive test result as follows:
 - a. Conduct a medical interview with the employee whose test results were positive.
 - b. Review the individual's medical history and any/all relevant biomedical factors.
 - c. Review all medical records made available by the employee tested to determine if a confirmed positive test resulted from legally prescribed medication.
 - d. When necessary, require that the original specimen be reanalyzed to determine the accuracy of the reported results.
 - e. Verify that the laboratory report and assessments are correct.
 3. Determine a schedule of unannounced testing for an employee who has been rehired after completing a rehabilitation program.
 4. Ensure that an individual who tested positive and was terminated has been drug tested in accordance with the DOT procedures before he/she is rehired.
- D. The following rules govern MRO determinations:

1. If the MRO determines, after appropriate review, that there is a legitimate medical explanation for the confirmed positive test result other than the unauthorized use of a prohibited drug, the MRO is not required to take further action.
2. If the MRO determines, after appropriate review, that there is no legitimate medical explanation for the confirmed positive test result other than the unauthorized use of a prohibited drug, the MRO shall report the findings to **Pickering Associates, Inc.** Drug Abuse Representative.
3. Based on a review of laboratory inspection reports, Quality Assurance and Quality Control Data, and other drug test results the MRO may conclude that a particular drug test result is scientifically insufficient for further action. Under these circumstances, the MRO should conclude that the test is negative for the presence of a prohibited drug metabolic in the employee's system.

E. See "Appendix A" for MRO listing.

7.45 Acknowledgement of Drug & Alcohol Prevention Program

I, the undersigned employee of **Pickering Associates, Inc.** acknowledge that I have received, read, and understand the Company's Policy and Procedure for responding to drugs and alcohol in the workplace. I have had an opportunity to have any/all aspects of this Policy and Procedure explained to me. I understand that this Policy and Procedure are terms and conditions of my employment. Violation of this Policy or any aspect of the Procedures may result in my termination. I agree to abide by the contents herein described.

EMPLOYEE'S SIGNATURE

DATE

WITNESS'S SIGNATURE

DATE

Chapter 8 - Workplace Violence Prevention Plan

8.1 Workplace Violence Prevention

The following chapter is the Violence Prevention Program for Pickering Associates, Inc.. We have developed policies and procedures identifying and respecting potential workplace violence. Pickering Associates, Inc. recognizes and ensures that workplace violence is considered a hazard for the purposes of Hazard Assessment, Elimination, and Control.

8.2 Implementation Guide

Pickering Associates, Inc. will make preventing and controlling workplace violence a priority and announce the formation of a management team to develop, review and implement policies dealing with violence in the workplace.

The management team will:

- Undertake an assessment of the company's readiness for dealing with workplace violence.
- Become experts on workplace violence.
- Serve as a liaison with specialized resources from the community.
- Be responsible for the education of supervisors and managers regarding workplace violence.
- Be responsible for developing an action plan to deal with an incident of workplace violence.

Pickering Associates, Inc. will conduct an education program regarding early warning signs of potentially violent behavior and steps to be followed in responding to and investigating an incident of workplace violence to include:

- Ominous threats - such as, "This could be like the post office."
- Threatening actions - intimidation, menacing gestures.
- Bizarre thoughts - perception that the world is falling apart, highly overstated sense of entitlement to a promotion.
- Obsession - holding a grudge, unrequited romantic interest.
- Supervisors and managers will be taught to recognize these behaviors and employees will be taught to report these signs to their management or to the threat management team.

Pickering Associates, Inc. will increase physical security measures and develop a cooperative relationship with local law enforcement authorities. Pickering Associates, Inc. will have in place a comprehensive plan for maintaining the security of the work environment.

8.3 Crisis procedures

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These procedures will be developed for responding to an incident of workplace violence. They are to include the following:

- What is the chain of command? What are the responsibilities of the immediate supervisor? When does the responsibility shift to the management team?
- What emergency notification is necessary? Local police, medical, fire, EAP, others? Internal security? Team members?
- What resources need to be solicited? Trauma consultant, physicians, security consultant, legal representative?
- What assessment procedures should be immediately instituted to determine the immediate safety of the workplace and the effect of the incident on the workplace?
- What information is available as to what occurred? Who are the witnesses? Is photographic information needed?
- What external and internal notifications need to be made?
- What counseling needs are necessary?
- What public relations concern should be dealt with immediately? What can be said, who should talk to reporters?

Consider the courts to prevent and address incidents of workplace violence (e.g. State laws, restraining orders, etc.).

Pickering Associates, Inc. will prevent workplace violence through the use of proper pre-screening, consistent enforcement of workplace rules and the use of employee assistance program and medical care resources. Pickering Associates, Inc. will develop a public relations strategy before it is needed. Any employee of Pickering Associates, Inc. who is a victim of workplace violence will be referred to and advised to consult a health care professional for treatment. This also holds true to any employee who has been exposed to any type of workplace violence. Every employee should feel safe and secure and free from violence in the workplace. Pickering Associates, Inc. views workplace violence as a serious problem and will take serious action against any employee who commits any act of violence toward any other employee or officer or Pickering Associates, Inc..

8.4 Responsibility

The IIPP administrator for workplace security is: Ryan K. Taylor

Program Administrator has the authority and responsibility for implementing the provisions of this program for:

Pickering Associates, Inc.

All managers and supervisors are responsible for implementing and maintaining this

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plan in their work areas and for answering employee questions about the Injury & Illness Prevention Program. A copy of this plan is available from each manager and supervisor.

8.5 Compliance

Management of Pickering Associates, Inc. is responsible for ensuring that all safety and health policies and procedures involving workplace security are clearly communicated and understood by all employees. Managers and supervisors are expected to enforce the rules fairly and uniformly. All employees are responsible for using safe work practices, for following all directives, policies and procedures, and for assisting in maintaining a safe and secure work environment. Our system of ensuring that all employees, including supervisors and managers, comply with work practices that are designed to make the workplace more secure, and do not engage in verbal threats or physical actions which create a security hazard for others in the workplace. This includes:

- Informing employees, supervisors, and managers of the provisions of our Program for Workplace Security.
- Evaluating the performance of all employees in complying with Pickering Associates, Inc. workplace security measures.
- Recognizing employees who perform work practices which promote security in the workplace.
- Providing training and/or counseling to employees whose performance in complying with work practices designed to ensure workplace security is deficient.
- Disciplining workers for failure to comply with workplace security practices.

8.6 Communication

At Pickering Associates, Inc. we recognize that to maintain a safe, healthy, and secure workplace we must have open, two-way communication between all employees, including managers and supervisors, on all workplace safety, health and security issues. Pickering Associates, Inc. has a communication system designed to encourage a continuous flow of safety, health and security information between management and our employees without fear of reprisal and in a form that is readily understandable. Our system consists of one or more of the following checked items:

- New employee orientation on our establishment's workplace security policies, procedures, and work practices.
- Review of our IIPP Program for Workplace Security.
- Training programs designed to address specific aspects of workplace security.
- Regularly scheduled safety meetings to discuss workplace security.

- Effective communication of safety, health and security concerns between employee, supervisors, and managers, including translation where appropriate.
- Posted or distributed workplace security information.
- A system for workers to inform management about workplace security hazards and verbal or physical threats of violence that includes protecting employees from retaliation by the person making the threats.
- A system for immediately and safely communicating a warning to law enforcement authorities, management, and other employees about an imminent act of violence or threat of imminent violence.
- Other:

8.7 Incident Investigations

Procedures for investigating incidents of workplace violence include:

- Reviewing all previous incidents involving violence at our workplace.
- Visiting the scene of an incident as soon as possible.
- Interviewing injured and threatened employees and witnesses.
- Examining the workplace for security risk factors associated with the incident, including any reports of inappropriate behavior by the perpetrator.
- Determining the cause of the incident.
- Taking corrective action to prevent the incident from recurring.
- Recording the findings and corrective actions taken; and
- Other

8.8 Hazard Correction

Hazards which threaten the security of employees shall be corrected in a timely manner when they are first observed or discovered. Immediate corrective action includes:

- Notification of law enforcement authorities when a criminal act has occurred.
- Emergency medical care provided in the event of any violent act upon an employee.

- Post-event trauma counseling for those employees desiring such assistance.

8.9 Recordkeeping & Documentation

Records of workplace security inspections, including the person or persons conducting the inspection, the unsafe conditions and work practices that have been identified and the action taken to correct the identified unsafe conditions and work practices, are recorded on a hazard assessment and correction form. Documentation of safety, health and security training for each worker, including each workers name or other identifier, training dates, type(s) of training, and training providers are recorded on a worker training and instruction form.

Inspection records and training documentation will be maintained according to the following checked schedule:

- For three years, except for training records of employees who have worked for less than one year which are provided to the worker upon termination of employment.
- Since we have less than ten workers, including managers and supervisors, we only maintain inspection records until the hazard is corrected and only maintain a log of instructions to workers with respect to worker job assignments when they are first hired or assigned new duties.

8.10 Workplace Security Assessment Form

Date: _____ Inspection No. _____
 Company Name _____
 Address _____
 City _____ State _____ Zip _____
 Nature of Business _____ Hours Of Operation _____

Describe the physical layout of the establishment. Indicate its location to other businesses or residences in the area and access to the street.

Number/Gender of employees on-site between 10 p.m. and 5 a.m. _____

Describe nature and frequency of client/customer/patient/passenger/other contact:

Are cash transactions conducted with the public during work hours? If yes, how much cash is kept in the cash register or in another place accessible to a robber? \$_____

Is there a safe or lock-box on the premises into which cash is deposited? _____

What is the security history of the establishment and environs?

What physical security measures are present?

What work practices has the company implemented to increase security?

Has the company provided security training to employees? If so, has the training been effective?

8.11 Hazard Assessment

Periodic inspections to identify and evaluate workplace security hazards and treats of workplace violence are performed by the following competent observer(s) in the following areas of our workplace-

Competent Observer _____

Area _____

Periodic inspections are performed according to the following schedule: Weekly and when the following incidents occur:

- When we initially established our Program for Workplace Security.
- When new, previously unidentified security hazards are recognized.
- When occupational injuries or threats of injury occur.
- Whenever workplace security conditions warrant an inspection.

Periodic inspections for security hazards consist of identification and evaluation of workplace security hazards and changes in employee work practices, and may require assessing for more than one type of workplace violence. Pickering Associates, Inc. performs inspections for each type of workplace violence by using the methods specified below to identify and evaluate workplace security hazards.

8.12 Three Categories of Violence

Type I

An assailant with no legitimate ties to the workplace enters to commit a robbery or some other criminal act.

Type II

Acts of violence are committed by recipients of company services, such as customers, clients, patients, or passengers.

Type III

Involves violent acts by current or former employees, supervisors or managers, or others with ties to the workplace (e.g. spouses, relatives, or friends of employees).

8.13 Inspections

Inspections for Type I workplace security hazards include assessing:

- The exterior and interior of the workplace for its attractiveness to robbers.
- The need for security surveillance measures, such as mirrors or cameras.
- Posting of signs notifying the public that limited cash is kept on the premises.
- Procedures for employee response during a robbery or other criminal act.
- Procedures for reporting suspicious persons or activities.
- Posting of emergency telephone numbers for law enforcement, fire and medical services where employees have access to a telephone with an outside line.
- Limiting of the amount of cash on hand and using time access safes for large bills.
- Other: _____

Inspections for Type 11 workplace security hazards include assessing:

- Access to, and freedom of movement within, the workplace.
- Adequacy of workplace security systems, such as door locks, security windows, physical barriers, and restraint systems.
- Frequency and severity of threatening or hostile situations that may lead to violent acts by persons who are service recipients of our establishment.
- Employees' skill in safely handling threatening or hostile service recipients.
- Effectiveness of systems to warn others of a security danger or to summon assistance (e.g., alarms or panic buttons).
- The use of work practices such as "buddy" systems for specified emergency events.
- The availability of employee escape routes.
- Other: _____

Inspections for Type III workplace security hazards include assessing:

- How effectively our establishment's anti-violence policy has been made known to employee's, supervisors, or managers.
- Employees perceptions about how management treats its employees.
- Awareness by employees, supervisors, and managers of the warning signs of potential workplace violence.
- Access to, and freedom of movement within, the workplace by non-employees, including recently discharged employees or persons with whom one of our employee's is having a dispute.
- Frequency and severity of employee reports of threats of physical or verbal abuse by managers, supervisors, or other employees.
- How effectively violent acts, threats or physical violence, verbal abuse, property damage or other signs of strain or pressure in the workplace are handled by management.
- How effectively employee disciplinary and discharge procedures are handled.
- Other: _____

8.14 Corrective Measures

Corrective measures for Type I workplace security hazards can include:

- Making the workplace unattractive to robbers.
- Utilizing surveillance measures, such as cameras or mirrors, to provide information as to what is going on outside and inside the workplace.

- Procedures for the reporting suspicious persons or activities.
- Posting of emergency telephone numbers for law enforcement, fire and medical services where employees have access to a telephone with an outside line.
- Posting of signs notifying the public that limited cash is kept on the premises.
- Limiting the amount of cash on hand and using time access safes for large bills.
- Employee, supervisor, and management training on emergency action procedures.
- Other: _____

Corrective measures for Type II workplace security hazards include:

- Controlling access to and freedom of movement within the workplace consistent with business necessity.
- Ensuring the adequacy of workplace security systems, such as door locks, security windows, physical barriers, and restraint systems.
- Providing employee training in recognizing and handling threatening or hostile situations that may lead to violent acts by persons who are service recipients of our establishment.
- Placing effective systems to warn others of a security danger or to summon assistance (e.g., alarms or panic buttons).
- Providing procedures for a “buddy” system for specified emergency events.
- Ensuring adequate employee escape routes.
- Other: _____

Corrective measures for Type III workplace security hazards include:

- Effectively communicating our establishment's anti-violence policy to all employees, supervisors, and managers.
- Improving employees' perceptions about how management treats its employees.
- Increasing awareness by employees, supervisors, and managers of the warning signs of potential workplace violence.
- Controlling access to and freedom of movement within, the workplace by non-employees, including recently discharged employees or persons with whom one of our employee's is having a dispute,
- Providing counseling to employees, supervisors, or managers who exhibit behavior that represents strain or pressure which may lead to physical or verbal abuse of co-employees.

- Ensure that all reports of violent acts, threats of physical violence, verbal abuse, property damage, or other signs of strain or pressure in the workplace are handled effectively by management and that the person making the report is not subject to retaliation by the person making the threat.
- Ensure that employee disciplinary and discharge procedures address the potential for workplace violence.
- Other _____

8.15 Workplace Security Training Program

Pickering Associates, Inc. Program for Workplace Security addresses the hazards known to be associated with the three major types of workplace violence.

Type I workplace violence involves a violent act by an assailant with no legitimate relationship to the workplace who enters the workplace to commit a robbery or other criminal act.

Type II involves a violent act by a recipient of a service provided by our establishment, such as a client, patient, customer, passenger or a criminal suspect or prisoner.

Type III involves a violent act by a current/former employee, supervisor or manager, or another person who has some employment-related involvement with Pickering Associates, Inc., such as an employee's spouse or lover; an employee's relative or friend; or another person who has a dispute with one of our employees.

8.16 All Necessary Safeguards to Protect Employees Required

Pickering Associates, Inc. shall furnish and use safety devices and safeguards, and shall adopt and use practices, means, methods, operations, and processes which are reasonably adequate to render such employment and place of employment safe and healthful. Every company shall do every other thing reasonably necessary to protect the life, safety, and health of employees.

8.17 Training and Instruction

All employees, including managers and supervisors, shall have training and instruction on general and job-specific workplace security practices. Training and instruction shall be provided as follows:

- When the Program for Workplace Security is first established.
- To all new employees and all other employees for which training has not

previously been provided.

- To all supervisors and managers.
- To all employees, supervisors, and managers given new job assignments for which specific workplace security training for that job assignment has not previously been provided.
- Whenever the company is made aware of a new or previously unrecognized security hazards.
- Workplace security training and instruction includes, but is not limited to, the following:
 - Explanation of the Program for Workplace Security including measures for reporting any violent acts, threats of violence or verbal abuse.
 - Recognition of workplace security hazards including the risk factors associated with the three types of workplace violence.
 - Measures to prevent workplace violence, including procedures for reporting workplace security hazards or threats to managers and supervisors.
 - Ways to diffuse hostile or threatening situations.
 - Measures to summon others for assistance.
 - Employee routes of escape.
 - Emergency action and post-emergency procedures.

In addition, we provide specific instructions to all employees regarding workplace security hazards unique to their job assignment, to the extent that such information was not already covered in other training.

Type I training and instruction for managers, supervisors, and employees include:

- Crime awareness
- Location and operation of alarm systems
- Communication procedures
- Proper work practices for specific workplace activities or assignments, such as late night retail sales, taxi-cab driver, or security guard
- Other: _____

Type II training and instruction for managers, supervisors, and employees include:

- Self-protection
- Dealing with angry, hostile, and threatening individuals
- Care, use, and maintenance of alarm tools and other protective devices
- Location and operation of alarm systems
- Determination of when to use the "buddy" system or other assistance from coworkers

- Awareness of indicators that lead to violent acts by recipients of service providers
- Other: _____

Type III training and instruction for managers, supervisors, and employees include:

- Pre-employment screening practices
- Employee Assistance Program
- Awareness of indicators that lead to violent acts
- Managing with respect and consideration for employee well-being
- Review of anti-violence policy and procedures
- Other: _____

8.18 Levels of Workplace Violence Exhibited by Employees

Level One:

- Refuses to cooperate with immediate supervisor.
- Spreads rumors and gossip to harm others.
- Consistently argues with coworkers.
- Belligerent toward customers/clients.
- Constantly swears at others.
- Makes unwanted sexual comments.

Level Two:

- Argues increasingly with customers, vendors, coworkers and management.
- Openly refuses to obey company policies and procedures.
- Sabotages equipment and steals property for revenge.
- Verbalizes wishes to hurt coworkers and/or management.
- Sees self as victimized by management ("They're all against me").

Level Three:

Frequent displays of intense anger resulting in:

- Recurrent Suicidal Threats
- Recurrent Physical/Verbal Fights
- Destruction of Property

- Recurrent Threats
- Utilization of Weapons to Harm Others

Chapter 9 - Fire Safety

9.1 Introduction

Policy and planning for fire safety at Pickering Associates, Inc. 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 department, 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.

9.2 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, West Virginia law, Pickering Associates, Inc. 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.

9.3 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 fire prevention and response: * Fire Safety * Fire-Extinguisher Operation * Self-Contained Breathing Apparatus

9.4 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 work place such as offices. Safe handling of Class A combustibles means: Disposing of waste daily. Keeping 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 each day, need not be covered.) Using safe ash trays 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.

9.5 Class B Combustibles

Class B combustibles are flammable and combustible liquids (including oils, greases, tars, oil-base 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 Office. 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.

9.6 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.

9.7 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.

9.8 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 an Pickering Associates, Inc. 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.

9.9 Fire Fighting Equipment

This section describes the fixed and portable equipment that is 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.

9.10 Fire Detectors

Several types of automatic fire detectors are used throughout Pickering Associates, Inc., according to particular needs and purposes. All of them will detect fire (by one of several means) and transmit an alarm to the fire station. In the many buildings equipped with evacuation alarm bells, the automatic detectors activate those alarms, as do the manual pull boxes. In some cases, automatic extinguishing systems are activated by automatic detectors. The Fire Department always dispatches firefighters and apparatus to the scene of any automatically actuated alarm.

9.11 Sprinkler Systems

Many buildings are provided with automatic sprinkler systems. The sprinkler heads 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

activates an alarm at the fire station, and firefighters are 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.

9.12 Alarm System

In most buildings, evacuation alarm bells are automatically activated when fire is detected. They can 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.

9.13 Fire Doors

Automatic fire doors and dampers are 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.

9.14 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 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 Responsible Safety Officer.

9.15 Fire Hydrants

Fire hydrants are maintained for emergency use by the Fire Department. They must be kept accessible and in good working condition. Certain temporary uses may be authorized in writing by the Chief or Assistant Chief of the Fire Department. An example of such temporary use may be connection by construction contractors. When temporary connections are authorized, the following practices must be observed: Use only valved outlets. Use only a hydrant spanner provided by the Fire Department. (Other types of wrench can damage the wrench flats on the valve stem.) Do not leave connections in place unattended, except at construction sites. Close a hydrant valve 1/8th turn after fully opening it. (This is done so that a person mistakenly turning the valve the wrong way will not cause damage by forcing it.) When replacing the outlet caps after using a hydrant, screw them on only hand-tight.

9.16 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.

9.17 Construction Areas

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

9.18 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.) Several 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.

9.19 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

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 Responsible Safety Officer.

9.20 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 10 - Electrical Safety

10.1 Policy

It is the policy of Pickering Associates, Inc. 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 Pickering Associates, Inc..

10.2 Employee Responsibility

All Pickering Associates, Inc. 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 Pickering Associates, Inc. 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 counter 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.

10.3 Procedures

It is the policy of Pickering Associates, Inc. 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.

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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 operation 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.

10.4 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 physical contact by assigned personnel. A backup protective system must be totally independent of the first-line protection and must be capable of functioning in the event of total failure of the first-line protective system. 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.

10.5 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.

10.6 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 ($J=CV^2/2=LI^2/2$). 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.

10.7 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.

10.8 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.

10.9 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.

10.10 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.

10.11 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.

10.12 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 circuitry must only be done when it is absolutely necessary.

10.13 Safety Glasses

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

10.14 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.

10.15 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.

10.16 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.

10.17 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.

10.18 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 coffeepots, 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.

The following check list 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.

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.

10.19 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 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 breath 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 separate bleeders. Automatic shorting devices that operate when the equipment is de-energized or the enclosure is opened should be used. The time required for a capacitor to discharge to safe voltage (50 volts or less) must not be greater than the time needed for 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 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 number to ground conveniently and adequately ALL designated points. Be grounded and located at 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.

10.20 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 path when excitation is interrupted. 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.

10.21 Safety Design

Proper philosophy is vital to the safe design of most control applications. The following check list should be used as a guide. Checkout. Interlock chains must be checked for proper operation after installation, after any modification, 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.

10.22 Radiation Hazards

This section covers radiation hazards that may be encountered in working with electrical equipment. The following information should be used as a rough guide to radiation safety. Hazardous electromagnetic radiation must be isolated in shielded enclosures. Transmission paths of microwave energy must be enclosed or barricaded and well-marked. Care must be taken to avoid reflecting energy out of this path. Suitable goggles must be worn where exposure is possible. Dose rates must not exceed those shown below. Monitoring. When equipment capable of generating a radiation hazard is used, monitoring must be provided to detect and measure the radiation. Where personnel may be exposed, this monitoring equipment should be arranged to de-energize the generating equipment at a safe preset level. Isolation. Equipment that produces x-rays (high-voltage vacuum tubes operating at more than 15,000 volts) or any equipment that under fault conditions could produce x-rays (e.g., spectrometers) must be isolated from personnel. This isolation may be by distance or by lead shielding. For any questions, call the Responsible Safety Officer. High-power sources of ultraviolet, infrared, and visible light must be isolated by barriers that are opaque to the radiation. When a beam of this radiation is projected out of an enclosure, the beam path must be barricaded and well marked. Care must be taken to eliminate reflective surfaces along the beam path. Suitable goggles must be worn where exposure is possible.

10.23 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.

10.24 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.

10.25 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 person doing work and restored when work is complete.

10.26 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 permissive key that interrupts input power when key is removed from control panel. Grounding of power supply output must occur either automatically when key is removed from control panel or manually before access door can be opened.

10.27 High Current

To work on high current power supplies (normally for magnets), treat system as a high voltage power supply, if energy storage is 5 joules or more when system is off. If not, then requirements for working on 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 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.

10.28 Working on Power Supplies

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

10.29 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 insure 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.

10.30 Arc Flash and Electrical Safety

An arc flash is the explosive release of energy that occurs when there is a phase-to-phase or phase to ground arc fault. The arc fault may be the result of unsafe work procedures such as a dropped tool or accidental contact by a human. Additionally, an arc fault may be caused by corrosion, insulation failure, conductive dust, and contact by animals.

During an arc flash, the rapid heating of air molecules and the vaporization of conductive metals generate an intense pressure blast. This blast pressure can propel shrapnel, tools and workers through the air. The heat wave generated by an arc flash may be severe enough to melt metal and severely burn a worker that is standing in the vicinity of the flash.

Workers that are exposed to an arc flash sustain injuries typical to an explosion such as, burns, loss of sight, loss of hearing, broken bones, head injuries and shrapnel injuries.

APPLICABLE CODES AND STANDARDS

NFPA 70E covers the full range of electrical safety issues, including safety related work practices, maintenance, special equipment requirements, and installation. It focuses on protecting people and identifies requirements that are considered necessary to provide a workplace that is free of electrical hazards. OSHA bases its electrical safety mandates, found in Subpart S part 1910 and Subpart K part 1926, on the comprehensive information found in NFPA 70E. NFPA 70E is recognized as the tool that illustrates how an employer might comply with these OSHA standards. The relationship between the OSHA regulations and NFPA 70E can be described as OSHA is the "shall" and NFPA 70E the "how."

OSHA mandates that all services to electrical equipment be done in a de-energized state. Working live can only be under special circumstances. If it is necessary to work

live (>50 volts to ground), the regulations outlined in NFPA 70E, Article 130 should be used as a tool to comply with OSHA mandates Subpart S part 1910.333(a)(1).

NFPA 70E — The Safety related work practices as outlined in NFPA 70E and application tables will be followed and adhered to for the safety of all employees. This standard outlines safety programs, calculations for the degree of hazard, personal protective equipment, worker training and warning labels for equipment.

IEEE 1584 - ARC FLASH HAZARD ANALYSIS / CALCULATIONS

This article deals with calculating the size of the potential fault. These calculations provide a basis for the level of personal protective equipment (PPE) that is required when examining or servicing equipment.

ARC FLASH AND ENCLOSURES

Article 110.16 of the National Electric Code (NEC) states that switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that require examination or maintenance while energized, must be clearly field marked so that qualified persons examining or servicing the equipment know the potential hazards that exist. A couple of common field marking labels are found below in figures 5 and 6.

Since the NEC requires field marking of enclosures where arc flash hazards exist, UL does not require an arc flash hazard marking for enclosures by the integrator or manufacturer of the equipment. It is the responsibility of the end user to determine the arc hazard that exists in respect to the power supply to the equipment and the specific components used in that equipment.

Once the arc flash hazard analysis has been completed for a specific piece of equipment, a flash protection boundary is established. This boundary is not based on a protective rating of the enclosure but rather the level of energy that an arc flash could produce. Any person that comes within this protection boundary must use personal protective equipment according to the level of fault that has been calculated. In general, NFPA 70E states that for low voltage applications (below 600V), a 4-foot protection boundary must be observed.

ARC FLASH AND BUSBAR SYSTEMS

When designing a custom busbar power distribution system, it is important to ensure that the phases, neutral and ground busbars are properly spaced and are braced to support a specific electrical short. Standardizing on a pre-tested bus-bar system can eliminate costly engineering and design work by providing safe and acceptable configurations for the set of pre-tested components.

CONCLUSIONS FOR ARC FLASH HAZARDS

Arc flash hazard should be taken seriously. End users should perform detailed hazard analysis and proper safety measures must be taken to prevent injuries.

IEEE 1584 and NFPA 70E should be the guideline for flash hazard analysis and safety initiatives.

Enclosures must be field labeled to warn of potential arc flash hazards.

Empty enclosures do not require arc flash ratings or testing.

Pre-Tested Busbar systems should meet or exceed spacing and short-circuit bracing standards.



Figure 5 – Generic Field Label



Figure 6 — Equipment Specific Field Label

Chapter 11 - Chemical Safety

11.1 Introduction

The objective of this chapter is to provide guidance to all Pickering Associates, Inc. employees and participating guests who use hazardous materials so that they may perform their work safely. 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.

11.2 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 Pickering Associates, Inc. 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, Pickering Associates, Inc. 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 Pickering Associates, Inc. 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 Pickering Associates, Inc. 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 Pickering Associates, Inc. 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

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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.

11.3 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.

11.4 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 Pickering Associates, Inc. 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.

11.5 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 Pickering Associates, Inc. policy for the woman to inform the Responsible Safety Officer of her pregnancy immediately.

11.6 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.

11.6.a OZONE Safety

OSHA regulates employee exposure to ozone gas through its Air Contaminants Standard, 29 CFR 1910.1000 as noted below. The permissible exposure limit (PEL) is listed in Table Z-1 as an 8-hour, time-weighted average value of 0.1 part of ozone per million parts of air (ppm). Rule 29 CFR 1910.1000(e) requires that administrative or engineering controls must first be identified and implemented whenever feasible to achieve compliance with the PEL. When such controls are not feasible to achieve compliance, personal protective equipment, respirators, or any other protective measures shall be used to keep the exposure of employees to ozone gas within the PEL.

Another applicable OSHA standard is the Hazard Communication Standard (HCS), 29 CFR 1910.1200. This is touched on below in this chapter but is covered in a separate chapter. The HCS provides workers exposed to hazardous chemicals with the "right to know" the identities and hazards of those materials, as well as appropriate protective measures. When workers have such information, they are able to take steps to protect themselves from experiencing adverse effects from [chemical](#) exposure.

The HCS requires employers to develop and implement a written hazard communication program for their workplace if their employees are exposed to [hazardous chemicals](#). Employers are also required to ensure containers are labeled with an appropriate hazard warning; maintain [material safety data sheets \(MSDSs\)](#) in the workplace and make them readily accessible to exposed workers; and train employees to understand the hazards, know how to protect themselves, and be able to use the available labels and MSDSs. The labels and [MSDSs](#) are developed by the chemical [manufacturer](#) or importer of the product and provided to downstream employers when they obtain the [hazardous chemical](#) for use in the workplace.

11.6.b Air Contaminants Standard, 29 CFR 1910.1000

1910.1000(a)(1)

Substances with limits preceded by "C" - Ceiling Values. An employee's exposure to any substance in Table Z-1, the exposure limit of which is preceded by a "C", shall at no time exceed the exposure limit given for that substance. If instantaneous monitoring is not feasible, then the ceiling shall be assessed as a 15-minute time weighted average exposure which shall not be exceeded at any time during the working day. For a list of all substances covered in Table Z-1 please see the following link:

http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9992

1910.1000(a)(2)

Other substances -- 8-hour Time Weighted Averages. An employee's exposure to any substance in Table Z-1, the exposure limit of which is not preceded by a "C", shall not exceed the 8-hour Time Weighted Average given for that substance any 8-hour work shift of a 40-hour work week.

1910.1000(b)

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Table Z-2. An employee's exposure to any substance listed in Table Z-2 shall not exceed the exposure limits specified as follows:

1910.1000(b)(1)

8-hour time weighted averages. An employee's exposure to any substance listed in Table Z-2, in any 8-hour work shift of a 40-hour work week, shall not exceed the 8-hour time weighted average limit given for that substance in Table Z-2.

1910.1000(b)(2)

Acceptable ceiling concentrations. An employee's exposure to a substance listed in Table Z-2 shall not exceed at any time during an 8-hour shift the acceptable ceiling concentration limit given for the substance in the table, except for a time period, and up to a concentration not exceeding the maximum duration and concentration allowed in the column under "acceptable maximum peak above the acceptable ceiling concentration for an 8-hour shift".

1910.1000(b)(3)

Example. During an 8-hour work shift, an employee may be exposed to a concentration of Substance A (with a 10 ppm TWA, 25 ppm ceiling and 50 ppm peak) above 25 ppm (but never above 50 ppm) only for a maximum period of 10 minutes. Such exposure must be compensated by exposures to concentrations less than 10 ppm so that the cumulative exposure for the entire 8-hour work shift does not exceed a weighted average of 10 ppm.

[1910.1000\(c\)](#)

Table Z-3. An employee's exposure to any substance listed in Table Z-3, in any 8-hour work shift of a 40-hour work week, shall not exceed the 8-hour time weighted average limit given for that substance in the table.

1910.1000(d)

Computation formulae. The computation formula which shall apply to employee exposure to more than one substance for which 8-hour time weighted averages are listed in subpart Z of 29 CFR Part 1910 in order to determine whether an employee is exposed over the regulatory limit is as follows:

1910.1000(d)(1)(i)

The cumulative exposure for an 8-hour work shift shall be computed as follows:

$$E = (C_a T_a + C_b T_b + \dots + C_n T_n) \div 8$$

Where:

E is the equivalent exposure for the working shift.

C is the concentration during any period of time T where the concentration remains constant.

T is the duration in hours of the exposure at the concentration C.

The value of E shall not exceed the 8-hour time weighted average specified in Subpart Z or 29 CFR Part 1910 for the substance involved.

1910.1000(d)(1)(ii)

To illustrate the formula prescribed in paragraph (d)(1)(i) of this section, assume that Substance A has an 8-hour time weighted average limit of 100 ppm noted in Table Z-1. Assume that an employee is subject to the following exposure:

Two hours exposure at 150 ppm
Two hours exposure at 75 ppm
Four hours exposure at 50 ppm

Substituting this information in the formula, we have

$$(2 \times 150 + 2 \times 75 + 4 \times 50) \div 8 = 81.25 \text{ ppm}$$

Since 81.25 ppm is less than 100 ppm, the 8-hour time weighted average limit, the exposure is acceptable.

1910.1000(d)(2)(i)

in case of a mixture of air contaminants an employer shall compute the equivalent exposure as follows:

$$E_m = (C_1 \div L_1 + C_2 \div L_2) + \dots + (C_n \div L_n)$$

Where:

E_m is the equivalent exposure for the mixture.

C is the concentration of a particular contaminant.

L is the exposure limit for that substance specified in Subpart Z of 29 CFR Part 1910.

The value of E_m shall not exceed unity (1).

1910.1000(d)(2)(ii)

To illustrate the formula prescribed in paragraph (d)(2)(i) of this section, consider the following exposures:

Substance	Actual concentration of 8-hour exposure (ppm)	8-hour TWA PEL (ppm)
B	500	1,000
C	45	200
D	40	200

Substituting in the formula, we have:

$$E_m = 500 \div 1,000 + 45 \div 200 + 40 \div 200$$

$$E_m = 0.500 + 0.225 + 0.200$$

$$E_m = 0.925$$

Since E_m is less than unity (1), the exposure combination is within acceptable limits.

1910.1000(e)

To achieve compliance with paragraphs (a) through (d) of this section, administrative or engineering controls must first be determined and implemented whenever feasible. When such controls are not feasible to achieve full compliance, protective equipment or any other protective measures shall be used to keep the exposure of employees to air contaminants within the limits prescribed in this section. Any equipment and/or technical measures used for this purpose must be approved for each particular use by a competent industrial hygienist or other technically qualified person. Whenever respirators are used, their use shall comply with the section on Respirators.

11.6.c Hazard Communication Standard (HCS), 29 CFR 1910.1200

The purpose of this section is to ensure that the hazards of all chemicals produced or imported are evaluated, and that information concerning their hazards is transmitted to employers and employees. This transmittal of information is to be accomplished by means of comprehensive hazard communication programs, which are to include container labeling and other forms of warning, material safety data sheets and employee training. The Hazard Communication Standard is covered in a separate chapter, please refer to this chapter for further details.

11.7 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.

11.8 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 Pickering Associates, Inc. stock room for most of the common chemicals.

11.9 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 Responsible Safety Officer).

11.10 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 bag 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

11.11 Disposal of Chemicals

All Pickering Associates, Inc. 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. 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.

11.12 Beryllium

Beryllium is used predominantly in three forms: beryllium metal, beryllium oxide, and beryllium-copper alloys. Beryllium-copper alloys may consist of 0.5 to 4% beryllium, although the most common alloy has about 2% beryllium. Beryllium may also be alloyed with other metals, such as nickel and cobalt, or be found as a salt, e.g., beryllium fluoride, chloride, nitrate, or sulfate, and as beryllium hydroxide. Exposure to beryllium and its compounds can damage the skin, eyes, and respiratory system. The soluble beryllium salts, especially the fluoride and sulfate, are skin sensitizers and in high concentrations are also primary skin irritants. If beryllium gets into broken skin, the cut may abscess and not heal properly until the substance is removed. Eye irritations are also common, and splash-burns can cause damage to the cornea. Breathing dust and fumes, however, is the most common cause of beryllium poisoning. The effects of inhaling high levels of beryllium can range from mild inflammation of the nose and throat, a condition that resembles a cold, to a severe pneumonia-like reaction characterized by coughing, difficulty in breathing, pain and tightness in the chest, loss of appetite, and general fatigue. The effects of inhaling low levels of beryllium over an extended period of time may be delayed from a few months to years after the last exposure. Chronic beryllium poisoning in most cases affects the respiratory tract. The onset may be manifested by weakness, loss of weight, shortness of breath, and coughing. Beryllium dusts or powders constitute a moderate fire hazard. However, any fire involving beryllium is a serious threat to the health of nearby personnel. Avoid skin contact with beryllium salts or salt solutions, and do not allow metallic beryllium to come in contact with open wounds or abrasions. Wear gloves when handling beryllium or beryllium compounds when loose contamination (dust or chips) is present. There is no

danger in ordinary skin contact with beryllium metal, alloys, or fused-ceramic material. All operations involving the generation of airborne beryllium must be done under controlled conditions for which concurrence must be obtained from the Responsible Safety Officer. Operations such as machining, grinding, welding, cutting, drilling, sawing, and milling must be enclosed and the exhaust ventilated through high-efficiency filters. A hazardous concentration of beryllium fumes may be generated when the metal is heated above 650C (1200F), or when the oxide is heated above 1540C (2800F). Scrupulous adherence to good housekeeping practices and plant and personal cleanliness is an obvious necessity. All beryllium parts must be stored and transported in labeled containers. One of the following labels may be used. "Beryllium (Beryllium oxides)" "Contains Beryllium" All beryllium and beryllium-contaminated waste must be placed in properly marked containers and picked up by the Decontamination and Waste Disposal Section. The following work on beryllium-copper alloys may be performed without special controls: lathe cutting using a coolant, shearing, forming, hand sawing, hand filing, hand sanding, and soft soldering in a hood.

11.13 Cadmium

The greatest exposure potential is probably from welding or burning cadmium-plated parts and brazing or silver soldering with cadmium-containing rods and wires. These brazing alloys contain 15 to 19% cadmium. Finely divided cadmium metal and cadmium oxide fumes are highly toxic and must not be inhaled or ingested. A single exposure to high levels of cadmium in the air can cause severe lung irritation, which may be fatal. Symptoms usually appear 4 to 10 hours after exposure when cough, labored breathing, and commonly a feeling of constriction or a burning sensation in the chest develop. Generalized flu-like symptoms characterized by shaky chills, sweating, aching in the extremities and back, headache, and dizziness may also develop. Continued exposure to low levels of cadmium in the air can result in chronic poisoning characterized by irreversible lung injury and kidney damage. Cadmium is suspected of causing cancer in humans. Symptoms of the cumulative effects of cadmium may appear after exposure has terminated. Cadmium metal dust will burn with the evolution of a very hazardous brownish-yellow fume. Remove all cadmium from plated parts before welding or burning. Substitute cadmium-free silver solder whenever possible. When cadmium is melted, temperatures should be kept as low as possible, consistent with the requirement of the operation, to prevent excessive fume generation. Indoor work or continuous outdoor work that involves the generation of airborne cadmium must be enclosed to the maximum extent practical and be provided with a good exhaust system that collects and removes the fumes as they are formed. If the work is outdoor and intermittent, a properly fitted fume respirator must be used. In confined spaces where an exhaust system is not practical, a supplied-air respirator must be worn. Evaluation of exhaust systems and work situations and supply of respiratory protective equipment are available from the Responsible Safety Officer. Cadmium-containing and cadmium-plated parts should be kept separate from parts not containing cadmium and marked appropriately so that accidental exposures resulting from cutting and welding will not occur. When there is cadmium dust, cleaning must be performed by vacuum pickup or wet mopping. No dry sweeping or blowing is permitted.

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Chapter 12 - Hazards Communications

12.1 Introduction

Every company must establish, implement and maintain a written Injury and Illness Prevention Program and a copy must be maintained at each workplace or at a central worksite if the company has non-fixed worksites. The requirements consist of the following eight elements:

- Responsibility
- Compliance
- Communication
- Hazard Assessment
- Accident/Exposure Investigation
- Hazard Correction
- Training and Instruction
- Recordkeeping

This program has been prepared for use by SafetyManual.com Consultants for your industry which has been determined to potentially be 'high hazard'. Proper use of this program requires that the RSO is to carefully review the requirements for each of the eight IIP Program elements found in this program, fill in the appropriate blank spaces and check those items that are applicable to your workplace. The recordkeeping section requires that the RSO select and implement the category appropriate for your establishment. Sample forms for hazard assessment and correction, accident/exposure investigation, and worker training and instruction are provided with this program. This program must be maintained by Pickering Associates, Inc. and Ryan K. Taylor in order to be effective.

12.2 Injury and Illness Prevention Program Responsibility

The Injury and Illness Prevention Program (IIP Program) administrator, also known as The Responsible Safety Officer – Ryan K. Taylor is the Program Administrator, and has the authority and responsibility for implementing the provisions of this program for Pickering Associates, Inc..

All managers and supervisors are responsible for implementing and maintaining the IIP Program in their work areas and for answering worker questions about the manual. A copy of this manual is available from each manager and supervisor.

12.3 Compliance

Management is responsible for ensuring that all safety and health policies and procedures are clearly communicated and understood by all employees. Managers and supervisors are expected to enforce the rules fairly and uniformly.

All employees are responsible for using safe work practices, for following all directives, policies and procedures, and for assisting in maintaining a safe work environment.

Our system of ensuring that all workers comply with the rules and maintain a safe work environment include:

- Informing workers of the provisions of our IIP Program;
- Evaluating the safety performance of all workers;

- Recognizing employees who perform safe and healthful work practices;
- Providing training to workers whose safety performance is deficient;
- Disciplining workers for failure to comply with safety & health work practices; and
- The following practices:

12.4 Communication

We recognize that open, two-way communication between management and staff on health and safety issues is essential to an injury-free, productive workplace. The following system of communication is designed to facilitate a continuous flow of safety and health information between management and staff in a form that is readily understandable and consists of one or more of the following checked items:

- New worker orientation including a discussion of safety and health policies and procedures.
- Review of our IIP Program.
- Workplace safety and health training programs.
- Regularly scheduled safety meetings.
- Effective communication of safety and health concerns between workers and supervisors, including translation where appropriate.
- Posted or distributed safety information.
- A system for workers to anonymously report about workplace hazards.
- Our establishment has less than ten employees and communicates with and instructs employees orally about general safe work practices and with respect to hazards unique to each employee's job assignment.
- A labor/management safety and health committee that meets regularly, prepares written records of the safety and health committees meetings, reviews results of the periodic scheduled inspections, reviews investigations of accidents and exposures and makes suggestions to management for the prevention of future incidents, reviews investigations of alleged hazardous conditions, and submits recommendations to assist in the evaluation of employee safety suggestion.
- Other:

12.5 Hazard Assessment

Periodic inspections to identify and evaluate workplace hazards shall be performed by the following competent observer(s) in the following areas of our workplace:

Competent Observer	Area
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Periodic inspections are performed according to the following schedule: Weekly, and when the follow circumstances occur:

- When we initially established our IIP Program;
- When new substances, processes, procedures or equipment which present potential new hazards are introduced into our workplace;
- When new, previously unidentified hazards are recognized;
- When occupational injuries and illnesses occur;
- When we hire and/or reassign permanent or intermittent workers to processes, operations, or tasks for which a hazard evaluation has not been previously conducted; and
- Whenever workplace conditions warrant an inspection.
- Periodic inspections consist of identification and evaluation of workplace hazards utilizing applicable sections of the attached Hazard Assessment Checklist and any other effective methods to identify and evaluate workplace hazards.

12.6 Accident / Exposure Investigations

Procedures for investigating workplace accidents and hazardous substance exposures include:

- Visiting the accident scene as soon as possible;
- Interviewing injured workers and witnesses;
- Examining the workplace for factors associated with the accident/exposure;
- Determining the cause of the accident/exposure;
- Taking corrective action to prevent the accident/exposure from reoccurring; and
- Recording the findings and corrective actions taken.

12.7 Hazard Correction

Unsafe or unhealthy work conditions, practices or procedures shall be corrected in a timely manner based on the severity of the hazards. Hazards shall be corrected according to the following procedures:

- When observed or discovered;
- When an imminent hazard exists which cannot be immediately abated without endangering employee(s) and/or property, we will remove all exposed workers from the area except those necessary to correct the existing condition. Workers necessary to correct the hazardous condition shall be provided with the necessary protection; and
- All such actions taken and dates they are completed shall be documented on the

appropriate forms.

12.8 Training and Instruction

All workers, including managers and supervisors, shall have training and instruction on general and job-specific safety and health practices. Training and instruction shall be provided as follows:

- When the IIP Program is first established;
- To all new workers, except for construction workers who are provided training through a OSHA approved construction industry occupational safety and health training program;
- To all workers given new job assignments for which training has not previously provided;
- Whenever new substances, processes, procedures or equipment are introduced to the workplace and represent a new hazard;
- Whenever the company is made aware of a new or previously unrecognized hazard;
- To supervisors to familiarize them with the safety and health hazards to which workers under their immediate direction and control may be exposed; and
- To all workers with respect to hazards specific to each employee's job assignment.
- Workplace safety and health practices for all industries include, but are not limited to, the following:
 - Explanation of the company's IIP Program, emergency action plan and fire prevention plan, and measures for reporting any unsafe conditions, work practices, injuries and when additional instruction is needed.
 - Use of appropriate clothing, including gloves, footwear, and personal protective equipment.
 - Information about chemical hazards to which employees could be exposed and other hazard communication program information.
 - Availability of toilet, hand-washing and drinking water facilities.
 - Provisions for medical services and first aid including emergency procedures.
 - In addition, we provide specific instructions to all workers regarding hazards unique to their job assignment, to the extent that such information was not already covered in other training.

12.9 Recordkeeping

We have checked one of the following categories as our recordkeeping policy.

Category 1.

Our industry is classified as being low hazard or general industry. With the implementation of this IIPP we have meet all the Federal OSHA requirements and all of West Virginia regulations.

Category 2.

Our establishment is on a designated high hazard industry list. We have taken the following steps to implement and maintain our IIP Program:

1. Records of hazard assessment inspections, including the person(s) or persons conducting the inspection, the unsafe conditions and work practices that have been identified and the action taken to correct the identified unsafe conditions and work practices, are recorded on a hazard assessment and correction form; and
2. Documentation of safety and health training for each worker, including the worker's name or other identifier, training dates, type(s) of training, and training providers are recorded on a worker training and instruction form. We also include the records relating to worker training provided by a construction industry occupational safety and health program approved by OSHA.

Inspection records and training documentation will be maintained according to the following checked schedule:

- For three years, except for training records of employees who have worked for less than one year which are provided to the worker upon termination of employment; or
- Since we have less than ten workers, including managers and supervisors, we maintain inspection records only until the hazard is corrected and only maintain a log of instructions to workers with respect to worker job assignments when they are first hired or assigned new duties.

Category 3.

We are a local governmental entity (any county, city, or district, and any public or quasi-public corporation or public agency therein) and we are not required to keep written records of the steps taken to implement and maintain our IIP Program.

12.10 List of Training Subjects

We may train our workers about any of the following checked training subjects:

- The company's Code of Safe Practices.
- Confined spaces.
- Safe practices for operating any agricultural equipment.
- Good housekeeping, fire prevention, safe practices for operating any construction equipment.
- Safe procedures for cleaning, repairing, servicing and adjusting equipment and machinery.
- Safe access to working areas.
- Protection from falls.
- Electrical hazards, including working around high voltage lines.
- Crane operations.
- Trenching and excavation work.
- Proper use of powered tools.
- Guarding of belts and pulleys, gears and sprockets, and conveyor nip points.
- Machine, machine parts, and prime movers guarding.
- Lock-out/tag-out procedures.
- Materials handling.

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- Chainsaw and other power tool operation.
 - Tree falling/bucking procedures and precautions, including procedures for recognizing and working with hazard trees, snags, lodged trees, and unsafe weather conditions.
 - Yarding operations, including skidding, running lines, unstable logs, rigging and communication.
 - Landing and loading areas, including release of rigging, landing layout, moving vehicles and equipment, and log truck locating, loading and wrapping.
 - Fall protection from elevated locations.
 - Use of elevated platforms, including condors and scissor lifts.
 - Safe use of explosives.
 - Driver safety.
 - Slips, falls, and back injuries.
 - Ergonomic hazards, including proper lifting techniques and working on ladders or in a stooped posture for prolonged periods at one time.
 - Personal protective equipment.
 - Respiratory Equipment.
 - Hazardous chemical exposures.
 - Hazard communication.
 - Physical hazards, such as heat/cold stress, noise, and ionizing and non-ionizing radiation.
 - Laboratory safety.
 - Bloodborne pathogens and other biological hazards.
 - Other job-specific hazards, such as
-
-
-

12.11 Hazard Assessment Checklist

GENERAL WORK ENVIRONMENT

Are all worksites clean and orderly?

Are work surfaces kept dry or appropriate means taken to assure the surfaces are slip-resistant?

Are all spilled materials or liquids cleaned up immediately?

Is combustible scrap, debris and waste stored safely and removed from the worksite promptly?

Is accumulated combustible dust routinely removed from elevated surfaces, including the overhead structure of buildings?

Is combustible dust cleaned up with a vacuum system to prevent the dust going into suspension?

Is metallic or conductive dust prevented from entering or accumulation on or around electrical enclosures or equipment?

Are covered metal waste cans used for oily and paint-soaked waste?

Are all oil and gas fired devices equipped with flame failure controls that will prevent flow of fuel if pilots or main burners are not working?

Are paint spray booths, dip tanks and the like cleaned regularly?

Are the minimum number of toilets and washing facilities provided?

Are all toilets and washing facilities clean and sanitary?

Are all work areas adequately illuminated?

Are pits and floor openings covered or otherwise guarded?

PERSONAL PROTECTIVE EQUIPMENT & CLOTHING

Are protective goggles or face shields provided and worn where there is any danger of flying particles or corrosive materials?

Are approved safety glasses required to be worn at all times in areas where there is a risk of eye injuries such as punctures, abrasions, contusions or burns?

Are employees who need corrective lenses (glasses or contacts lenses) in working environments with harmful exposures, required to wear only approved safety glasses, protective goggles, or use other medically approved precautionary procedures?

Are protective gloves, aprons, shields, or other means provided against cuts, corrosive liquids and chemicals?

Are hard hats provided and worn where danger of falling objects exists?

Are hard hats inspected periodically for damage to the shell and suspension system?

Is appropriate foot protection required where there is the risk of foot injuries from hot, corrosive, poisonous substances, falling objects, crushing or penetrating actions?

Are approved respirators provided for regular or emergency use where needed?

Is all protective equipment maintained in a sanitary condition and ready for use?

Do you have eye wash facilities and a quick drench shower within the work area where employees are exposed to injurious corrosive materials?

Where special equipment is needed for electrical workers, is it available?

When lunches are eaten on the premises, are they eaten in areas where there is no exposure to toxic materials or other health hazards?

Is protection against the effects of occupational noise exposure provided when sound levels exceed those of the OSHA noise standard?

WALKWAYS

Are aisles and passageways kept clear?

Are aisles and walkways marked as appropriate?

Are wet surfaces covered with non-slip materials?

Are holes in the floor, sidewalk or other walking surface repaired properly, covered or otherwise made safe?

Is there safe clearance for walking in aisles where motorized or mechanical handling equipment is operating.

Are spilled materials cleaned up immediately?

Are materials or equipment stored in such a way that sharp projectiles will not interfere with the walkway?

Are changes of direction or elevations readily identifiable?

Are aisles or walkways that pass near moving or operating machinery, welding operations or similar operations arranged so employees will not be subjected to potential hazards?

Is adequate headroom provided for the entire length of any aisle or walkway?

Are standard guardrails provided wherever aisle or walkway surfaces are elevated more than 30 inches above any adjacent floor or the ground?

Are bridges provided over conveyors and similar hazards?

FLOOR & WALL OPENINGS

Are floor openings guarded by a cover, guardrail, or equivalent on all sides (except at entrance to stairways or ladders)?

Are toeboards installed around the edges of a permanent floor opening (where persons may pass below the opening)?

Are skylight screens of such construction and mounting that they will withstand a load of at least

200 pounds?

Is the glass in windows, doors, glass walls that are subject to human impact, of sufficient thickness and type for the condition of use?

Are grates or similar type covers over floor openings such as floor drains, of such design that foot traffic or rolling equipment will not be affected by the grate spacing?

Are unused portions of service pits and pits not actually in use either covered or protected by guardrails or equivalent?

Are manhole covers, trench covers and similar covers, plus their supports, designed to carry a truck rear axle load of at least 20,000 pounds when located in roadways and subject to vehicle traffic?

Are floor or wall openings in fire resistive construction provided with doors or covers compatible with the fire rating of the structure and provided with self-closing feature when appropriate?

STAIRS & STAIRWAYS

Are standard stair rails or handrails on all stairways having four or more risers?

Are all stairways at least 22 inches wide?

Do stairs have at least a 6'6" overhead clearance?

Do stairs angle no more than 50 and no less than 30 degrees?

Are stairs of hollow-pan type treads and landings filled to noising level with solid material?

Are step risers on stairs uniform from top to bottom, with no riser spacing greater than 7-1/2 inches?

Are steps on stairs and stairways designed or provided with a surface that renders them slip resistant?

Are stairway handrails located between 30 and 34 inches above the leading edge of stair treads?

Do stairway handrails have a least 1-1/2 inches of clearance between the handrails and the wall or surface they are mounted on?

Are stairway handrails capable of withstanding a load of 200 pounds, applied in any direction?

Where stairs or stairways exit directly into any area where vehicles may be operated, are adequate barriers and warnings provided to prevent employees stepping into the path of traffic?

Do stairway landings have a dimension measured in the direction of travel, at least equal to width of the stairway?

Is the vertical distance between stairway landings limited to 12 feet or less?

ELEVATED SURFACES

Are signs posted, when appropriate, showing the elevated surface load capacity?

Are surfaces elevated more than 30 inches above the floor or ground provided with standard guardrails?

Are all elevated surfaces (beneath which people or machinery could be exposed to falling objects) provided with standard 4-inch toeboards?

Is a permanent means of access and egress provided to elevated storage and work surfaces?

Is required headroom provided where necessary?

Is material on elevated surfaces piled, stacked or racked in a manner to prevent it from tipping, falling, collapsing, rolling or spreading?

Are dock boards or bridge plates used when transferring materials between docks and trucks or rail cars?

EXITING OR EGRESS

Are all exits marked with an exit sign and illuminated by a reliable light source?

Are the directions to exits, when not immediately apparent, marked with visible signs?

Are doors, passageways or stairways, that are neither exits nor access to exits and which could

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be mistaken for exits, appropriately marked "NOT AN EXIT", "TO BASEMENT", "STOREROOM", and the like?

Are exit signs provided with the word "EXIT" in lettering at least 5 inches high and the stroke of the lettering at least 1/2 inch wide?

Are exit doors side-hinged?

Are all exits kept free of obstructions?

Are at least two means of egress provided from elevated platforms, pits or rooms where the absence of a second exit would increase the risk of injury from hot, poisonous, corrosive, suffocating, flammable, or explosive substances?

Are there sufficient exits to permit prompt escape in case of emergency?

Are special precautions taken to protect employees during construction and repair operations?

Is the number of exits from each floor of a building, and the number of exits from the building itself, appropriate for the building occupancy load?

Are exit stairways which are required to be separated from other parts of a building enclosed by at least two hour fire-resistive construction in buildings more than four stories in height, and not less than one-hour fire resistive construction elsewhere?

When ramps are used as part of required exiting from a building, is the ramp slope limited to 1-foot vertical and 12 feet horizontal?

Where exiting will be through frameless glass doors, glass exit doors, storm doors, and such are the doors fully tempered and meet the safety requirements for human impact?

EXIT DOORS

Are doors that are required to serve as exits designed and constructed so that the way of exit travel is obvious and direct?

Are windows that could be mistaken for exit doors, made inaccessible by means of barriers or railings?

Are exit doors operable from the direction of exit travel without the use of a key or any special knowledge or effort, when the building is occupied?

Is a revolving, sliding or overhead door prohibited from serving as a required exit door?

Where panic hardware is installed on a required exit door, will it allow the door to open by applying a force of 15 pounds or less in the direction of the exit traffic?

Are doors on cold storage rooms provided with an inside release mechanism that will release the latch and open the door even if it's padlocked or otherwise locked on the outside?

Where exit doors open directly onto any street, alley or other area where vehicles may be operated, are adequate barriers and warnings provided to prevent employees stepping into the path of traffic?

Are doors that swing in both directions and are located between rooms where there is frequent traffic, provided with viewing panels in each door?

PORTABLE LADDERS

Are all ladders maintained in good condition, joints between steps and side rails tight, all hardware and fittings securely attached, and moveable parts operating freely without binding or undue play?

Are non-slip safety feet provided on each ladder?

Are non-slip safety feet provided on each metal or rung ladder?

Are ladder rungs and steps free of grease and oil?

Is it prohibited to place a ladder in front of doors opening toward the ladder except when the door is blocked open, locked or guarded?

Is it prohibited to place ladders on boxes, barrels, or other unstable bases to obtain additional height?

Are employees instructed to face the ladder when ascending or descending?

Are employees prohibited from using ladders that are broken, missing steps, rungs, or cleats, broken side rails or other faulty equipment?

Are employees instructed not to use the top 2 steps of ordinary stepladders as a step?

When portable rung ladders are used to gain access to elevated platforms, roofs, and the like does the ladder always extend at least 3 feet above the elevated surface?

Is it required that when portable rung or cleat type ladders are used the base is so placed that slipping will not occur, or it is lashed or otherwise held in place?

Are portable metal ladders legibly marked with signs reading "CAUTION" "Do Not Use Around Electrical Equipment" or equivalent wording?

Are employees prohibited from using ladders as guys, braces, skids, gin poles, or for other than their intended purposes?

Are employees instructed to only adjust extension ladders while standing at a base (not while standing on the ladder or from a position above the ladder)?

Are metal ladders inspected for damage?

Are the rungs of ladders uniformly spaced at 12 inches, center to center?

HAND TOOLS & EQUIPMENT

Are all tools and equipment (both, company and employee-owned) used by employees at their workplace in good condition?

Are hand tools such as chisels, punches, which develop mushroomed heads during use, reconditioned or replaced as necessary?

Are broken or fractured handles on hammers, axes and similar equipment replaced promptly?

Are worn or bent wrenches replaced regularly?

Are appropriate handles used on files and similar tools?

Are employees made aware of the hazards caused by faulty or improperly used hand tools?

Are appropriate safety glasses, face shields, and similar equipment used while using hand tools or equipment that might produce flying materials or be subject to breakage?

Are jacks checked periodically to assure they are in good operating condition?

Are tool handles wedged tightly in the head of all tools?

Are tool cutting edges kept sharp so the tool will move smoothly without binding or skipping?

Are tools stored in dry, secure location where they won't be tampered with?

Is eye and face protection used when driving hardened or tempered spuds or nails?

PORTABLE (POWER OPERATED) TOOLS & EQUIPMENT

Are grinders, saws, and similar equipment provided with appropriate safety guards?

Are power tools used with the correct shield, guard or attachment recommended by the manufacturer?

Are portable circular saws equipped with guards above and below the base shoe?

Are circular saw guards checked to assure they are not wedged up, thus leaving the lower portion of the blade unguarded?

Are rotating or moving parts of equipment guarded to prevent physical contact?

Are all cord-connected, electrically operated tools and equipment effectively grounded or of the approved double insulated type?

Are effective guards in place over belts, pulleys, chains, and sprockets, on equipment such as concrete mixers, air compressors, and the like?

Are portable fans provided with full guards or screens having openings 1/2 inch or less?

Is hoisting equipment available and used for lifting heavy objects, and are hoist ratings and characteristics appropriate for the task?

Are ground-fault circuit interrupters provided on all temporary electrical 15 and 20 ampere circuits, used during periods of construction?

Are pneumatic and hydraulic hoses on power-operated tools checked regularly for deterioration

or damage?

ABRASIVE WHEEL EQUIPMENT GRINDERS

Is the work rest used and kept adjusted to within 1/8 inch of the wheel?

Is the adjustable tongue on the top side of the grinder used and kept adjusted to within 1/4 inch of the wheel?

Do side guards cover the spindle, nut, and flange and 75 percent of the wheel diameter?

Are bench and pedestal grinders permanently mounted?

Are goggles or face shields always worn when grinding?

Is the maximum RPM rating of each abrasive wheel compatible with the RPM rating of the grinder motor?

Are fixed or permanently mounted grinders connected to their electrical supply system with metallic conduit or other permanent wiring method?

Does each grinder have an individual on and off control switch?

Is each electrically operated grinder effectively grounded?

Before new abrasive wheels are mounted, are they visually inspected and ring tested?

Are dust collectors and powered exhausts provided on grinders used in operations that produce large amounts of dust?

Are splashguards mounted on grinders that use coolant, to prevent the coolant reaching employees?

Is cleanliness maintained around grinder?

POWDER ACTUATED TOOLS

Are employees who operate powder-actuated tools trained in their use and carry a valid operator's card?

Do the powder-actuated tools being used have written approval of the Division of Occupational Safety and Health?

Is each powder-actuated tool stored in its own locked container when not being used?

Is a sign at least 7" by 10" with bold type reading "POWDER-ACTUATED TOOL IN USE" conspicuously posted when the tool is being used?

Are powder-actuated tools left unloaded until they are actually ready to be used?

Are powder-actuated tools inspected for obstructions or defects each day before use?

Do powder-actuated tools operators have and use appropriate personal protective equipment such as hard hats, safety goggles, safety shoes and ear protectors?

MACHINE GUARDING

Is there a training program to instruct employees on safe methods of machine operation?

Is there adequate supervision to ensure that employees are following safe machine operating procedures?

Is there a regular program of safety inspection of machinery and equipment?

Is all machinery and equipment kept clean and properly maintained?

Is sufficient clearance provided around and between machines to allow for safe operations, set up and servicing, material handling and waste removal?

Is equipment and machinery securely placed and anchored, when necessary to prevent tipping or other movement that could result in personal injury?

Is there a power shut-off switch within reach of the operator's position at each machine?

Can electric power to each machine be locked out for maintenance, repair, or security?

Are the non-current carrying metal parts of electrically operated machines bonded and grounded?

Are foot-operated switches guarded or arranged to prevent accidental actuation by personnel or falling objects?

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Are manually operated valves and switches controlling the operation of equipment and machines clearly identified and readily accessible?

Are all emergency stop buttons colored red?

Are all pulleys and belts that are within 7 feet of the floor or working level properly guarded?

Are all moving chains and gears properly guarded?

Are splashguards mounted on machines that use coolant, to prevent the coolant from reaching employees?

Are methods provided to protect the operator and other employees in the machine area from hazards created at the point of operation, ingoing nip points, rotating parts, flying chips, and sparks?

Are machinery guards secure and so arranged that they do not offer a hazard in their use?

If special hand tools are used for placing and removing material, do they protect the operator's hands?

Are revolving drums, barrels, and containers required to be guarded by an enclosure that is interlocked with the drive mechanism, so that revolution cannot occur unless the guard enclosure is in place, so guarded?

Do arbors and mandrels have firm and secure bearings and are they free from play?

Are provisions made to prevent machines from automatically starting when power is restored after a power failure or shutdown?

Are machines constructed so as to be free from excessive vibration when the largest size tool is mounted and run at full speed?

If machinery is cleaned with compressed air, is air pressure controlled and personal protective equipment or other safeguards used to protect operators and other workers from eye and body injury?

Are fan blades protected with a guard having openings no larger than 1/2 inch, when operating within 7 feet of the floor?

Are saws used for ripping, equipped with anti-kick back devices and spreaders?

Are radial arm saws so arranged that the cutting head will gently return to the back of the table when released?

LOCKOUT BLOCKOUT PROCEDURES

Is all machinery or equipment capable of movement, required to be de-energized or disengaged and blocked or locked out during cleaning, servicing, adjusting or setting up operations, whenever required?

Is the locking-out of control circuits in lieu of locking-out main power disconnects prohibited?

Are all equipment control valve handles provided with a means for locking-out?

Does the lockout procedure require that stored energy (i.e. mechanical, hydraulic, air,) be released or blocked before equipment is locked-out for repairs?

Are appropriate employees provided with individually keyed personal safety locks?

Are employees required to keep personal control of their key(s) while they have safety locks in use?

Is it required that employees check the safety of the lock out by attempting a start up after making sure no one is exposed?

Where the power disconnecting means for equipment does not also disconnect the electrical control circuit:

Are the appropriate electrical enclosures identified?

Is means provide to assure the control circuit can also be disconnected and locked out?

WELDING, CUTTING & BRAZING

Are only authorized and trained personnel permitted to use welding, cutting or brazing equipment?

Do all operator have a copy of the appropriate operating instructions and are they directed to follow them?

Are compressed gas cylinders regularly examined for obvious signs of defects, deep rusting, or leakage?

Is care used in handling and storage of cylinders, safety valves, relief valves, and the like, to prevent damage?

Are precautions taken to prevent the mixture of air or oxygen with flammable gases, except at a burner or in a standard torch?

Are only approved apparatus (torches, regulators, pressure-reducing valves, acetylene generators, manifolds) used?

Are cylinders kept away from sources of heat?

Is it prohibited to use cylinders as rollers or supports?

Are empty cylinders appropriately marked their valves closed and valve-protection caps on?

Are signs reading: DANGER NO-SMOKING, MATCHES, OR OPEN LIGHTS, or the equivalent posted?

Are cylinders, cylinder valves, couplings, regulators, hoses, and apparatus keep free of oily or greasy substances?

Is care taken not to drop or strike cylinders?

Unless secured on special trucks, are regulators removed and valve-protection caps put in place before moving cylinders?

Do cylinders without fixed hand wheels have keys, handles, or non-adjustable wrenches on stem valves when in service?

Are liquefied gases stored and shipped valve-end up with valve covers in place?

Are employees instructed to never crack a fuel-gas cylinder valve near sources of ignition?

Before a regulator is removed, is the valve closed and gas released from the regulator?

Is red used to identify the acetylene (and other fuel-gas) hose, green for oxygen hose, and black for inert gas and air hose?

Are pressure-reducing regulators used only for the gas and pressures for which they are intended?

Is open circuit (No Load) voltage of arc welding and cutting machines as low as possible and not in excess of the recommended limits?

Under wet conditions, are automatic controls for reducing no-load voltage used?

Is grounding of the machine frame and safety ground connections of portable machines checked periodically?

Are electrodes removed from the holders when not in use?

Is it required that electric power to the welder be shut off when no one is in attendance?

Is suitable fire extinguishing equipment available for immediate use?

Is the welder forbidden to coil or loop welding electrode cable around his body?

Are wet machines thoroughly dried and tested before being used?

Are work and electrode lead cables frequently inspected for wear and damage, and replaced when needed?

Do means for connecting cables' lengths have adequate insulation?

When the object to be welded cannot be moved and fire hazards cannot be removed, are shields used to confine heat, sparks, and slag?

Are firewatchers assigned when welding or cutting is performed, in locations where a serious fire might develop?

Are combustible floors kept wet, covered by damp sand, or protected by fire-resistant shields?

When floors are wet down, are personnel protected from possible electrical shock?

When welding is done on metal walls, are precautions taken to protect combustibles on the other side?

Before hot work is begun, are used drums, barrels, tanks, and other containers so thoroughly

cleaned that no substances remain that could explode, ignite, or produce toxic vapors?

Is it required that eye protection helmets, hand shields and goggles meet appropriate standards?

Are employees exposed to the hazards created by welding, cutting, or bracing operations protected with personal protective equipment and clothing?

Is a check made for adequate ventilation in and where welding or cutting is performed?

When working in confined places are environmental monitoring tests taken and means provided for quick removal of welders in case of an emergency?

COMPRESSORS & COMPRESSED AIR

Are compressors equipped with pressure relief valves, and pressure gauges?

Are compressor air intakes installed and equipped to ensure that only clean uncontaminated air enters the compressor?

Are air filters installed on the compressor intake?

Are compressors operated and lubricated in accordance with the manufacturer's recommendations?

Are safety devices on compressed air systems checked frequently?

Before any repair work is done on the pressure system of a compressor, is the pressure bled off and the system locked-out?

Are signs posted to warn of the automatic starting feature of the compressors?

Is the belt drive system totally enclosed to provide protection for the front, back, top, and sides?

Is it strictly prohibited to direct compressed air towards a person?

Are employees prohibited from using highly compressed air for cleaning purposes?

If compressed air is used for cleaning off clothing, is the pressure reduced to less than 10 psi?

When using compressed air for cleaning, do employees use personal protective equipment?

Are safety chains or other suitable locking devices used at couplings of high pressure hose lines where a connection failure would create a hazard?

Before compressed air is used to empty containers of liquid, is the safe working pressure of the container checked?

When compressed air is used with abrasive blast cleaning equipment, is the operating valve a type that must be held open manually?

When compressed air is used to inflate auto tires, is a clip-on chuck and an inline regulator preset to 40 psi required?

Is it prohibited to use compressed air to clean up or move combustible dust if such action could cause the dust to be suspended in the air and cause a fire or explosion hazard?

COMPRESSED AIR RECEIVERS

Is every receiver equipped with a pressure gauge and with one or more automatic, spring-loaded safety valves?

Is the total relieving capacity of the safety valve capable of preventing pressure in the receiver from exceeding the maximum allowable working pressure of the receiver by more than 10 percent?

Is every air receiver provided with a drainpipe and valve at the lowest point for the removal of accumulated oil and water?

Are compressed air receivers periodically drained of moisture and oil?

Are all safety valves tested frequently and at regular intervals to determine whether they are in good operating condition?

Is there a current operating permit issued by the Division of Occupational Safety and Health?

Is the inlet of air receivers and piping systems kept free of accumulated oil and carbonaceous materials?

COMPRESSED GAS & CYLINDERS

Are cylinders with a water weight capacity over 30 pounds equipped with means for connecting a valve protector device, or with a collar or recess to protect the valve?

Are cylinders legibly marked to clearly identify the gas contained?

Are compressed gas cylinders stored in areas which are protected from external heat sources such as flame impingement, intense radiant heat, electric arcs, or high temperature lines?

Are cylinders located or stored in areas where they will not be damaged by passing or falling objects, or subject to tampering by unauthorized persons?

Are cylinders stored or transported in a manner to prevent them creating a hazard by tipping, falling or rolling?

Are cylinders containing liquefied fuel gas, stored or transported in a position so that the safety relief device is always in direct contact with the vapor space in the cylinder?

Are valve protectors always placed on cylinders when the cylinders are not in use or connected for use?

Are all valves closed off before a cylinder is moved, when the cylinder is empty, and at the completion of each job?

Are low pressure fuel-gas cylinders checked periodically for corrosion, general distortion, cracks, or any other defect that might indicate a weakness or render it unfit for service?

Does the periodic check of low pressure fuel-gas cylinders include a close inspection of the cylinders' bottom?

HOIST & AUXILIARY EQUIPMENT

Is each overhead electric hoist equipped with a limit device to stop the hook travel at its highest and lowest point of safe travel?

Will each hoist automatically stop and hold any load up to 125 percent of its rated load, if its actuating force is removed?

Is the rated load of each hoist legibly marked and visible to the operator?

Are stops provided at the safe limits of travel for trolley hoist?

Are the controls of hoists plainly marked to indicate the direction of travel or motion?

Is each cage-controlled hoist equipped with an effective warning device?

Are close-fitting guards or other suitable devices installed on hoist to assure hoist ropes will be maintained in the sheave grooves?

Are all hoist chains or ropes of sufficient length to handle the full range of movement for the application while still maintaining two full wraps on the drum at all times?

Are nip points or contact points between hoist ropes and sheaves which are permanently located within 7 feet of the floor, ground or working platform, guarded?

Is it prohibited to use chains or rope slings that are kinked or twisted?

Is it prohibited to use the hoist rope or chain wrapped around the load as a substitute, for a sling?

Is the operator instructed to avoid carrying loads over people?

Are only employees who have been trained in the proper use of hoists allowed to operate them?

INDUSTRIAL TRUCKS - FORKLIFTS

Are only trained personnel allowed to operate industrial trucks?

Is substantial overhead protective equipment provided on high lift rider equipment?

Are the required lift truck operating rules posted and enforced?

Is directional lighting provided on each industrial truck that operates in an area with less than 2 foot candles per square foot of general lighting?

Does each industrial truck have a warning horn, whistle, gong or other device which can be clearly heard above the normal noise in the areas where operated?

Are the brakes on each industrial truck capable of bringing the vehicle to a complete and safe

stop when fully loaded?

Will the industrial truck's parking brake effectively prevent the vehicle from moving when unattended?

Are industrial trucks operating in areas where flammable gases or vapors, or combustible dust or ignitable fibers may be present in the atmosphere, approved for such locations?

Are motorized hand and hand/rider trucks so designed that the brakes are applied, and power to the drive motor shuts off when the operator releases his/her grip on the device that controls the travel?

Are industrial trucks with internal combustion engine operated in buildings or enclosed areas, carefully checked to ensure such operations do not cause harmful concentration of dangerous gases or fumes?

SPRAYING OPERATIONS

Is adequate ventilation assured before spray operations are started?

Is mechanical ventilation provided when spraying operation is done in enclosed areas?

When mechanical ventilation is provided during spraying operations, is it so arranged that it will not circulate the contaminated air?

Is the spray area free of hot surfaces?

Is the spray area at least 20 feet from flames, sparks, operating electrical motors and other ignition sources?

Are portable lamps used to illuminate spray areas suitable for use in a hazardous location?

Is approved respiratory equipment provided and used when appropriate during spraying operations?

Do solvents used for cleaning have a flash point of 100E F or more?

Are fire control sprinkler heads kept clean?

Are "NO SMOKING" signs posted in spray areas, paint rooms, paint booths, and paint storage areas?

Is the spray area kept clean of combustible residue?

Are spray booths constructed of metal, masonry, or other substantial noncombustible material?

Are spray booth floors and baffles noncombustible and easily cleaned?

Is infrared drying apparatus kept out of the spray area during spraying operations?

Is the spray booth completely ventilated before using the drying apparatus?

Is the electric drying apparatus properly grounded?

Are lighting fixtures for spray booths located outside of the booth and the interior lighted through sealed clear panels?

Are the electric motors for exhaust fans placed outside booths or ducts?

Are belts and pulleys inside the booth fully enclosed?

Do ducts have access doors to allow cleaning?

Do all drying spaces have adequate ventilation?

ENTERING CONFINED SPACES

Are confined spaces thoroughly emptied of any corrosive or hazardous substances, such as acids or caustics, before entry?

Before entry, are all lines to a confined space, containing inert, toxic, flammable, or corrosive materials valved off and blanked or disconnected and separated?

Is it required that all impellers, agitators, or other moving equipment inside confined spaces be locked-out if they present a hazard?

Is either natural or mechanical ventilation provided prior to confined space entry?

Before entry, are appropriate atmospheric tests performed to check for oxygen deficiency, toxic substance and explosive concentrations in the confined space before entry?

Is adequate illumination provided for the work to be performed in the confined space?

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Is the atmosphere inside the confined space frequently tested or continuously monitor during conduct of work?

Is there an assigned safety standby employee outside of the confined space, whose sole responsibility is to watch the work in progress, sound an alarm if necessary, and render assistance?

Is the standby employee or other employees prohibited from entering the confined space without lifelines and respiratory equipment if there is any questions as to the cause of an emergency?

In addition to the standby employee, is there at least one other trained rescuer in the vicinity?

Are all rescuers appropriately trained and using approved, recently inspected equipment?

Does all rescue equipment allow for lifting employees vertically from a top opening?

Are there trained personnel in First Aid and CPR immediately available?

Is there an effective communication system in place whenever respiratory equipment is used and the employee in the confined space is out of sight of the standby person?

Is approved respiratory equipment required if the atmosphere inside the confined space cannot be made acceptable?

Is all portable electrical equipment used inside confined spaces either grounded and insulated, or equipped with ground fault protection?

Before gas welding or burning is started in a confined space, are hoses checked for leaks, compressed gas bottles forbidden inside of the confined space, torches lighted only outside of the confined area and the confined area tested for an explosive atmosphere each time before a lighted torch is to be taken into the confined space?

If employees will be using oxygen-consuming equipment such as salamanders, torches, furnaces, in a confined space, is sufficient air provided to assure combustion without reducing the oxygen concentration of the atmosphere below 19.5 percent by volume?

Whenever combustion-type equipment is used in confined space, are provisions made to ensure the exhaust gases are vented outside of the enclosure?

Is each confined space checked for decaying vegetation or animal matter, which may produce methane?

Is the confined space checked for possible industrial waste, which could contain toxic properties?

If the confined space is below the ground and near areas where motor vehicles will be operating, is it possible for vehicle exhaust or carbon monoxide to enter the space?

ENVIRONMENTAL CONTROLS

Are all work areas properly illuminated?

Are employees instructed in proper first aid and other emergency procedures?

Are hazardous substances identified which may cause harm by inhalation, ingestion, skin absorption or contact?

Are employees aware of the hazards involved with the various chemicals they may be exposed to in their work environment, such as ammonia, chlorine, epoxies, and caustics?

Is employee exposure to chemicals in the workplace kept within acceptable levels?

Can a less harmful method or product be used?

Is the work area's ventilation system appropriate for the work being performed?

Are spray painting operations done in spray rooms or booths equipped with an appropriate exhaust system?

Is employee exposure to welding fumes controlled by ventilation, use of respirators, exposure time, or other means?

Are welders and other workers nearby provided with flash shields during welding operations?

If forklifts and other vehicles are used in buildings or other enclosed areas, are the carbon monoxide levels kept below maximum acceptable concentration?

Has there been a determination that noise levels in the facilities are within acceptable levels?
Are steps being taken to use engineering controls to reduce excessive noise levels?
Are proper precautions being taken when handling asbestos and other fibrous materials?
Are caution labels and signs used to warn of asbestos?
Are wet methods used, when practicable, to prevent the emission of airborne asbestos fibers, silica dust and similar hazardous materials?
Is vacuuming with appropriate equipment used whenever possible rather than blowing or sweeping dust?
Are grinders, saws, and other machines that produce respirable dusts vented to an industrial collector or central exhaust system?
Are all local exhaust ventilation systems designed and operating properly such as airflow and volume necessary for the application? Are the ducts free of obstructions or the belts slipping?
Is personal protective equipment provided, used and maintained wherever required?
Are there written standard operating procedures for the selection and use of respirators where needed?
Are restrooms and washrooms kept clean and sanitary?
Is all water provided for drinking, washing, and cooking potable?
Are all outlets for water not suitable for drinking clearly identified?
Are employees' physical capacities assessed before being assigned to jobs requiring heavy work?
Are employees instructed in the proper manner of lifting heavy objects?
Where heat is a problem, have all fixed work areas been provided with spot cooling or air conditioning?
Are employees screened before assignment to areas of high heat to determine if their health condition might make them more susceptible to having an adverse reaction?
Are employees working on streets and roadways where they are exposed to the hazards of traffic, required to wear bright colored (traffic orange) warning vest?
Are exhaust stacks and air intakes located that contaminated air will not be recirculated within a building or other enclosed area?
Is equipment producing ultra-violet radiation properly shielded?

FLAMMABLE & COMBUSTIBLE MATERIALS

Are combustible scrap, debris and waste materials (i.e. oily rags) stored in covered metal receptacles and removed from the worksite promptly?
Is proper storage practiced to minimize the risk of fire including spontaneous combustion?
Are approved containers and tanks used for the storage and handling of flammable and combustible liquids?
Are all connections on drums and combustible liquid piping, vapor and liquid tight?
Are all flammable liquids kept in closed containers when not in use (e.g. parts cleaning tanks, pans)?
Are bulk drums of flammable liquids grounded and bonded to containers during dispensing?
Do storage rooms for flammable and combustible liquids have explosion-proof lights?
Do storage rooms for flammable and combustible liquids have mechanical or gravity ventilation?
Is liquefied petroleum gas stored, handled, and used in accordance with safe practices and standards?
Are liquefied petroleum storage tanks guarded to prevent damage from vehicles?
Are all solvent wastes and flammable liquids kept in fire-resistant covered containers until they are removed from the worksite?
Is vacuuming used whenever possible rather than blowing or sweeping combustible dust?
Are fire separators placed between containers of combustibles or flammables, when stacked one upon another, to assure their support and stability?

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Are fuel gas cylinders and oxygen cylinders separated by distance, fire resistant barriers or other means while in storage?

Are fire extinguishers selected and provided for the types of materials in areas where they are to be used?

Class A: Ordinary combustible material fires.

Class B: Flammable liquid, gas or grease fires.

Class C: Energized-electrical equipment fires.

If a Halon 1301 fire extinguisher is used, can employees evacuate within the specified time for that extinguisher?

Are appropriate fire extinguishers mounted within 75 feet of outside areas containing flammable liquids, and within 10 feet of any inside storage area for such materials?

Is the transfer/withdrawal of flammable or combustible liquids performed by trained personnel?

Are fire extinguishers mounted so that employees do not have to travel more than 75 feet for a class "A" fire or 50 feet for a class "B" fire?

Are employees trained in the use of fire extinguishers?

Are extinguishers free from obstructions or blockage?

Are all extinguishers serviced, maintained and tagged at intervals not to exceed one year?

Are all extinguishers fully charged and in their designated places?

Is a record maintained of required monthly checks of extinguishers?

Where sprinkler systems are permanently installed, are the nozzle heads directed or arranged so that water will not be sprayed into operating electrical switchboards and equipment?

Are "NO SMOKING" signs posted where appropriate in areas where flammable or combustible materials are used or stored?

Are "NO SMOKING" signs posted on liquefied petroleum gas tanks?

Are "NO SMOKING" rules enforced in areas involving storage and use of flammable materials?

Are safety cans used for dispensing flammable or combustible liquids at a point of use?

Are all spills of flammable or combustible liquids cleaned up promptly?

Are storage tanks adequately vented to prevent the development of excessive vacuum or pressure as a result of filling, emptying, or atmosphere temperature changes?

Are storage tanks equipped with emergency venting that will relieve excessive internal pressure caused by fire exposure?

Are spare portable or butane tanks, which are used by industrial trucks stored in accord with regulations?

FIRE PROTECTION

Do you have a fire prevention plan?

Does your plan describe the type of fire protection equipment and/or systems?

Have you established practices and procedures to control potential fire hazards and ignition sources?

Are employees aware of the fire hazards of the material and processes to which they are exposed?

Is your local fire department well acquainted with your facilities, location and specific hazards?

If you have a fire alarm system, is it tested at least annually?

If you have a fire alarm system, is it certified as required?

If you have interior standpipes and valves, are they inspected regularly?

If you have outside private fire hydrants, are they flushed at least once a year and on a routine preventive maintenance schedule?

Are fire doors and shutters in good operating condition?

Are fire doors and shutters unobstructed and protected against obstructions, including their counterweights?

Are fire door and shutter fusible links in place?

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Are automatic sprinkler system water control valves, air and water pressures checked weekly/periodically as required?
Is maintenance of automatic sprinkler system assigned to responsible persons or to a sprinkler contractor?
Are sprinkler heads protected by metal guards, when exposed to physical damage?
Is proper clearance maintained below sprinkler heads?
Are portable fire extinguishers provided in adequate number and type?
Are fire extinguishers mounted in readily accessible locations?
Are fire extinguishers recharged regularly and noted on the inspection tag?
Are employees periodically instructed in the use of extinguishers and fire protection procedures?

HAZARDOUS CHEMICAL EXPOSURES

Are employees trained in the safe handling practices of hazardous chemicals such as acids, caustics, and the like?
Are employees aware of the potential hazards involving various chemicals stored or used in the workplace--such as acids, bases, caustics, epoxies, and phenols?
Is employee exposure to chemicals kept within acceptable levels?
Are eye wash fountains and safety showers provided in areas where corrosive chemicals are handled?
Are all containers, such as vats and storage tanks labeled as to their contents--e.g. "CAUSTICS"?
Are all employees required to use personal protective clothing and equipment when handling chemicals (i.e. gloves, eye protection, and respirators)?
Are flammable or toxic chemicals kept in closed containers when not in use?
Are chemical piping systems clearly marked as to their content?
Where corrosive liquids are frequently handled in open containers or drawn from storage vessels or pipelines, is adequate means readily available for neutralizing or disposing of spills or overflows properly and safely?
Have standard operating procedures been established and are they being followed when cleaning up chemical spills?
Where needed for emergency use, are respirators stored in a convenient, clean and sanitary location?
Are respirators intended for emergency use adequate for the various uses for which they may be needed?
Are employees prohibited from eating in areas where hazardous chemicals are present?
Is personal protective equipment provided, used and maintained whenever necessary?
Are there written standard operating procedures for the selection and use of respirators where needed?
If you have a respirator protection program, are your employees instructed on the correct usage and limitations of the respirators?
Are the respirators NIOSH approved for this particular application?
Are they regularly inspected and cleaned sanitized and maintained?
If hazardous substances are used in your processes, do you have a medical or biological monitoring system in operation?
Are you familiar with the Threshold Limit Values or Permissible Exposure Limits of airborne contaminants and physical agents used in your workplace?
Have control procedures been instituted for hazardous materials, where appropriate, such as respirators, ventilation systems, handling practices, and the like?
Whenever possible, are hazardous substances handled in properly designed and exhausted booths or similar locations?

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Do you use general dilution or local exhaust ventilation systems to control dusts, vapors, gases, fumes, smoke, solvents or mists which may be generated in your workplace?

Is ventilation equipment provided for removal of contaminants from such operations as production grinding, buffing, spray painting, and/or vapor decreasing, and is it operating properly?

Do employees complain about dizziness, headaches, nausea, irritation, or other factors of discomfort when they use solvents or other chemicals?

Is there a dermatitis problem--do employees complain about skin dryness, irritation, or sensitization?

Have you considered the use of an industrial hygienist or environmental health specialist to evaluate your operation?

If internal combustion engines are used, is carbon monoxide kept within acceptable levels?

Is vacuuming used, rather than blowing or sweeping dusts whenever possible for clean up?

Are materials, which give off toxic asphyxiant, suffocating or anesthetic fumes, stored in remote or isolated locations when not in use?

HAZARDOUS SUBSTANCES COMMUNICATION

Is there a list of hazardous substances used in your workplace?

Is there a written hazard communication program dealing with Material Safety Data Sheets (MSDS) labeling, and employee training?

Who is responsible for MSDSs, container labeling, employee training?

Is each container for a hazardous substance (i.e. vats, bottles, storage tanks,) labeled with product identity and a hazard warning (communication of the specific health hazards and physical hazards)?

Is there a Material Safety Data Sheet readily available for each hazardous substance used?

How will you inform other companys whose employees share the same work area where the hazardous substances are used?

Is there an employee training program for hazardous substances?

Does this program 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 "Right to Know"?

Identification of where employees can see the company's written hazard communication program and where hazardous substances are present in their work area?

The physical and health hazards of substances in the work area, how to detect their presence, and specific protective measures to be used?

Details of the hazard communication program, including how to use the labeling system and MSDSs?

How employees will be informed of hazards of non-routine tasks, and hazards of unlabeled pipes?

ELECTRICAL

Are your workplace electricians familiar with the Cal/OSHA Electrical Safety Orders?

Do you specify compliance with Cal/OSHA for all contract electrical work?

Are all employees required to report as soon as practicable any obvious hazard to life or property observed in connection with electrical equipment or lines?

Are employees instructed to make preliminary inspections and/or appropriate tests to determine what conditions exist before starting work on electrical equipment or lines?

When electrical equipment or lines are to be serviced, maintained or adjusted, are necessary switches opened, locked-out and tagged whenever possible?

Are portable electrical tools and equipment grounded or of the double insulated type?

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Are electrical appliances such as vacuum cleaners, polishers, vending machines grounded?

Do extension cords being used have a grounding conductor?

Are multiple plug adapters prohibited?

Are ground-fault circuit interrupters installed on each temporary 15 or 20 ampere, 120 volt AC circuit at locations where construction, demolition, modifications, alterations or excavations are being performed?

Are all temporary circuits protected by suitable disconnecting switches or plug connectors at the junction with permanent wiring?

Is exposed wiring and cords with frayed or deteriorated insulation repaired or replaced promptly?

Are flexible cords and cables free of splices or taps?

Are clamps or other securing means provided on flexible cords or cables at plugs, receptacles, tools, and equipment and is the cord jacket securely held in place?

Are all cord, cable and raceway connections intact and secure?

In wet or damp locations, are electrical tools and equipment appropriate for the use or location or otherwise protected?

Is the location of electrical power lines and cables (overhead, underground, underfloor, other side of walls) determined before digging, drilling or similar work is begun?

Are metal measuring tapes, ropes, handlines or similar devices with metallic thread woven into the fabric prohibited where they could come in contact with energized parts of equipment or circuit conductors?

Is the use of metal ladders prohibited in area where the ladder or the person using the ladder could come in contact with energized parts of equipment, fixtures or circuit conductors?

Are all disconnecting switches and circuit breakers labeled to indicate their use or equipment served?

Are disconnecting means always opened before fuses are replaced?

Do all interior wiring systems include provisions for grounding metal parts of electrical raceways, equipment and enclosures?

Are all electrical raceways and enclosures securely fastened in place?

Are all energized parts of electrical circuits and equipment guarded against accidental contact by approved cabinets or enclosures?

Is sufficient access and working space provided and maintained about all electrical equipment to permit ready and safe operations and maintenance?

Are all unused openings (including conduit knockouts) in electrical enclosures and fittings closed with appropriate covers, plugs or plates?

Are electrical enclosures such as switches, receptacles, junction boxes, etc., provided with tight-fitting covers or plates?

Are disconnecting switches for electrical motors in excess of two horsepower, 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).

Is low voltage protection provided in the control device of motors driving machines or equipment, which could cause probably injury from inadvertent starting?

Is each motor disconnecting switch or circuit breaker located within sight of the motor control device?

Is each motor located within sight of its controller or the controller disconnecting means capable of being locked in the open position or is a separate disconnecting means installed in the circuit within sight of the motor?

Is the controller for each motor in excess of two horsepower, rated in horsepower equal to or in excess of the rating of the motor it serves?

Are employees who regularly work on or around energized electrical equipment or lines instructed in the cardiopulmonary resuscitation (CPR) methods?

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Are employees prohibited from working alone on energized lines or equipment over 600 volts?

NOISE

Are there areas in the workplace where continuous noise levels exceed 85 dBA? (To determine maximum allowable levels for intermittent or impact noise, see Title 8, Section 5097.)

Are noise levels being measured using a sound level meter or an octave band analyzer and records being kept?

Have you tried isolating noisy machinery from the rest of your operation?

Have engineering controls been used to reduce excessive noise levels?

Where engineering controls are determined not feasible, are administrative controls (i.e. worker rotation) being used to minimize individual employee exposure to noise?

Is there an ongoing preventive health program to educate employees in safe levels of noise and exposure, effects of noise on their health, and use of personal protection?

Is the training repeated annually for employees exposed to continuous noise above 85 dBA?

Have work areas where noise levels make voice communication between employees difficult been identified and posted?

Is approved hearing protective equipment (noise attenuating devices) available to every employee working in areas where continuous noise levels exceed 85 dBA?

If you use ear protectors, are employees properly fitted and instructed in their use and care?

Are employees exposed to continuous noise above 85 dBA given periodic audiometric testing to ensure that you have an effective hearing protection system?

FUELING

Is it prohibited to fuel an internal combustion engine with a flammable liquid while the engine is running?

Are fueling operations done in such a manner that likelihood of spillage will be minimal?

When spillage occurs during fueling operations, is the spilled fuel cleaned up completely, evaporated, or other measures taken to control vapors before restarting the engine?

Are fuel tank caps replaced and secured before starting the engine?

In fueling operations is there always metal contact between the container and fuel tank?

Are fueling hoses of a type designed to handle the specific type of fuel?

Is it prohibited to handle or transfer gasoline in open containers?

Are open lights, open flames, or sparking or arcing equipment prohibited near fueling or transfer of fuel operations?

Is smoking prohibited in the vicinity of fueling operations?

Are fueling operations prohibited in building or other enclosed areas that are not specifically ventilated for this purpose?

Where fueling or transfer of fuel is done through a gravity flow system, are the nozzles of the self-closing type?

IDENTIFICATION OF PIPING SYSTEMS

When nonpotable water is piped through a facility, are outlets or taps posted to alert employees that it is unsafe and not to be used for drinking, washing or other personal use?

When hazardous substances are transported through above ground piping, is each pipeline identified at points where confusion could introduce hazards to employees?

When pipelines are identified by color painting, are all visible parts of the line so identified?

When pipelines are identified by color painted bands or tapes, are the bands or tapes located at reasonable intervals and at each outlet, valve or connection?

When pipelines are identified by color, is the color code posted at all locations where confusion could introduce hazards to employees?

When the contents of pipelines are identified by name or name abbreviation, is the information

readily visible on the pipe near each valve or outlet?

When pipelines carrying hazardous substances are identified by tags, are the tags constructed of durable materials, the message carried clearly and permanently distinguishable and are tags installed at each valve or outlet?

When pipelines are heated by electricity, steam or other external source, are suitable warning signs or tags placed at unions, valves, or other serviceable parts of the system?

MATERIAL HANDLING

Is there safe clearance for equipment through aisles and doorways?

Are aiseways designated, permanently marked, and kept clear to allow unhindered passage?

Are motorized vehicles and mechanized equipment inspected daily or prior to use?

Are vehicles shut off and brakes set prior to loading or unloading?

Are containers or combustibles or flammables, when stacked while being moved, always separated by dunnage sufficient to provide stability?

Are dock boards (bridge plates) used when loading or unloading operations are taking place between vehicles and docks?

Are trucks and trailers secured from movement during loading and unloading operations?

Are dock plates and loading ramps constructed and maintained with sufficient strength to support imposed loading?

Are hand trucks maintained in safe operating condition?

Are chutes equipped with sideboards of sufficient height to prevent the materials being handled from falling off?

Are chutes and gravity roller sections firmly placed or secured to prevent displacement?

At the delivery end of rollers or chutes, are provisions made to brake the movement of the handled materials.

Are pallets usually inspected before being loaded or moved?

Are hooks with safety latches or other arrangements used when hoisting materials so that slings or load attachments won't accidentally slip off the hoist hooks?

Are securing chains, ropes, chockers or slings adequate for the job to be performed?

When hoisting material or equipment, are provisions made to assure no one will be passing under the suspended loads?

Are Material Safety Data Sheets available to employees handling hazardous substances?

TRANSPORTING EMPLOYEES & MATERIALS

Do employees who operate vehicles on public thoroughfares have valid operator's licenses?

When seven or more employees are regularly transported in a van, bus or truck, is the operator's license appropriate for the class of vehicle being driven?

Is each van, bus or truck used regularly to transport employees, equipped with an adequate number of seats?

When employees are transported by truck, are provision provided to prevent their falling from the vehicle?

Are vehicles used to transport employees, equipped with lamps, brakes, horns, mirrors, windshields and turn signals in good repair?

Are transport vehicles provided with handrails, steps, stirrups or similar devices, so placed and arranged that employees can safely mount or dismount?

Are employee transport vehicles equipped at all times with at least two reflective type flares?

Is a full charged fire extinguisher, in good condition, with at least 4 B:C rating maintained in each employee transport vehicle?

When cutting tools with sharp edges are carried in passenger compartments of employee transport vehicles, are they placed in closed boxes or containers which are secured in place?

Are employees prohibited from riding on top of any load, which can shift, topple, or otherwise

become unstable?

CONTROL OF HARMFUL SUBSTANCES BY VENTILATION

Is the volume and velocity of air in each exhaust system sufficient to gather the dusts, fumes, mists, vapors or gases to be controlled, and to convey them to a suitable point of disposal?

Are exhaust inlets, ducts and plenums designed, constructed, and supported to prevent collapse or failure of any part of the system?

Are clean-out ports or doors provided at intervals not to exceed 12 feet in all horizontal runs of exhaust ducts?

Where two or more different type of operations are being controlled through the same exhaust system, will the combination of substances being controlled, constitute a fire, explosion or chemical reaction hazard in the duct?

Is adequate makeup air provided to areas where exhaust systems are operating?

Is the intake for makeup air located so that only clean, fresh air, which is free of contaminants, will enter the work environment?

Where two or more ventilation systems are serving a work area, is their operation such that one will not offset the functions of the other?

SANITIZING EQUIPMENT & CLOTHING

Is personal protective clothing or equipment, that employees are required to wear or use, of a type capable of being easily cleaned and disinfected?

Are employees prohibited from interchanging personal protective clothing or equipment, unless it has been properly cleaned?

Are machines and equipment, which processes, handle or apply materials that could be injurious to employees, cleaned and/or decontaminated before being overhauled or placed in storage?

Are employees prohibited from smoking or eating in any area where contaminants are present that could be injurious if ingested?

When employees are required to change from street clothing into protective clothing, is a clean changeroom with separate storage facility for street and protective clothing provided?

Are employees required to shower and wash their hair as soon as possible after a known contact has occurred with a carcinogen?

When equipment, materials, or other items are taken into or removed from a carcinogen regulated area, is it done in a manner that will not contaminate non-regulated areas or the external environment?

TIRE INFLATION

Where tires are mounted and/or inflated on drop center wheels is a safe practice procedure posted and enforced?

Where tires are mounted and/or inflated on wheels with split rims and/or retainer rings is a safe practice procedure posted and enforced?

Does each tire inflation hose have a clip-on chuck with at least 24 inches of hose between the chuck and an in-line hand valve and gauge?

Does the tire inflation control valve automatically shut off the airflow when the valve is released?

Is a tire restraining device such as a cage, rack or other effective means used while inflating tires mounted on split rims, or rims using retainer rings?

Are employees strictly forbidden from taking a position directly over or in front of a tire while it's being inflated?

EMERGENCY ACTION PLAN

Are you required to have an emergency action plan?

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Does the emergency action plan comply with requirements of T8CCR 3220(a)?
Have emergency escape procedures and routes been developed and communicated to all companys?
Do employees, who remain to operate critical plant operations before they evacuate, know the proper procedures?
Is the employee alarm system that provides a warning for emergency action recognizable and perceptible above ambient conditions?
Are alarm systems properly maintained and tested regularly?
Is the emergency action plan reviewed and revised periodically?
Do employees know their responsibilities:
For reporting emergencies?
During an emergency?
For conducting rescue and medical duties?

INFECTION CONTROL

Are employees potentially exposed to infectious agents in body fluids?
Have occasions of potential occupational exposure been identified and documented?
Has a training and information program been provided for employees exposed to or potentially exposed to blood and/or body fluids?
Have infection control procedures been instituted where appropriate, such as ventilation, universal precautions, workplace practices, and personal protective equipment?
Are employees aware of specific workplace practices to follow when appropriate? (Hand washing, handling sharp instruments, handling of laundry, disposal of contaminated materials, reusable equipment.)
Is personal protective equipment provided to employees, and in all appropriate locations?
Is the necessary equipment (i.e. mouthpieces, resuscitation bags, and other ventilation devices) provided for administering mouth-to-mouth resuscitation on potentially infected patients?
Are facilities/equipment to comply with workplace practices available, such as hand-washing sinks, biohazard tags and labels, needle containers, detergents/disinfectants to clean up spills?
Are all equipment and environmental and working surfaces cleaned and disinfected after contact with blood or potentially infectious materials?
Is infectious waste placed in closable, leak proof containers, bags or puncture-resistant holders with proper labels?
Has medical surveillance including HBV evaluation, antibody testing and vaccination been made available to potentially exposed employees?
Training on universal precautions?
Training on personal protective equipment?
Training on workplace practices, which should include blood drawing, room cleaning, laundry handling, clean up of blood spills?
Training on needlestick exposure/management?
Hepatitis B vaccinations?

ERGONOMICS

Can the work be performed without eyestrain or glare to the employees?
Does the task require prolonged raising of the arms?
Do the neck and shoulders have to be stooped to view the task?
Are there pressure points on any parts of the body (wrists, forearms, back of thighs)?
Can the work be done using the larger muscles of the body?
Can the work be done without twisting or overly bending the lower back?
Are there sufficient rest breaks, in addition to the regular rest breaks, to relieve stress from repetitive-motion tasks?

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Are tools, instruments and machinery shaped, positioned and handled so that tasks can be performed comfortably?

Are all pieces of furniture adjusted, positioned and arranged to minimize strain on all parts of the body?

VENTILATION FOR INDOOR AIR QUALITY

Does your HVAC system provide at least the quantity of outdoor air required by the State Building Standards Code, Title 24, Part 2 at the time the building was constructed?

Is the HVAC system inspected at least annually, and problems corrected?

Are inspection records retained for at least 5 years?

CRANE CHECKLIST

Are the cranes visually inspected for defective components prior to the beginning of any work shift?

Are all electrically operated cranes effectively grounded?

Is a crane preventive maintenance program established?

Is the load chart clearly visible to the operator?

Are operating controls clearly identified?

Is a fire extinguisher provided at the operator's station?

Is the rated capacity visibly marked on each crane?

Is an audible warning device mounted on each crane?

Is sufficient illumination provided for the operator to perform the work safely?

Are cranes of such design, that the boom could fall over backward, equipped with boomstops?

Does each crane have a certificate indicating that required testing and examinations have been performed?

Are crane inspection and maintenance records maintained and available for inspection?

12.12 Hazard Assessment and Correction Record

Date of Inspection: Person Conducting Inspection:

Unsafe Condition or Work Practice:

Corrective Action Taken:

12.13 Accident / Exposure Investigation Report

Date & Time of Accident:

Location:

Accident Description:

Employees Involved:

Preventive Action Recommendations:

Corrective Actions Taken:

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Manager Responsible:

Date Completed:

12.14 Worker Training and Instruction Record

EMPLOYEE NAME	TRAINING DATES	TYPE OF TRAINING	TRAINERS

Chapter 13 - Emergencies

13.1 Organization

Pickering Associates, Inc. requires that during every emergency an organized effort be made to protect personnel from further injury and to minimize property damage. All of Pickering Associates, Inc.'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.

13.2 Master Emergency Response Plan

Pickering Associates, Inc.'s Master Emergency Response Plan delineates lines of authority and responsibility for emergency response. In this context, a major emergency may be one of the following: a potential major loss to a building or facility; an emergency that involves more than one building or facility; a situation in which a choice must be made in the assignment of relative levels of authority among emergency-response groups; a potential hazard to the surrounding community; threat; civil disturbances or alerts; natural disasters such as earthquakes, floods, and landslides; and site wide electrical power or other utility failure. During response to such major events, if deemed necessary by management or Pickering Associates, Inc. Fire or Police may be summoned, and a predesignated succession of management personnel would determine who would take charge. The primary responsibility person designated to be in charge is to ensure that priorities are established, that the response is appropriate and adequately implemented, and that the proper notifications are made. In most cases the direct involvement of local supervision and remedial action will be necessary. Adequate emergency response will be made at the group, department, and building levels, with support from Fire, Medical, Protective Services, and other support organizations. As a practical matter it must be recognized that management personnel are normally on site only 40 of the 168 hours per week. Thus, there may be considerable delay before management personnel can assume on-site direction of major emergencies. This highlights the importance of local initiative, at least at the onset of an emergency. The underlying philosophy of the emergency response plan is the recognition that each employee has a vital role and a basic responsibility in the area of safety and emergency action. The only reasonable expectation is that at the onset of an emergency the initial response will be at the individual level. Immediate and knowledgeable action is vital. The emergency plans for individual buildings and facilities set forth the responses to be taken by employees following the discovery of an emergency. Following the immediate measures taken by the individual, the responsibility for action will normally proceed upward through normal organizational lines of authority to the Building Manager and to emergency-response groups. Involvement of individuals at a higher level of responsibility will depend on the particular situation. To reiterate, levels of responsibility proceed downward from top management while action and response levels proceed upward from the first person involved. Don't be afraid to call outside assistance like police and firefighters. Dial 911. When the police, firefighters or paramedics arrive, surrender command to an qualified emergency specialist. Notify management as soon as practical, which means after all immediate responses have been exercised. The operator at 911 will tell you who is the person in

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charge of the specialized personnel assigned to respond to the emergency. An orderly transfer of responsibility is then made from the local building or facility organization to this responding unit. The examples listed below identify the most likely outside incident commander for the following types of emergencies: Injury: Ranking Fire Officer or Physician Fire: Ranking Fire Officer Bomb Threat: Ranking Police Officer Civil Disturbance: Ranking Police Officer Radioactive or Chemical Spills: Ranking Fire Officer Responsible Safety Officer Special Toxic Clean Up crew or alternate Power Outage: Pacific Gas and Electric or local Plant Power Engineer Mechanical Utility Failures: Construction and Maintenance Department Superintendent Structural Plant Failures: Engineering Department Head or alternate Landslide: Engineering Department Head or alternate In most emergencies the person who should be in charge is obvious. However, an emergency might arise that requires the major involvement of more than one emergency-response group. In such a case the ultimate authority among those on the scene may not be obvious. In this event, management should be consulted for direction.

13.3 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).

13.4 Operational Safety Procedures

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

13.5 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.

13.6 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.

13.7 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 14 - Personal Protective Equipment

14.1 Introduction

Pickering Associates, Inc. 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.

14.2 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.

14.3 Radiation Monitoring

Protective clothing must be monitored for radioactive contamination before being sent to the laundry.

14.4 Protective Shoes

Pickering Associates, Inc. encourages the wearing of safety shoes by making them available to any employee at cost from a manufacturer. 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.

14.5 Protective Gloves

Pickering Associates, Inc. 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.

14.6 Head Protection

Pickering Associates, Inc. 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.

14.7 Eye Protection

Pickering Associates, Inc. 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.

14.8 Eye Protection Devices

Eye-protection devices are classified in four categories: Personal safety glasses. Goggles, face shields, etc. Temporary safety glasses provided to visitors in eye-hazard areas Laser safety eye wear.

14.9 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 Pickering Associates, Inc. requirements as prescribed by OSHA in ANSI 288.2-1980, Standard Practices for Respiratory Protection.

14.10 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 (Responsible Safety Officer will provide assistance upon request in this determination). 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.

14.11 Respiratory Equipment

The Responsible Safety Officer has selected the types of respiratory protective equipment to be used at Pickering Associates, Inc.. Any changes to protective equipment, its application, or the substitution of alternative protective equipment must be approved by the Responsible Safety Officer before its use. Pickering Associates, Inc. has a wide variety of respiratory protective equipment available. Each respirator has certain capabilities and limitations that are taken into account when issued. The types of respiratory protective devices provided by Pickering Associates, Inc. are described below. Disposable dust masks are approved for protection against low (nonhazardous) levels of nuisance dusts. They provide no protection against vapors or gases, and they cannot be used in oxygen-deficient areas. There are no applicable training or fitting restrictions. Air-purifying, half- and full-face masks are approved for protection against low concentration of toxic particulates, organic vapors, acid gases, and ammonia. Specific cartridges must be selected for protection against each material. They must never be used in atmospheres deficient in oxygen, when carbon monoxide or oxides of nitrogen are suspected, or when conditions prevent a good face seal. Such conditions may be a growth of beard, sideburns, a skullcap that projects under the facepiece or temple pieces on eyeglasses. Users must be trained, fitted, and medically approved before they can be issued a respirator. Supplied-air, half- and full-face masks may be used in atmospheres unsuitable for air-purifying respirators but cannot be used in areas which are immediately dangerous to life or health. Compressors are normally used to supply breathing air, but compressed air cylinders may also be used. The user must be medically approved, trained, and fitted before using this equipment. Personnel will not be fitted or issued a respirator if there is any condition that may prevent a good face seal, such as a beard, sideburns, skullcap, or temple pieces on eyeglasses. Supplied-air hoods are approved for respiratory protection in any atmosphere not immediately dangerous to life or health, and from which the wearer can escape without the aid of a respirator. The user must be medically approved and trained in its proper use. The presence of a beard, sideburns, skullcap, or eyeglasses will not affect the performance of this type of respirator.

Chapter 15 - Noise

15.1 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.

15.2 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.

15.3 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.

15.4 Reducing Noise Exposure

Noise exposure can be reduced by using engineering controls, administrative procedures, or personal protective devices. Engineering Controls Reduction of noise production at the source: 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: Increase distance between noise and personnel exposed Construction of barriers between noise source and personnel Sound treatment of ceilings and walls Administrative Procedures: Job schedule changes Personnel rotation Personnel Protective Devices: Ear plugs 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.

15.5 Measurement

The measurement of hearing is called audiometry. Audiometric tests are used to determine whether or not the hearing of workers is adversely affected by noise. The appropriate Medical Services provider will give a pre-employment audiometric test to every employee who will regularly work in a high noise area. Thereafter, an audiometric test is given to all such employees at the time of their periodic physical examination. In addition, all employees whose noise exposures equal or exceed an eight-hour, time-weighted average of 85 dBA will be given an initial baseline audiometric test that must be preceded by at least 14 hours without exposure to workplace noise. Thereafter, the test will be repeated annually. To reduce unwanted noise, the audiometric test is administered by placing each individual in a sound insulated booth. Earphones are placed on the individual's head and a microprocessor audiometer presents a series of fixed frequency pure tones between 500 and 8000 Hz in each ear. These frequencies include the most useful range of hearing, as well as those frequencies most likely to show changes as a result of exposure to damaging levels of noise. By comparing tests taken at successive intervals, it can be determined how an employee's hearing ability is affected by a noisy environment.

15.6 Other Noises

Nuisance noises are noises that are not intense enough to cause hearing loss but that do disturb or interfere with normal activities, such as: Speech communication Telephone communication Listening to TV or radio broadcasts Concentration during mental activities Relaxation Sleep The amount of interference is dependent upon the intensity

of the noise and its characteristics, such as steady versus intermittent noise, high or low pitch. The amount of interference may also depend upon the person's personality, attitude toward the source, familiarity with the noise, and the intrusiveness of the noise. What is music to one ear may be noise to another!

Chapter 16 - Tools

16.1 Company Provided Tools

Pickering Associates, Inc. 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.

Everyone is required to be responsible for all tools and equipment that you use; remember which vehicle you took the item from and return it to that vehicle. When you lay the item or tool on the ground, remember where you placed it so you can return it to the proper vehicle. It would be appreciated that when leaving the job, that all Employees help by looking around for any tools or equipment that wasn't replaced.

16.2 Grounding

Tools that are not double-insulated must be effectively grounded and tested. Testing must be accomplished before 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.

16.3 Shop Rules

Any Pickering Associates, Inc. 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 17 - Ladders and Scaffolds

17.1 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 non-conducting 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.

17.2 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.

17.3 Floors

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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 toe boards. 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.

17.4 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 work place 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 1/2inch 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.

17.5 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).

17.6 Powered Platforms and Equipment for Building Maintenance

17.6.a Operations.

(a) Training.

(1) Working platforms shall be operated only by qualified persons who are proficient in the operation, safe use and inspection of the particular working platform to be operated.

(2) All employees who operate working platforms shall be trained in the following:

(A) Recognition of, and preventive measures for, the safety hazards associated with their individual work tasks.

(B) General recognition and prevention of safety hazards associated with the use of working platforms, including the provisions in the article relating to the particular working platform to be operated.

(C) Emergency action plan procedures are required.

(D) Work procedures required in subsection (a)(4) of this section.

(E) Personal fall arrest system inspection care, use and system performance.

(3) Training of employees in the operation and inspection of working platforms shall be done by a qualified person.

(4) Written work procedures for the operation, safe use and inspection of working platforms shall be provided for employee training. Pictorial methods of instruction, may be used, in lieu of written work procedures, if employee communication is improved using this method. The operating manuals supplied by manufacturers for platform system components can serve as the basis for these procedures.

(5) The company shall certify that employees have been trained in operating and inspecting a working platform by preparing a certification record which includes the identity of the person trained, the signature of the company or the person who conducted the training and the date that training was completed. The certification record shall be prepared at the completion of the training required in subsection (a)(2) of this section, and shall be maintained in a file for the duration of the employee's employment. The certification record shall be kept readily available for review by the Division.

(b) Use.

(1) Working platforms shall not be loaded in excess of the rated load, as stated on the platform load rating plate.

(2) Employees shall be prohibited from working on snow, ice, or other slippery material

covering platforms, except for the removal of such materials.

(3) Adequate precautions shall be taken to protect the platform, wire ropes and safety lines from damage due to acids or other corrosive substances, in accordance with the recommendations of the corrosive substance producer, supplier, platform manufacturer or other equivalent information sources. Platform members which have been exposed to acids or other corrosive substances shall be washed down with a neutralizing solution, at a frequency recommended by the corrosive substance producer or supplier.

(4) Platform members, supporting members constructed of aluminum, wire ropes and safety lines shall be protected when using a heat producing process. Wire ropes and safety lines which have been contacted by the heat producing process shall be considered to be permanently damaged and shall not be used.

(5) The platform shall not be operated in winds in excess of 25 miles per hour except to move it from an operating to a storage position. Wind speed shall be determined based on the best available information, which includes on-site anemometer readings and local weather forecasts which predict wind velocities for the area.

(6) On exterior installations, an anemometer shall be mounted on the platform to provide information of onsite wind velocities prior to and during the use of the platform. The anemometer may be a portable (hand held) unit which is temporarily mounted during platform use.

(7) Tools, materials and debris not related to the work in progress shall not be allowed to accumulate on platforms. Stabilizer ties shall be located so as to allow unencumbered passage along the full length of the platform and shall be of such length so as not to become entangled in rollers, hoists or other machinery.

Chapter 18 - Mechanical Guarding

18.1 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 gives 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 insure 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 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 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 19 - Materials Handling

19.1 Introduction

Pickering Associates, Inc. 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.

19.2 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.

19.3 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.

19.4 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 Pickering Associates, Inc. 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, splinters, 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 leader and give the commands to lift, lower, etc. Two persons carrying a long 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 of 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.

19.5 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.

19.6 Inspections

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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.

19.7 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.

19.8 Off Site Shipping

Material being shipped off site must be packed or crated by competent shipping personnel. Boxes, wooden crates, and other packing materials must be safely consigned to waste or salvage as soon as practicable following unpacking.

19.9 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.

19.10 Clean Work Areas

All areas controlled by Pickering Associates, Inc. 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. Call for assistance. 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.

19.11 **Cranes**

There are two types of heavy duty cranes at Pickering Associates, Inc.. 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: Professional Operator/Rigger: Person whose principal assignment includes crane operation and rigging functions. The chief operator/rigger must ensure that those professional operator/riggers under his/her supervision maintain the necessary qualifications. 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. Incidental operator/riggers must be reexamined at least once every three years. Designated operator/riggers must have Government identification cards (Federal Form 46), endorsed appropriately. Before an employee may operate any of these cranes, the supervisor must arrange for the employee to receive incidental crane-operator training on the appropriate crane. Successful

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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.

19.12 Loading the Crane

The crane must not be loaded beyond its rated load except for test purposes. Hoist chain or hoist rope must be free of kinks or twists and must not be wrapped around the load. Crane operators and floor persons must follow the OSHA requirements relating to moving the load.

19.13 Design Parameters

The Engineering Department is responsible for establishing design parameters relating to general requirements, cabs, foot walks and ladders, stops, bumpers and rail sweeps, brakes, electric equipment, hoisting equipment, warning devices, and other appurtenances to cranes as required in Occupational Safety and Health Standards, 29 CFR 1910.179. In addition the Responsible Safety Officer shall establish design parameters for bridge cranes and to incorporate provisions for maintenance work stations (platforms, railings, ladders, tie-off points, etc.) that permit maintenance personnel to safely perform their operations. Cranes must have the load capacity marked on each side of the bridge or on the rail in the case of a monorail and jib crane. Mobile cranes must have the load capacity marked in a convenient location. The Responsible Safety Officer must review specifications developed by the Engineering Department.

19.14 Crane Inspections Required

All crane functional operating mechanisms for maladjustment interfering with proper operation and for excessive wear of components. On days used inspection is required by a crane operator. Deterioration or leakage in lines, tanks, valves, drain pumps, and other parts of air or hydraulic systems. On days used inspection is required by a crane operator. Hooks. On days used visual inspection by a crane operator is required. Annual inspections must have signed reports by Pickering Associates, Inc. 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. Wire-rope slings, including end connections, for excessive wear, broken wires, stretch, kinking, or twisting. Visual inspection by 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. Pickering Associates, Inc. or an outside Engineer must inspect rope reeving for noncompliance with manufacturer's recommendations before first use and annually thereafter.

19.15 Six Month Crane Inspections

According to OSHA requirements a crane that has been idle for a period of over six months must be inspected before being placed in service.

19.16 Crane Maintenance

All crane hooks and lifting fixtures must be magnafluxed at least every four years. This will normally coincide with the certification load testing and inspection. The person in charge of a crane may request testing of hooks and/or lifting fixtures more frequently than every four years. The person in charge must give the Responsible Safety Officer a schedule of the desired frequency for testing the hook so that disassembly of the hook block can be included in their schedule for preventive maintenance of a particular crane.

19.17 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.

19.18 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.

19.19 Forklift Operators

The Responsible Safety Officer must be notified whenever it is desired to acquire a crane from excess sources.

19.20 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 and caution and instruction markings are in place and legible. The user must consider that changes in load dimension may affect truck capacities.

19.21 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.

19.22 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 fork lift 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 Pickering Associates, Inc.. 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.

19.23 Safety Inspection, Responsibility

Each operator is responsible for the safety and safety inspection of his or her lifting devices (such as screw pin shackles, hoist rings, commercial equipment, etc.) and for its lifting fixtures (such as spreader bars, special slings, Pickering Associates, Inc.-designed equipment, etc.). All lifting fixtures designed at Pickering Associates, Inc. must be proof tested to twice their maximum rated loads before they are placed in service. A magnetic particle inspection or other appropriate crack detection inspection is required after the proof test. The capacity must be marked on the lifting fixture so that it is clearly visible to the equipment operator. All lifting device pins of 2-inch diameter or larger

must have a magnetic particle inspection before they are placed in service. All lifting fixtures must be inspected at least once every four years (or upon request), using magnetic particle detection or other appropriate methods. The Responsible Safety Officer must ensure that proof testing is performed on all lifting fixtures designed at Pickering Associates, Inc. before they are placed in service; that adequate test records are kept; and that the lifting devices and fixtures are used and maintained correctly. Upon request, the Responsible Safety Officer will provide a current test report to the user. For equipment designed at Pickering Associates, Inc., the Responsible Safety Officer must provide the user with the information required to operate the lifting device or fixture safely.

19.24 Design Stress

The Responsible Safety Officer is responsible for the design, fabrication, and testing of lifting fixtures. The design stress for lifting fixtures must not exceed one-fifth (1/5) the ultimate strength of the material at the operating temperature. If welded fabrication is used, the design stress must take into consideration any weakening effects of welding, such as those that occur in aluminum alloys. If practical, avoid welding in the fabrication of lifting fixtures; however, if welding is used, design and fabrication must conform to the latest standards of the American Welding Society (AWS). Careful, thoughtful design and follow-up are required. The following rules apply when designing welded units: There must be no possibility of subjecting welds to tearing loads. Stresses in welds must be substantially uniform. Where possible, design lifting fixtures so that the main loads are carried only by structural members, plates, or shear pins rather than by welds. Examine this possibility carefully. Welded fabrications must be proof tested to twice the maximum rated load followed by a magnetic particle inspection or other appropriate crack inspection method. Primary load carrying welds and welds in tension must be x-rayed. The screw-thread engagement required for conservative development of the full strength of a screw fastener depends upon the screw fastener material and the material of the threaded member. If the fastener is made of the same material as the female threaded member, e.g., a low-carbon steel bolt and a hole threaded into low-carbon steel, an engagement of at least 1-1/2 diameters is required. A hardened steel screw (Allen screw) in mild steel requires at least 2-diameters engagement. A low-carbon screw fastener, threaded into a tapped hole in aluminum alloy, copper, or cast iron must have a threaded engagement of 1-1/2 diameters. Other material combinations must be approved by the Responsible Safety Officer. Safety hoist rings may be used to make lifts up to their rated load when screwed 2 hoist ring bolt diameters into materials such as aluminum alloy, copper, or cast iron. When special high strength bolts are required, consider the use of nonstandard pitch threads to avoid the possibility of using the wrong bolt in the lifting device. Any bolt used as part of Pickering Associates, Inc.-designed lifting fixtures or pickup devices must be tested to two (2) times its rated load. A crack detection inspection must be performed after the load test to ensure soundness. It is desirable to maintain a supply of tested bolts in the event that one is lost. Once a lifting device or fixture is in the hands of the user, it is the user's responsibility to ensure that the proper bolt is inserted to the proper depth and correctly torqued.

19.25 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 non-vertical. 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 20 - Fall Protection

20.1 Introduction

Pickering Associates, Inc. will determine if the walking/working surfaces on which its employees are to work have the strength and structural integrity to support employees safely. Employees will be allowed to work on those surfaces only when the surfaces have the requisite strength and structural integrity.

20.2 Unprotected Sides and Edges

Each employee on a walking/working surface (horizontal and vertical surface) with an unprotected side or edge which is 6 feet (1.8m) or more above a lower level will be protected from falling by the use of guardrail systems, safety net systems, or personal fall arrest systems.

20.3 Leading Edges

Each employee who is constructing a leading edge 6 feet (1.8m) or more above the lower levels will be protected from falling by guardrail systems, safety net systems, or personal fall arrest systems. Exception: When Pickering Associates, Inc. can demonstrate that it is infeasible or creates a greater hazard to use these systems, Pickering Associates, Inc. will develop and implement a fall protection plan.

Each employee on a walking/working surface 6 feet (1.8m) or more above a lower level where leading edges are under construction, but who is not engaged in the leading edge work, will be protected from falling by a guardrail system, safety net system, or personal fall arrest system. If a guardrail system is chosen to provide the fall protection, and a controlled access zone has already been established for leading edge work, the control line may be used in lieu of a guardrail along the edge that parallels the leading edge.

20.4 Hoist Areas

Each employee in a hoist area will be protected from falling 6 feet (1.8m) or more to lower levels by guardrail systems or personal fall arrest systems. If guardrail systems, (or chain gate, or guardrail) or portions thereof, are removed to facilitate the hoisting operation (e.g., during landing of materials), and an employee must lean through the access opening or out over the edge of the access opening (to receive or guide

equipment and materials, for example), that employee will be protected from fall hazards by a personal fall arrest system.

20.5 Holes

Each employee on walking/working surfaces will be protected from falling through holes (including skylights) more than 6 feet (1.8m) above lower levels, by personal fall arrest systems, covers, or guardrail systems erected around such holes.

Each employee on a walking/working surface will be protected from tripping in or stepping into or through holes (including skylights) by covers.

Each employee on a walking/working surface will be protected from objects falling through holes (including skylights) by covers.

20.6 Formwork and Reinforcing Steel

Each employee on the face of formwork or reinforcing steel will be protected from falling 6 feet (1.8m) or more to lower levels by personal fall arrest systems, safety net systems, or positioning device systems.

20.7 Ramps, Runways, and Other Walkways

Each employee on ramps, runways, and other walkways will be protected from falling 6 feet (1.8m) or more to lower levels by guardrail systems.

20.8 Excavations

Each employee at the edge of an excavation 6 feet (1.8m) or more in depth will be protected from falling by guardrail systems, fences, or barricades when the excavations are not readily seen because of plant growth or other visual barrier.

Each employee at the edge of a well, pit, shaft, and similar excavation 6 feet (1.8m) or more in depth will be protected from falling by guardrail systems, fences, barricades, or covers.

20.9 Dangerous Equipment

Each employee less than 6 feet (1.8m) above dangerous equipment will be protected from falling into or onto the dangerous equipment by guardrail systems or by equipment guards.

Each employee 6 feet (1.8m) or more above dangerous equipment will be protected from fall hazards by guardrail systems, personal fall arrest systems, or safety net systems.

20.10 Overhand Bricklaying and Related Work

Each employee performing overhand bricklaying and related work 6 feet (1.8m) or more above lower levels, will be protected from falling by guardrail system, safety net systems, personal fall arrest systems, or will work in a controlled access zone.

Each employee reaching more than 10 inches (25cm) below the level of the walking/working surface on which they are working, will be protected from falling by a guardrail system, safety net system, or personal fall arrest system.

20.11 Roofing Work on Low Slope - Roofs

Each employee engaged in roofing activities on low-slope roofs, with unprotected sides and edges 6 feet (1.8m) or more above lower levels will be protected from falling by guardrail systems, safety net systems, personal fall arrest systems, or a combination of warning line system and guardrail system, warning line system and safety net system, or warning line system and personal fall arrest system, or warning line system and safety monitoring system. Or on roofs 50-feet (15.25m) or less in width the use of a safety monitoring system alone (i.e., without the warning line system) is permitted.

Steep Roofs

Each employee on a steep roof with unprotected sides and edges 6 feet (1.8m) or more above lower levels will be protected from falling by guardrail systems with toeboards, safety net systems, or personal fall arrest systems.

Precast Concrete Erection

Each employee engaged in the erection of precast concrete members (including, but

not limited to the erection of wall panels, columns, beams, and floor and roof "tees") and related operations such as grouting of precast concrete members, who is 6 feet (1.8m) or more above lower levels will be protected from falling by guardrail systems, safety net systems, or personal fall arrest systems.

Residential Construction

Each employee engaged in residential construction activities 6 feet (1.8m) or more above lower levels will be protected by guardrail systems, safety net system, or personal fall arrest system.

Wall Openings

Each employee working on, at, above, or near wall openings (including those with chutes attached) where the outside bottom edge of the wall opening is 6 feet (1.8m) or more above lower levels and the inside bottom edge of the wall opening is less than 39 inches (1.0m) above the walking/working surface, will be protected from falling by the use of a guardrail system, safety net system, or a personal fall arrest system.

Walking/Working Surface Not Otherwise Addressed

Each employee on a walking/working surface 6 feet (1.8m) or more above lower levels will be protected from falling by a guardrail system, safety net system, or personal fall arrest system.

Protection From Falling Objects

When an employee is exposed to falling objects, Pickering Associates, Inc. will have each employee wear a hard hat and will implement one of the following measures:

- Erect toeboards, screens, or guardrail systems to prevent objects from falling from higher levels
- Erect a canopy structure and keep potential falling objects far enough from the edge of the higher level so that those objects would not go over the edge if they were accidentally displaced
- Barricade the area to which objects could fall, prohibit employees from entering the barricaded area, and keep objects that may fall far enough away from the edge of a higher level so that those objects would not go over the edge if they were accidentally displaced

20.12 Fall Protection Systems Criteria and Practices

Pickering Associates, Inc. will provide and install all fall protection systems for an employee before that employee begins the work that necessitates the fall protection.

Guardrail Systems

Guardrail systems and their use will comply with the following provisions:

- Top edge height of top rails, or equivalent guardrail system members, will be 42 inches (1.1m) plus or -minus 3 inches (8cm) above the walking/working level. When conditions warrant, the height of the top edge may exceed the 45-inch height, provided the guardrail system meets all other criteria of this paragraph.
- Midrails, screens, mesh, intermediate vertical members, or equivalent intermediate structural members will be installed between the top edge of the guardrail system and the walking/working surface when there is no wall or parapet wall at least 21 inches (53cm) high.
- Screens and mesh, when used, will extend from the top rail to the walking/working level and along the entire opening between top rail supports.
- Intermediate members (such as balusters), when used between posts, will be not more than 19 inches (48cm) apart.
- Other structural members (such as additional midrails and architectural panels) will be installed such that there are no openings in the guardrail system that are more than 19 inches (.5m) wide.
- Guardrail systems will be capable of withstanding, without failure, a force of at least 200 pounds (890 N) applied within 2 inches (5.1cm) of the top edge, in any outward or downward direction, at any point along the top edge.
- When the 200 pound load is applied in a downward direction, the top edge of the guardrail will not deflect to a height less than 39 inches (1.0m) above the walking/working level.
- Midrails, screens, mesh, intermediate vertical members, solid panels, and equivalent structural members will be capable of withstanding, without failure, a force of at least 150 pounds applied in any downward or outward direction at any point along the midrail or other member.
- Guardrail systems will be so surfaced as to prevent injury to an employee from punctures or lacerations, and to prevent snagging of clothing.

The ends of all top rails and midrails will not overhang the terminal posts, except where such overhang does not constitute a projection hazard.

Steel banding and plastic banding will not be used as top rails or midrails. Top rails and midrails will be at least one-quarter inch (0.6cm) nominal diameter or thickness to prevent cuts and lacerations. If wire rope is used for top rails, it will be flagged at not more than 6-foot intervals with high visibility material.

When guardrail systems are used at hoisting areas, a chain, gate or removable guardrail section will be placed across the access opening between guardrail sections when hoisting operations are not taking place.

When guardrail systems are used at holes, they will be erected on all unprotected sides or edges of the hole.

When guardrail systems are used around holes used for the passage of materials, the hole will have not more than two sides provided with removable guardrail sections to allow the passage of materials. When the hole is not in use, it will be closed over with a cover, or a guardrail system will be provided along all unprotected sides or edges.

When guardrail systems are used around holes which are used as points of access (such as ladderways), they will be provided with a gate, or be so offset that a person cannot walk directly into the hole.

Guardrail systems used on ramps and runways will be erected along each unprotected side or edge.

Manila, plastic or synthetic rope being used for top rails or midrails will be inspected as frequently as necessary to ensure that it continues to meet the strength requirements.

Safety Net Systems

Safety net systems and their use will comply with the following provisions:

Safety nets will be installed as close as practicable under the walking/working surface on which employees are working, but in no case more than 30 feet (9.1 m) below such level. When nets are used on bridges, the potential fall area from the walking/working surface to the net will be unobstructed.

Safety nets will extend outward from the outermost projection of the work surface as follows:

Vertical distance from working level to horizontal plane of net	Minimum required horizontal distance of outer edge of net from the edge of the working surface
Up to 5 feet	8 feet

More than 5 feet up to 10 feet	10 feet
More than 10 feet	13 feet

Safety nets will be installed with sufficient clearance under them to prevent contact with the surface or structures below when subjected to an impact force equal to the drop test.

Safety nets and their installations will be capable of absorbing an impact force equal to that produced by the drop test.

Defective nets will not be used. Safety nets will be inspected at least once a week for wear, damage, and other deterioration. Defective components will be removed from service. Safety nets will also be inspected after any occurrence which could affect the integrity of the safety net system.

Materials, scrap pieces, equipment, and tools which have fallen into the safety net will be removed as soon as possible from the net and at least before the next work shift.

The maximum size of each safety net mesh opening will not exceed 36 square inches (230cm²) nor be longer than 6 inches (15cm) on any side, and the opening, measured center-to-center of mesh ropes or webbing, will not be longer than 6 inches (15cm). All mesh crossings will be secured to prevent enlargement of the mesh opening.

Each safety net (or section of it) will have a border rope for webbing with a minimum breaking strength of 5,000 pounds (22.2kN).

Connections between safety net panels will be as strong as integral net components and will be spaced not more than 6 inches (15cm) apart.

Personal Fall Arrest Systems

Personal fall arrest systems and their use will comply with the provisions set forth below:

Connectors will be drop forged, pressed or formed steel, or made of equivalent materials.

Connectors will have a corrosion-resistant finish, and all surfaces and edges will be smooth to prevent damage to interfacing parts of the system.

Dee-rings and snaphooks will have a minimum tensile strength of 5,000 pounds (22.2kN).

Dee-rings and snaphooks will be proof-tested to a minimum tensile load of 3,600 pounds (16kN) without cracking, breaking, or taking permanent deformation.

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Snaphooks will be sized to be compatible with the member to which they are connected to prevent unintentional disengagement of the snaphook by depression of the snaphook keeper by the connected member, or will be locking type snaphook designed and used to prevent disengagement of the snaphook by the contact of the snaphook keeper by the connected member.

Unless the snaphook is a locking type and designed for the following connections, snaphooks will not be engaged:

- Directly to webbing, rope or wire rope
- To each other
- To a dee-ring to which another snaphook or other connector is attached
- To a horizontal lifeline
- To any object which is incompatibly shaped or dimensioned in relation to the snaphook such that unintentional disengagement could occur by the connected object being able to depress the snaphook keeper and release itself

On suspended scaffolds or similar work platforms with horizontal lifelines which may become vertical lifelines, the devices used to connect to a horizontal lifeline will be capable of locking in both directions on the lifeline.

Horizontal lifelines will be designed, installed, and used, under the supervision of a qualified person, as part of a complete personal fall arrest system, which maintains a safety factor of at least two.

Lanyards and vertical lifelines will have a minimum breaking strength of 5,000 pounds (22.2kN).

During the construction of elevator shafts, two employees may be attached to the same lifeline in the hoistway, provided both employees are working atop a false car that is equipped with guardrails; the strength of the lifeline is 10,000 pounds (5,000 pounds per employee attached) (44.4kN); and all other criteria specified in this paragraph for lifelines have been met.

Lifelines will be protected against being cut or abraded.

Self-retracting lifelines and lanyards which automatically limit freefall distance to 2feet (0.61m) or less will be capable of sustaining a minimum tensile load of 3,000 pounds (13.3 kN) applied to the device with the lifeline or lanyard in the fully extended position.

Self-retracting lifelines and lanyards which do not limit free fall distance to 2 feet (0.61m) or less, ripstitch lanyards, and tearing and deforming lanyards will be capable of sustaining a minimum tensile load of 5,000 pounds (22.2kN) applied to the device with the lifeline or lanyard in the fully extended position.

Ropes and straps (webbing) used in lanyards, lifelines, and strength components of body belts and body harnesses will be made from synthetic fibers.

Anchorage used for attachment of personal fall arrest equipment will be independent of any anchorage being used to support or suspend platforms and capable of supporting at least 5,000 pounds (22.2kN) per employee attached, or will be designed, installed, and used as follows:

As part of a complete personal fall arrest system which maintains a safety factor of at least two; and

Under the supervision of a qualified person.

Personal fall arrest systems, when stopping a fall, will:

Limit maximum arresting force on an employee to 900 pounds (4kN) when used with a body harness

Limit maximum arresting force on an employee to 1,800 pounds (8kN) when used with a body harness.

Be rigged such that an employee can neither free fall more than 6 feet (1.8m), nor contact any lower level

Bring an employee to a complete stop and limit maximum deceleration distance an employee travels to 3.5 feet (1.07m)

Have sufficient strength to withstand twice the potential impact energy of an employee free falling a distance of 6 feet (1.8m), or the free fall distance permitted by the system, whichever is less.

The attachment point of the body harness will be located in the center of the wearer's back near shoulder level, or above the wearer's head.

Body harnesses, and components will be used only for employee protection (as part of a personal fall arrest system or positioning device system) and not to hoist materials.

Personal fall arrest systems and components subjected to impact loading will be immediately removed from service and will not be used again for employee protection until inspected and determined by a competent person to be undamaged and suitable for reuse.

Pickering Associates, Inc. will provide for prompt rescue of employees in the event of a fall or will assure that employees are able to rescue themselves.

Personal fall arrest systems will be inspected prior to each use for wear, damage and other deterioration, and defective components will be removed from service.

Personal fall arrest systems will not be attached to guardrail systems, nor will they be attached to hoists except as specified.

When a personal fall arrest system is used at hoist areas, it will be rigged to allow the movement of the employee only as far as the edge of the walking/working surface.

Positioning Device Systems

Positioning device systems and their use will conform to the following provisions:

Positioning devices will be rigged such that an employee cannot free fall more than 2 feet (.9m).

Positioning devices will be secured to an anchorage capable of supporting at least twice the potential impact load of an employee's fall or 3,000 pounds (13.3kN), whichever is greater.

Connectors will be drop forged, pressed or formed steel, or made of equivalent materials.

Connectors will have a corrosion-resistant finish, and all surfaces and edges will be smooth to prevent damage to interfacing parts of this system.

Connecting assemblies will have a minimum tensile strength of 5,000 pounds (22.2kN).

Dee-rings and snaphooks will be proof-tested to a minimum tensile load of 3,600 pounds (16kN) without cracking, breaking, or taking permanent deformation.

Snaphooks will be sized to be compatible with the member to which they are connected to prevent unintentional disengagement of the snaphook by depression of the snaphook keeper by the connected member, or will be a locking type snaphook designed and used to prevent disengagement of the snaphook by the contact of the snaphook keeper by the connected member.

Unless the snaphook is a locking type and designed for the following connections, snaphooks will not be engaged:

- Directly to webbing, rope or wire rope

- To each other
- To a dee-ring to which another snaphook or other connector is attached
- To a horizontal lifeline
- To any object which is incompatibly shaped or dimensioned in relation to the snaphook such that unintentional disengagement could occur by the connected object being able to depress the snaphook keeper and release itself

Positioning device systems will be inspected prior to each use for wear, damage, and other deterioration, and defective components will be removed from service.

Body belts, harnesses, and components will be used only for employee protection (as part of a personal fall arrest system or positioning device system) and not to hoist materials.

Warning Line Systems

Warning line systems and their use will comply with the following provisions:

The warning line will be erected around all sides of the roof work area.

When mechanical equipment is not being used, the warning line will be erected not less than 6 feet (1.8m) from the roof edge.

When the mechanical equipment is being used, the warning line will be erected not less than 6 feet (1.8m) from the roof edge which is parallel to the direction of mechanical equipment operation, and not less than 10 feet (3.1m) from the roof edge which is perpendicular to the direction of mechanical equipment operation.

Points of access, materials handling areas, storage areas, and hoisting areas will be connected to the work area by an access path formed by two warning lines.

When the path to a point of access is not in use, a rope, wire, chain, or other barricade, equivalent in strength and height to the warning line, will be placed across the path at the point where the path intersects the warning line erected around the work area, or the path will be offset such that a person cannot walk directly into the work area.

Warning lines will consist of ropes, wires, or chains, and supporting stanchions erected as follows:

The rope, wire, or chain will be flagged at not more than 6 foot (1.8m) intervals with high-visibility material

The rope, wire, or chain will be rigged and supported in such a way that its lowest point

(including sag) is no less than 34 inches (.9m) from the walking/working surface and its highest point is no more than 39 inches (1.0m) from the walking/working surface

After being erected, with the rope, wire, or chain attached, stanchions will be capable of resisting, without tipping over, a force of at least 16 pounds applied horizontally against the stanchion, 30 inches (.8m) above the walking/working surface, perpendicular to the warning line, and in the direction of the floor, roof, or platform edge

The rope, wire, or chain will have a minimum tensile strength of 500 pounds (22.2kN), and after being attached to the stanchions, will be capable of supporting, without breaking

The line will be attached at each stanchion in such a way that pulling on one section of the line between stanchions will not result in slack being taken up in adjacent sections before the stanchion tips over

No employee will be allowed in the area between a roof edge and a warning line unless the employee is performing roofing work in that area.

Mechanical equipment on roofs will be used or stored only in areas where employees are protected by a warning line system, guardrail system, or personal fall arrest system.

Controlled Access Zones

Controlled access zones and their use will conform to the following provisions:

When used to control access to areas where leading edge and other operations are taking place the controlled access zone will be defined by a control line or by any other means that restricts access.

When control lines are used, they will be erected not less than 6 feet (1.8m) nor more than 25 feet (7.7m) from the unprotected or leading edge, except when erecting precast concrete members.

When erecting precast concrete members, the control line will be erected not less than 6 feet (1.8m) nor more than 60 feet (18m) or half the length of the member being erected, whichever is less, from the leading edge.

The control line will extend along the entire length of the unprotected or leading edge and will be approximately parallel to the unprotected or leading edge.

The control line will be connected on each side to a guardrail system or wall.

When used to control access to areas where overhand bricklaying and related work are taking place:

The controlled access zone will be defined by a control line erected not less than 10 feet (3.1m) nor more than 15 feet (4.5m) from the working edge.

The control line will extend for a distance sufficient for the controlled access zone to enclose all employees performing overhand bricklaying and related work at the working edge and will be approximately parallel to the working edge.

Additional control lines will be erected at each end to enclose the controlled access zone.

Only employees engaged in overhand bricklaying or related work will be permitted in the controlled access zone.

Control lines will consist of ropes, wires, tapes, or equivalent materials, and supporting stanchions as follows:

Each line will be flagged or otherwise clearly marked at not more than 6 feet (1.8m) intervals with high-visibility material.

Each line will be rigged and supported in such a way that its lowest point (including sag) is not less than 39 inches (1m) from the walking/working surface and its highest point is not more than 45 inches (1.3m)[50 inches (1.3m) when overhand bricklaying operations are being performed] from the walking/working surface.

Each line will have a minimum breaking strength of 200 pounds (.88kN).

On floors and roofs where guardrail systems are not in place prior to the beginning of overhand bricklaying operations, controlled access zones will be enlarged, as necessary, to enclose all points of access, material handling areas, and storage areas.

On floors and roofs where guardrail systems are in place, but need to be removed to allow overhand bricklaying work or leading edge work to take place, only that portion of the guardrail necessary to accomplish that day's work will be removed.

Safety Monitoring Systems

Safety monitoring systems and their use will comply with the following provisions:

Pickering Associates, Inc. will designate a competent person to monitor the safety of other employees and Pickering Associates, Inc. will ensure that the safety monitor complies with the following:

The safety monitor will be competent to recognize fall hazards

The safety monitor will warn the employee when it appears that the employee is unaware of a fall hazard or is acting in an unsafe manner

The safety monitor will be on the same walking/working surface and within visual

sighting distance of the employee being monitored

The safety monitor will be close enough to communicate orally with the employee

The safety monitor will not have other responsibilities which could take the monitor's attention from the monitoring function

Mechanical equipment will not be used or stored in areas where safety monitoring systems are being used to monitor employees engaged in roofing operation on low-slope roofs.

No employee, other than an employee engaged in roofing work (on low-sloped roofs) or an employee covered by a fall protection plan, will be allowed in an area where an employee is being protected by a safety monitoring system.

Each employee working in a controlled access zone will be directed to comply promptly with fall hazard warnings from safety monitors.

Covers

Covers for holes in floors, roofs, and other walking/working surfaces will meet the following requirements:

Covers located in roadways and vehicular aisles will be capable of supporting, without failure, at least twice the maximum axle load of the largest vehicle expected to cross over the cover.

All other covers will be capable of supporting, without failure, at least twice the weight of employees, equipment, and materials that may be imposed on the cover at any one time.

All covers will be secured when installed so as to prevent accidental displacement by the wind, equipment, or employees.

All covers will be color coded or they will be marked with the word "HOLE" or "COVER" to provide warning of the hazard.

Protection From Falling Objects

Falling object protection will comply with the following provisions:

Toeboards, when used as falling object protection, will be erected along the edge of the overhead walking/working surface for a distance sufficient to protect employees below.

Toeboards will be capable of withstanding, without failure, a force of at least 50 pounds (222N) applied in any downward or outward direction at any point along the toeboard.

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Toeboards will be a minimum of 3 1/2 inches (9cm) in vertical height from their top edge to the level of the walking/working surface. They will have not more than 1/4 inch (0,6cm) clearance above the walking/working surface. They will be solid or have openings not over 1 inch (2.5cm) in greatest dimension.

Where tools, equipment, or materials are piled higher than the top edge of a toeboard, paneling or screening will be erected from the walking/working surface or toeboard to the top of a guardrail system's top rail or midrail, for a distance sufficient to protect employees below.

Guardrail systems, when used as failing object protection, will have all openings small enough to prevent passage of potential failing objects.

During the performance of overhand bricklaying and related work:

No materials or equipment except masonry and mortar will be stored within 4 feet (1.2m) of the working edge.

Excess mortar, broken or scattered masonry units, and all other materials and debris will be kept clear from the work area by removal at regular intervals.

During the performance of roofing work:

Materials and equipment will not be stored within 6 feet (1.8m) of roof edge unless guardrails are erected at the edge.

Materials which are piled, grouped, or stacked near a roof edge will be stable and self-supporting.

Canopies, when used as failing object protection, will be strong enough to prevent collapse and to prevent penetration by any objects which may fall onto the canopy.

20.13 Fall Protection Plan

This option is available only to employees engaged in leading edge work, precast concrete erection work, or residential construction work who can demonstrate that it is infeasible or it creates a greater hazard to use conventional fall protection equipment. The fall protection plan must conform to the following provisions.

- The fall protection plan will be prepared by a qualified person and developed specifically for the site where the leading edge work, precast concrete work, or residential construction work is being performed and the plan must be maintained up to

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date.

- Any changes to the fall protection plan will be approved by a qualified person.
- A copy of the fall protection plan with all approved changes will be maintained at the job site.
- The implementation of the fall protection plan will be under the supervision of a competent person.
- The fall protection plan will document the reasons why the use of conventional fall protection systems (guardrails systems, personal fall arrest systems, or safety nets systems) are infeasible or why their use would create a greater hazard.
- The fall protection plan will include a written discussion of other measures that will be taken to reduce or eliminate the fall hazard for workers who cannot be provided with protection from the conventional fall protection systems. For example, Pickering Associates, Inc. will discuss the extent to which scaffolds, ladders, or vehicle mounted work platforms can be used to provide a safer working surface and thereby reduce the hazard of falling.

The fall protection plan will identify each location where conventional fall protection methods cannot be used. These locations will then be classified as controlled access zones.

Where no other alternative measure has been implemented, Pickering Associates, Inc. will implement a safety monitoring system.

The fall protection plan must include a statement which provides the name or other method of identification for each employee who is designated to work in controlled access zones. No other employees may enter controlled access zones.

In the event an employee falls, or some other related, serious incident occurs (e.g., a near miss) the company will investigate the circumstances of the fall or other incident to determine if the fall protection plan needs to be changed (e.g., new practices, procedures, or training) and will implement those changes to prevent similar types of falls or incidents.

20.14 Training Requirements

Training Program

Pickering Associates, Inc. will provide a training program for each employee who might be exposed to fall hazards. The program will enable each employee to recognize the hazards of falling and will train each employee in the procedures to be followed in order to minimize these hazards.

Pickering Associates, Inc. will assure that each employee has been trained, as necessary, by a competent person qualified in the following areas:

- The nature of fall hazards in the work area
- The correct procedures for erecting, maintaining, disassembling, and inspecting the fall protection systems to be used
- The use and operation of guardrail system, personal fall arrest systems, safety net systems, warning line systems, safety monitoring systems, controlled access zones, and other protection to be used
- The role of each employee in the safety monitoring system when this system is used
- The limitations on the use of mechanical equipment during the performance of roofing work on low-sloped roofs
- The correct procedures for the handling and storage of equipment and materials and the erection of overhead protection
- The role of employees in fall protection plans
- The standards contained in this subpart

Certification of Training

Pickering Associates, Inc. will verify compliance with the above paragraph by preparing a written certification record. The written certification record will contain the name or other identity of the employee trained, the date(s) of the training, and the signature of the person who conducted the training or the signature of the supervisor. If Pickering Associates, Inc. relies on training conducted by another company or completed prior to the effective date of this section, the certification record will indicate the date the company determined the prior training was adequate rather than the date of actual training.

The latest training certification will be maintained.

Retraining

When the supervisor has reason to believe that any affected employee who has already been trained does not have the understanding and skill required by the above paragraph, Pickering Associates, Inc. will retrain each such employee. Circumstances where retraining is required include, but are not limited to, situations where:

- Changes in the workplace render previous training obsolete
- Changes in the types of fall protection equipment to be used render previous training obsolete
- Inadequacies in an affected employee's knowledge or use of fall protection systems or equipment indicate that the employee has not retained the requisite understanding or skill

20.15 Statement of Company Policy

Pickering Associates, Inc. is dedicated to the protection of its employees from on-the-job injuries. All employees of Pickering Associates, Inc. have the responsibility to work safely on the job. The purpose of this plan is to supplement our standard safety policy by providing safety standards specifically designed to cover fall protection on this job and to ensure that each employee is trained and made aware of the safety provisions which are to be implemented by this plan prior to the start of erection.

This fall protection plan addresses the use of other than conventional fall protection at a number of areas on the project, as well as identifying specific activities that require non-conventional means of fall protection. These areas include:

- Connecting activity (point of erection).
- Leading edge work.
- Unprotected sides or edge.
- Grouting.
- Installation of floor sheathing and joists.
- Roof sheathing operations.
- Erecting exterior walls
- Setting and bracing of roof trusses and rafters

In these cases, conventional fall protection systems may not be the safest choice. This plan is designed to enable employees to recognize the fall hazards on this job and to establish the procedures that are to be followed in order to prevent falls to lower levels or through holes and openings in walking/working surfaces.

Each employee will be trained in these procedures and strictly adhere to them except when doing so would expose the employee to a greater hazard. If, in the employees opinion, this is the case, the employee is to notify the foreman of the concern and the concern addressed before proceeding.

Safety policy and procedure on any one project cannot be administered, implemented, monitored and enforced by any one individual. The total objective of a safe, accident free work environment can only be accomplished by a dedicated, concerted effort by every individual involved with the project from management down to the last employee. Each employee must understand their value to Pickering Associates, Inc.; the costs of accidents, both monetary, physical, and emotional; the objective of the safety policy and procedures; the safety rules that apply to the safety policy and procedures; and what their individual role is in administering, implementing, monitoring, and compliance of their safety policy and procedures. This allows for a more personal approach to compliance through planning, training, understanding and cooperative effort, rather than by strict enforcement, If for any reason an unsafe act persists, strict enforcement will be implemented.

It is the responsibility of Ryan K. Taylor to implement this Fall Protection Plan. Ryan K. Taylor is responsible for continual observational safety checks of their work operations and to enforce the safety policy and procedures. The crew supervisor or foreman is responsible for correcting any unsafe acts or conditions immediately.

It is the responsibility of the employee to understand and adhere to the procedures of this plan and to follow the instruction of the crew supervisor or foreman. It is also the responsibility of the employee to bring to management's attention any unsafe or hazardous conditions or acts that may cause injury to either themselves or any other employees. Any changes to this Fall Protection Plan must be approved by Ryan K. Taylor.

20.16 Fall Protection Systems for Precast / Prestress Structures

Where conventional fall protection is infeasible or creates a greater hazard at the leading edge and during initial connecting activity, we plan to do this work using a safety monitoring system and expose only a minimum number of employees for the time necessary to actually accomplish the job. The maximum number of workers to be monitored by one safety monitor is six (6). We are designating the following trained employees as designated erectors and they are permitted to enter the controlled access zones and work without the use of conventional fall protection.

Safety Monitor:

Designated Erector:

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Designated Erector:

Designated Erector:

Designated Erector:

Designated Erector:

Designated Erector:

The safety monitor will be identified by wearing a _____ hard hat. The designated erectors will be identified by one of the following methods:

- They will wear a _____ colored arm band
- They will wear a _____ colored hard hat
- They will wear a _____ colored vest

Only individuals with the appropriate experience, skills, and training will be authorized as designated erectors. All employees that will be working as designated erectors under the safety monitoring system will have been trained and instructed in the following areas:

- Recognition of the fall hazards in the work area (at the leading edge and when making initial connection s--point of erection).
- Avoidance of fall hazards using established work practices which have been made known to the employees.
- Recognition of unsafe- practices or working conditions that could lead to a fall, such as windy conditions.
- The function, use, and operation of safety monitoring systems, guardrail systems, body belt/harness systems, control zones and other protection to be used.
- The correct procedure for erecting, maintaining, disassembling and inspecting the system(s) to be used.
- Knowledge of construction sequence or the erection plan.

A conference will take place prior to starting work involving all members of the erection, crew, crane crew and supervisors of any other concerned contractors. This conference will be conducted by the precast concrete erection supervisor in charge of the project. During the pre-work conference, erection procedures and sequences pertinent to this job will be thoroughly discussed and safety practices to be used throughout the project will be specified. Further, all personnel will be informed that the controlled access zones are off limits to all personnel other than those designated erectors specifically trained to

work in that area.

Safety Monitoring System:

A safety monitoring system is a fall protection system in which a competent person is responsible for recognizing and warning employees of fall hazards. The duties of the safety monitor are to:

- Warn by voice when approaching the open edge in an unsafe manner.
- Warn by voice if there is a dangerous situation developing which cannot be seen by another person involved with product placement, such as a member getting out of control.
- Make the designated erectors aware they are in a dangerous area.
- Be competent in recognizing fall hazards.
- Warn employees when they appear to be unaware of a fall hazard or are acting in an unsafe manner.
- Be on the same walking/working surface as the monitored employees and within visual sighting distance of the monitored employees.
- Be close enough to communicate orally with the employees.
- Not allow other responsibilities to encumber monitoring. If the safety monitor becomes too encumbered with other responsibilities, the monitor will:
 - Stop the erection process
 - Turn over other responsibilities to a designated erector
 - Turn over the safety monitoring function to another designated, competent person.

The safety monitoring system will not be used when the wind is strong enough to cause loads with large surface areas to swing out of radius, or result in loss of control of the load, or when weather conditions cause the walking/working surfaces to become icy or slippery.

Control Zone System:

A controlled access zone is an area designated and clearly marked, in which leading edge work may take place without the use of guardrail, safety net or personal fall arrest systems to protect the employees in the area. Control zone systems will comply with the following provisions:

- When used to control access to areas where leading edge and other operations are taking place the controlled access zone will be defined by a control line or by any other means that restricts access.

When control lines are used, they will be erected not less than 6 feet (1.8m) nor more than 60 feet (18m) or half the length of the member being erected, whichever is less, from the leading edge.

- The control line will extend along the entire length of the unprotected or leading edge and will be approximately parallel to the unprotected or leading edge.
- The control line will be connected on each side to a guardrail system or wall.
- Control lines will consist of ropes, wires, tapes, or equivalent materials, and supporting stanchions as follows:
 - Each line will be flagged or otherwise clearly marked at not more than 6 foot (1.8m) intervals with high-visibility material.
 - Each line will be rigged and supported in such a way that its lowest point (including sag) is not less than 39 inches (1 m) from the walking/working surface and its highest point is not more than 45 inches (1.3m) from the walking/working surface.
 - Each line will have a minimum breaking strength of 200 pounds (.88kN).

Holes:

All openings greater than 12 in. x 12 in. will have perimeter guarding or covering. All predetermined holes will have the plywood covers made in the precasters' yard and shipped with the member to the jobsite. Prior to cutting holes on the job, proper protection for the hole must be provided to protect the workers. Perimeter guarding or covers will not be removed without the approval of the erection foreman.

Precast concrete column erection through the existing deck required that many holes be provided through this deck. These are to be covered and protected. Except for the opening being currently used to erect a column, all opening protection is to left undisturbed. The opening being uncovered to erect a column will become part of the point of erection and will be addressed as part of this fall protection plan. This uncovering is to be done at the erection foreman's direction and will only occur immediately prior to "feeding" the columns through the opening. Once the end of the column is through the slab opening, there will no longer exist a fall hazard at this location.

Implementation of Fall Protection Plan:

EXAMPLE: The structure being erected is a multistory total precast concrete building consisting of columns, beams, wall panels and hollow core slabs and double tee floor and roof members.

The following is a list of the products and erection situations for this job:

Columns:

For columns 10 ft to 36 ft long, employees disconnecting crane hooks from columns will work from a ladder and wear a body belt/harness with lanyard and be tied off when both hands are needed to disconnect. For tying off, a vertical lifeline will be connected to the lifting eye at the top of the column, prior to lifting, to be used with a manually operated or mobile rope grab. For columns too high for the use of a ladder, 36 ft and higher, an added cable will be used to reduce the height of the disconnecting point so that a ladder can be used. This cable will be left in place until a point in erection that it can be removed safely. In some cases, columns will be unhooked from the crane by using an erection tube or shackle with a pull pin which is released from the ground after the column is stabilized.

The column will be adequately connected and/or braced to safely support the weight of a ladder with an employee on it.

Inverted Tee Beams:

Employees erecting inverted tee beams, at a height of 6 to 40 ft, will erect the beam, make initial connections, and in alignment from a ladder. If the employee needs to reach over the side of the beam to bar or make an adjustment to the alignment of the beam, they will mount the beam and be tied off to the lifting device in the beam after ensuring the load has been stabilized on its bearing. To disconnect the crane from the beam an employee will stand a ladder against the beam. Because the use of ladders is not practical at heights above 40 ft, beams will be initially placed with the use of tag lines and their final alignment made by a person on a manlift or similar employee positioning systems.

Spandrel Beams:

Spandrel beams at the exterior of the building will be aligned as closely as possible with the use of tag lines with the final placement of the spandrel beam made from a ladder at the open end of the structure. A ladder will be used to make the initial connections and a ladder will be used to disconnect the crane. The other end of the beam will be placed by the designated erector from the double tee deck under the observation of the safety monitor.

The beams will be adequately connected and/or braced to safely support the weight of a ladder with an employee on it.

Floor and Roof Members:

During installation of the precast concrete floor and/or roof members, the work deck continuously increases in area as more and more units are being erected and positioned. Thus, the unprotected floor/roof perimeter is constantly modified with the leading edge changing location as each member is installed. The fall protection for workers at the leading edge will be assured by properly constructed and maintained control zone lines not more than 60 ft away from the leading edge supplemented by a safety monitoring system to ensure the safety of all designated erectors working within the area defined by the control zone lines.

The hollow core slabs erected on the masonry portion of the building will be erected and grouted using the safety monitoring system. Grout will be placed in the space between the end of the slab and face shell of the concrete masonry by dumping from a wheelbarrow. The grout in the keyways between the slabs will be dumped from a wheelbarrow and then spread with long handled tools, allowing the worker to stand erect facing toward the unprotected edge and back from any work deck edge.

Whenever possible, the designated erectors will approach the incoming member at the leading edge only after it is below waist height so that the member itself provides protection against falls.

Except for the situations described below, when the arriving floor or roof member is within 2 to 3 inches of its final position, the designated erectors can then proceed to their position of erection at each end of the member under the control of the safety monitor. Crane hooks will be unhooked from double tee members by designated erectors under the direction and supervision of the safety monitor.

Designated erectors, while waiting for the next floor or roof member, will be constantly under the control of the safety monitor for fall protection and are directed to stay a minimum of six (6) feet from the edge. In the event a designated erector must move from one end of a member, which has just been placed at the leading edge, they must first move away from the leading edge a minimum of six (6) ft and then progress to the other and while maintaining the minimum distance of six (6) ft at all times.

Erection of double tees, where conditions require bearing of one end into a closed pocket and the other end on a beam ledge, restricting the tee legs from going directly into the pockets, require special considerations. The tee legs that are to bear in the closed pocket must hang lower than those at the beam bearing. The double tee will be "two-lined" in order to elevate one end higher than the other to allow for the low end to be ducked into the closed pocket using the following procedure.

The double tee will be rigged with a standard four-way spreader off of the main load line, an additional choker will be attached to the married point of the two-legged spreader at the end of the tee that is to be elevated. The double tee will be hoisted with the main load line and swung into a position as close as possible to the tee's final bearing elevation. When the tee is in this position and stabilized, the whip line load

block will be lowered to just above the tee deck. At this time, two erectors will walk out on the suspended tee deck at midspan of the tee member and pull the load block to the end of the tee to be elevated and attach the additional choker to the load block. The possibility of entanglement with the crane lines and other obstacles during this two lining process while raising and lowering the crane block on that second line could be hazardous to an encumbered employee. Therefore, the designated erectors will not tie off during any part of this process. While the designated erectors are on the double tee, the safety monitoring system will be used. After attaching the choker, the two erectors then step back on the previously erected tee deck and signal the crane operator to hoist the load with the whip line to the elevation that will allow for enough clearance to let the low end tee legs slide into the pockets when the main load line is lowered.

The erector, who is handling the lowered end of the tee at the closed pocket bearing, will step out on the suspended tee. An erection bar will then be placed between the end of the tee leg and the inside face of the pocketed spandrel member. The tee is barred away from the pocketed member to reduce the friction and lateral force against the pocketed member. As the tee is being lowered, the other erector remains on the tee which was previously erected to handle the other end. At this point the tee is slowly lowered by the crane to a point where the tee legs can freely slide into the pockets. The erector working the lowered end of the tee must keep pressure on the bar between the tee and the face of the pocketed spandrel member to very gradually let the tee legs slide into the pocket to its proper bearing dimension. The tee is then slowly lowered into its final erected position.

The designated erector should be allowed onto the suspended double tee, otherwise there is no control over the horizontal movement of the double tee and this movement could knock the spandrel off of its bearing or the column out of plumb. The control necessary to prevent hitting the spandrel can only be done safely from the top of the double tee being erected.

Loadbearing Wall Panels: The erection of the loadbearing wall panels on the elevated decks requires the use of a safety monitor and a controlled access zone that is a minimum of 25 ft and a maximum of 1/2 the length of the wall panels away from the unprotected edge, so that designated erectors can move freely and unencumbered when receiving the panels. Bracing, if required for stability, will be installed by ladder. After the braces are secured, the crane will be disconnected from the wall by using a ladder. The wall to wall connections will also be performed from a ladder.

Non-Loadbearing Panels (Cladding): The location of survey lines, panel layout and other installation prerequisites (prewelding, etc.) for non-loadbearing panels (cladding) will not commence until floor perimeter and floor openings have been protected. In some areas, it is necessary because of panel configuration to remove the perimeter protection as the cladding is being installed. Removal of perimeter protection will be performed on a bay to bay basis, just ahead of cladding erection to minimize temporarily unprotected floor edges. Those workers within 6 ft of the edge, receiving and positioning the cladding when the perimeter protection is removed will be tied off.

Detailing:

Employees exposed to falls of six (6) feet or more to lower levels, who are not actively engaged in leading edge work or connecting activity, such as welding, bolting, cutting, bracing, guying, patching, painting, or other operations, and who are working less than six(6) ft from an unprotected edge will be tied off at all times or guardrails will be installed. Employees engaged in these activities but who are more than six (6) ft from an unprotected edge as defined by the control zone lines, do not require fall protection but a warning line or control lines must be erected to remind employees they are approaching an area where fall protection is required.

20.17 Fall Protection Systems to be Used for Residential Construction

Installation of roof trusses/rafters, exterior wall erection, roof sheathing, floor sheathing and joist/truss activities will be conducted by employees who are specifically trained to do this type of work and are trained to recognize the fall hazards. The nature of such work normally exposes the employee to the fall hazard for a short period of time. This Plan details how Pickering Associates, Inc. minimizes these hazards.

Controlled Access Zones

When using the Plan to implement the fall protection options available, workers must be protected through limited access to high hazard locations. Before any non-conventional fall protection systems are used as part of the work plan, a Controlled Access Zone (CAZ) will be clearly defined by the competent person as an area where a recognized hazard exists. The demarcation of CAZ will be communicated by the competent person in a recognized manner, either through signs, wires, tapes, ropes or chains.

Pickering Associates, Inc. will take the following steps to ensure that the CAZ is clearly marked or controlled by the competent person:

1. All access to the CAZ must be restricted to authorized entrants.
2. All workers who are permitted in the CAZ will be listed in the appropriate sections of the Plan (or be visibly identifiable by the competent person) prior to implementation.
3. The competent person will ensure that all protective elements of the CAZ be implemented prior to the beginning of work.

Installation Procedures for Roof Truss and Rafter Erection

During the erection and bracing of roof trusses/rafters, conventional fall protection may present a greater hazard to workers. Safety nets, guardrails and personal fall arrest systems will not provide adequate fall protection because the nets will cause the walls to collapse, while there are no suitable attachment or anchorage points for guardrails or personal fall arrest systems.

Jobs requiring workers to use a ladder for the entire installation process will cause a greater hazard because the worker must stand on the ladder with his back or side to the front of the ladder. While erecting the truss or rafter the worker will need both hands to maneuver the truss and therefore cannot hold onto the ladder. In addition, ladders cannot be adequately protected from movement while trusses are being maneuvered into place. Many workers may experience additional fatigue because of the increase in overhead work with heavy materials, which can also lead to a greater hazard.

Exterior scaffolds cannot be utilized on this job because the ground, after recent backfilling, cannot support the scaffolding. In most cases, the erection and dismantling of the scaffold would expose workers to a greater fall hazard than erection of the trusses/rafters.

On all walls eight feet or less, workers will install interior scaffolds along the interior wall below the location where the trusses/rafters will be erected. "Sawhorse" scaffolds constructed of 46 inch sawhorses; and 2 x 10 planks will often allow workers to be elevated high enough to allow for the erection of trusses and rafters without working on the top plate of the wall.

In structures that have walls higher than eight feet and where the use of scaffolds and ladders would create a greater hazard, safe working procedures will be utilized when working on the top plate and will be monitored by the crew supervisor. During all stages of truss/rafter erection the stability of the trusses/rafters will be ensured at all times.

Pickering Associates, Inc. will take the following steps to protect workers who are exposed to fall hazards while working from the top plate installing trusses/rafters:

- Only the following trained workers will be allowed to work on the top plate during roof truss or rafter installation:
- Workers will have no other duties to perform during truss/rafter erection procedures.
- All trusses/rafters will be adequately braced before any worker can use the truss/rafter as a support.
- Workers will remain on the top plate using the previously stabilized truss/rafter as a support while other trusses/rafters are being erected.
- Workers will leave the area of the secured trusses only when it is necessary to

secure another truss/rafter.

- The first two trusses/rafters will be set from ladders leaning on side walls at points where the walls can support the weight of the ladder.
- A worker will climb onto the interior top plate via a ladder to secure the peaks of the first two trusses/rafters being set.

The workers responsible for detaching trusses from cranes and/or securing trusses at the peaks traditionally are positioned at the peak of the trusses/rafters. There are also situations where workers securing rafters to ridge beams will be positioned on top of the ridge beam.

Pickering Associates, Inc. will take the following steps to protect workers who are exposed to fall hazards while securing trusses/rafters at the peak of the trusses/ridge beam:

- Only the following trained workers will be allowed to work at the peak during roof truss or rafter installation:
- Once truss or rafter installation begins, workers not involved in that activity will not stand or walk below or adjacent to the roof opening or exterior walls in any area where they could be struck by falling objects.
- Workers will have no other duties than securing/bracing the trusses/ridge beam.
- Workers positioned at the peaks or in the webs of trusses or on top of the ridge beam will work from a stable position, either by sitting on a "ridge seat" or other equivalent surface that provides additional stability or by positioning themselves in previously stabilized trusses/rafters and leaning into and reaching through the trusses/rafters.
- Workers will not remain on or in the peak/ridge any longer than necessary to safely complete the task.

Roof Sheathing Operations

Workers typically install roof sheathing after all trusses/rafters and any permanent truss bracing is in place. Roof structures are unstable until some sheathing is installed, so workers installing roof sheathing cannot be protected from fall hazards by conventional fall protection systems until it is determined that the roofing system can be used as an anchorage point. At that point, employees will be protected by a personal fall arrest system.

Trusses/rafters are subject to collapse if a worker falls while attached to a single truss

with a belt/harness. Nets could also cause collapse, and there is no place to attach guardrails.

All workers will ensure that they have secure footing before they attempt to walk on the sheathing, including cleaning shoes/boots of mud or other slip hazards.

To minimize the time workers must be exposed to a fall hazard, materials will be staged to allow for the quickest installation of sheathing.

Pickering Associates, Inc. will take the following steps to protect workers who are exposed to fall hazards while installing roof sheathing:

Once roof sheathing installation begins, workers not involved in that activity will not stand or walk below or adjacent to the roof opening or exterior walls in any area where they could be struck by falling objects.

The competent person will determine the limits of this area, which will be clearly communicated to workers prior to placement of the first piece of roof sheathing.

The competent person may order work on the roof to be suspended for brief periods as necessary to allow other workers to pass through such area when this would not create a greater hazard.

Only qualified workers will install roof sheathing.

The bottom row of roof sheathing may be installed by workers standing in truss webs.

After the bottom row of roof sheathing is installed, a slide guard extending the width of the roof will be securely attached to the roof. Slide guards are to be constructed of no less than nominal 4" height capable of limiting the uncontrolled slide of workers. Workers should install the slide guard while standing in truss webs and leaning over the sheathing.

Additional rows of roof sheathing may be installed by workers positioned on previously installed rows of sheathing. A slide guard can be used to assist workers in retaining their footing during successive sheathing operations.

Additional slide guards will be securely attached to the roof at intervals not to exceed 13 feet as successive rows of sheathing are installed. For roofs with pitches in excess of 9-in-12, slide guards will be installed at four-foot intervals.

When wet weather (rain, snow, or sleet) are present, roof sheathing operations will be suspended unless safe footing can be assured for those workers installing sheathing.

When strong winds (above 40 miles per hour) are present, roof sheathing operations are to be suspended unless wind breakers are erected.

Installation of Floor Joists and Sheathing

During installation of floor sheath in g/joists (leading edge construction), the following steps will be taken to protect workers:

- Only the following trained workers will be allowed to install floor joists or sheathing:
 - Materials for the operations will be conveniently stages to allow for easy access to workers.
 - The first floor joists or trusses will be rolled into position and secured either from the ground, ladders or sawhorse scaffolds.
 - Each successive floor joist or truss will be rolled into place and secured from a platform created from a sheet of plywood laid over the previously secured floor joists or trusses.
 - Except for the first row of sheathing which will be installed from ladders or the ground, workers will work from the established deck.
 - Any workers not assisting in the leading edge construction while leading edges still exist (e.g., cutting the decking for the installers) will not be permitted within six feet of the leading edge under construction.

Erection of Exterior Walls

During the construction and erection of exterior walls, Pickering Associates, Inc. will take the following steps to protect workers:

- Only the following trained workers will be allowed to erect exterior walls:
 - A painted line six feet from the perimeter will be clearly marked prior to any wall erection activities to warn of the approaching unprotected edge.
 - Materials for operations will be conveniently staged to minimize fall hazards.
 - Workers constructing exterior walls will complete as much cutting of materials

and other preparation as possible away from the edge of the deck.

20.18 Enforcement

Constant awareness of and respect for fall hazards, and compliance with all safety rules are considered conditions of employment. The crew supervisor or foreman, as well as individuals in the Safety and Personnel Department, reserve the right to issue disciplinary warnings to employees, up to and including termination, for failure to follow the guidelines of this program.

20.19 Accident Investigations

All accidents that result in injury to workers, regardless of their nature, will be investigated and reported. It is an integral part of any safety program that documentation take place as soon as possible so that the cause and means of prevention can be identified to prevent a reoccurrence.

In the event that an employee falls or there is some other related, serious incident occurring, this plan will be reviewed to determine if additional practices, procedures, or training need to be implemented to prevent similar types of falls or incidents from occurring.

20.20 Changes to Plan

Any changes to the plan will be approved by Ryan K. Taylor. This plan will be reviewed by a qualified person as the job progresses to determine if additional practices, procedures or training needs to be implemented by the competent person to improve or provide additional fall protection. Workers will be notified and trained, if necessary, in the new procedures. A copy of this plan and all approved changes will be maintained at the jobsite.

20.21 Glossary of Terms

Anchorage - a secure point of attachment for lifelines, lanyards or deceleration devices.

Body Belt (safety belt) - a strap with means both for securing it about the waist and for attaching it to a lanyard, lifeline, or deceleration device. (No longer acceptable for fall protection after 1-1-98)

Body Harness - straps which may be secured about the employee in a manner that will distribute the fall arrest forces over at least the thighs, pelvis, waist, chest and shoulders with means for attaching it to other components of a personal fall arrest system.

Buckle - any device for holding the body belt or body harness closed around the employee's body.

Connector - a device which is used to couple (connect) parts of the personal fall arrest system and positioning device systems together. It may be an independent component of the system, such as a carabiner, or it may be an integral component of part of the system (such as a buckle or dee-ring sewn into a body belt or body harness, or a snap-hook spliced or sewn to a lanyard or self-retracting lanyard).

Controlled Access Zone (CAZ) - an area in which certain work (e.g., overhand bricklaying) may take place without the use of guardrail systems, personal fall arrest systems, or safety net systems and access to the zone is controlled.

Dangerous Equipment - equipment (such as pickling or galvanizing tanks, degreasing units, machinery, electrical equipment, and other units) which, as a result of form or function, may be hazardous to employees who fall onto or into such equipment.

Deceleration Device - any mechanism, such as a rope grab, rip-stitch lanyard, specially-woven lanyard, tearing or deforming lanyards, automatic self-retracting lifelines / lanyards, etc., which serves to dissipate a substantial amount of energy during a fall arrest, or otherwise limit the energy imposed on an employee during fall arrest.

Deceleration Distance - the additional vertical distance a falling employee travels, excluding lifeline elongation and free fall distance, before stopping, from the point at which the deceleration device begins to operate. It is measured as the distance between the location of an employee's body belt or body harness attachment point at the moment of activation (at the onset of fall arrest forces) of the deceleration device during a fall, and the location of that attachment point after the employee comes to a full stop.

Equivalent - alternative designs, materials, or methods to protect against a hazard which the company can demonstrate will provide an equal or greater degree of safety for employees than the methods, materials or designs specified in the standard.

Failure - load refusal, breakage, or separation of component parts. Load refusal is the point where the ultimate strength is exceeded.

Free Fall - the act of falling before a personal fall arrest system begins to apply force to

arrest the fall.

Free Fall Distance - the vertical displacement of the fall arrest attachment point on the employee's body belt or body harness between onset of the fall and just before the system begins to apply force to arrest the fall. This distance excludes deceleration distance, and lifeline/lanyard elongation, but includes any deceleration device slide distance or self retracting lifeline/lanyard extension before they operate and fall arrest forces occur.

Guardrail System - a barrier erected to prevent employees from falling to lower levels.

Hole - a gap or void 2 inches (5.1 cm) or more in its least dimension, in a floor, roof, or other walking/working surface.

Infeasible - that it is impossible to perform the construction work using a conventional fall protection system (i.e., guardrail system, safety net system, or personal fall arrest system) or that it is technologically impossible to use any one of these systems to provide fall protection.

Lanyard - a flexible line of rope, wire rope, or strap which generally has a connector of each end for connecting the body belt or body harness to a deceleration device, lifeline, or anchorage.

Leading Edge - the edge of a floor roof, or form work for a floor or other walking/working surface (such as the deck) which changes location as additional floor, roof, decking, or form work sections are placed, formed or constructed. A leading edge is considered to be an "unprotected side and edge" during periods when it is not actively and continuously under construction.

Lifeline - a component consisting of a flexible line for connection to an anchorage at one end to hang vertically (vertical lifeline), or for connection to anchorages at both ends to stretch horizontally (horizontal lifeline), and which serves as a means for connecting other components of a personal fall arrest system to the anchorage.

Low-Slope Roof - a roof having a slope less than or equal to 4 in 12 (vertical to horizontal).

Lower Levels - those area or surfaces to which an employee can fall. Such areas or surfaces include, but are not limited to, ground levels, floors, platforms, ramps, runways, excavations pits, tanks, material, water, equipment, structures, or portions thereof.

Mechanical Equipment - all motor or human propelled wheeled equipment used for roofing work, except wheelbarrows and mopcars.

Opening - a gap or void 30 inches (76 cm) or more high and 18 inches (48 cm) or more

wide, in a wall or partition, through which employees can fall to a lower level.

Overhand Bricklaying and Related Work - the process of laying bricks and masonry units such that the surface of the wall to be jointed is on the opposite side of the wall from the mason, requiring the mason to lean over the wall to complete the work. Related work includes mason tending and electrical installation incorporated into the brick wall during the overhand bricklaying process.

Personal Fall Arrest System - a system used to arrest an employee in a fall from a working level. It consists of an anchorage, connectors, a body belt or body harness and may include a lanyard, deceleration device, lifeline, or suitable combination of these. As of January 1, 1998, the use of a body belt for fall arrest is prohibited.

Positioning Device System - means a body belt or body harness system rigged to allow an employee to be supported on an elevated vertical surface, such as a wall, and work with both hands free while leaning.

Rope Grab - a deceleration device which travels on a lifeline and automatically, by friction, engages the lifeline and locks so as to arrest the fall of an employee. A rope grab usually employs the principle of inertial locking, cam/level locking, or both.

Roof - the exterior surface on the top of a building. This does not include floors or formwork which, because a building has not been completed, temporarily become the top surface of a building.

Roofing Work - the hoisting, storage, application, and removal of roofing materials and equipment, including related insulation, sheet metal, and vapor barrier work, but not including the construction of the roof deck.

Safety-Monitoring System - a safety system in which a competent person is responsible for recognizing and warning employees of fall hazards.

Self-Retracting Lifeline Lanyard - a deceleration device containing a drum-wound line which can be slowly extracted from, or retracted onto, the drum under slight tension during normal employee movement, and which, after onset of a fall, automatically locks the drum and arrests the fall.

Snaphook - a connector comprised of a hook-shaped member with a normally closed keeper, or similar arrangement, which may be opened to permit the hook to receive an object and, when released, automatically closes to retain the object. Snaphooks are generally one of two types.

1. The locking type with a self-closing, self-locking keeper which remains closed and locked until unlocked and pressed open for connection or disconnection.
2. The non-locking type with a self-closing keeper which remains closed until

pressed open for connection or disconnection. As of January 1, 1998, the use of a non-locking snaphook as part of personal fall arrest systems and positioning device systems is prohibited.

Steep Roof - a roof having a slope greater than 4 to 12 inches (vertical to horizontal).

Toeboard - a low protective barrier that will prevent the fall of materials and equipment to lower levels and provide protection from falls for personnel.

Unprotected Sides and Edges - any side or edge (except at entrances to points of access) of a walking/working surface, e.g., floor, roof, ramp, or runway where there is no wall or guardrail system at least 39 inches (1.0m) high.

Walking/Working Surface - any surface, whether horizontal or vertical on which an employee walks or works, including, but not limited to, floors, roofs, ramps, bridges, runways, formwork and concrete reinforcing steel but not including ladders, vehicles, or trailers, on which employees must be located in order to perform their job duties.

Warning Line System - means a barrier erected on a roof to warn employees that they are approaching an unprotected roof side or edge, and which designates an area in which roofing work may take place without the use of guardrail, body belt, or safety net systems to protect employees in the area.

Work Area - that portion of a walking/working surface where job duties are being performed.

20.22 Certification of Training for Fall Protection

Employee Name: ID#

Training Program included:

Date Training Completed:

Training Conducted By:
(Print Name)

Signature

Date

Pickering Associates, Inc.

Chapter 21 - Scaffolds – General Requirements

21.1 General Requirements.

(a) Scaffolds shall be provided for all work that cannot be done safely by employees standing on permanent or solid construction at least 20 inches wide, except where such work can be safely done from ladders.

EXCEPTIONS:

1. Work of a limited nature and of short duration when the permanent or solid construction is less than 20 inches in width and the fall distance does not exceed 15 feet in height and provided adequate risk control is recognized and maintained under competent supervision.
2. Work of a short duration from joists or similar members at 2 feet or closer centers, planks resting on these members forming a plank platform 12 inches wide or equivalent protection.

(b) Scaffolds shall be constructed of wood or other suitable materials such as steel or aluminum members of known strength characteristics. Where materials other than wood are used, or where scaffold designs differ from those specified in these Orders, the scaffold and its parts must provide a degree of strength, rigidity and safety equivalent to that provided by the described scaffold it replaces.

(c) Anchorage and bracing shall be such that scaffolds and falsework will be prevented from swaying, tipping, or collapsing.

(d) Scaffold lumber, except for planks, used on suspended or ladder-jack scaffolds, shall be the equivalent of "selected lumber," free from damage that affects its strength. (See definitions for lumber specifications.)

(e) (1) Extension planking of the finger type shall be made with at least 5 fingers on each side. These fingers shall be at least 1-inch by 2 1/8-inch selected straight-grained Douglas fir or material of equal strength. All metal fittings shall be adequate to maintain the structural qualities of the device.

(2) The length of the extended planking shall not exceed 12 feet 6 inches, and the actual mechanical overlap between the 2 halves shall be not less than 1/8 of the length of the extended planking. A substantial stop shall be provided to maintain this overlap.

(3) Not more than one employee shall be permitted at one time on any extension planking that is more than 3 feet in height.

(4) Extension planking shall not be used as a platform on ladder-jack, suspended, or other unstable scaffolds.

(f) (1) Except as specified in other Orders, all planking shall be at least equivalent to 2-inch x 10-inch (nominal) lumber selected for scaffold grade plank as defined Lumber--"Structural Plank."

(2) The maximum permissible spans for 2 x 10-inch (nominal) or 2 x 9-inch (rough) planks shall be as shown in the following Table:

Working Load (psf)	25	50	75
Permissible Span (ft.).....	10	8	7

(3) Manufactured planks with spans in excess of 10 feet shall be labeled to indicate the maximum safe working load based on a safety factor of four.

(4) All planks shall be capable of safely sustaining the intended load.

(g) Except as specified in other Orders, a scaffold plank shall not overhang its support by more than 18 inches, unless access to this overhanging portion is prevented by a guardrail, or other barrier, or unless the other plank end is securely anchored.

(h) Inspection of Lumber. All scaffold lumber shall be visually inspected for defects before and during use. Defective lumber shall not be used.

(i)

(1) Nailing. All nailed joints in scaffolds and wooden falsework must contain enough properly placed nails of ample size to carry the loads they are intended to support.

(2) Nailed joints or connections shall not be used to support concrete hoppers with a capacity in excess of 1/2 cubic yard.

(3) Double-headed nails shall not be used for attaching railings or in other service where the projections might catch on the clothing of workers or create similar hazards.

(4) No nail smaller than 8-penny shall be used in the construction of scaffolding.

(5) All nails shall be driven full length or to the first head when double-headed nails are used.

(6) The minimum number of nails per connection shall be in accordance with the following table:

	1" x 6" Material	1" x 8" Material	2" Material
Ledgers	4-8d	5-8d	2-16d
Ribbons	3-8d	3-8d	
Braces	3-8d	3-8d	2-16d
Guardrails	2-8d	2-8d	2-16d

(7) Lubricated or wax-coated nails shall not be used in the construction of scaffolds, falsework, or other temporary installations.

(j) Prohibited Types of Scaffolds. Lean-to or jack scaffolds, shore scaffolds, nailed brackets, loose tile, loose brick, loose blocks, stilts, or other similar unstable objects shall not be used as working platforms, or for the support of such platform.

EXCEPTION: Bricklayer's "jump boards" no higher than 20 inches above the regular scaffold platform are acceptable for such service when supported by piers of carefully piled bricks or concrete blocks.

(k) Erection and Dismantling.

(1) The erection and dismantling of scaffolds or falsework shall be performed under the supervision and direction of a qualified person.

NOTE: In addition to persons meeting the requirements of "qualified persons" or person(s) possessing a certification of competence in scaffold erection, dismantling and use issued by trade associations, State-approved apprenticeship or training programs or other similar training programs shall be considered a "qualified person(s)."

(2) Erection and dismantling of scaffolds shall be performed in accordance with good engineering practice. Where engineering design is required by these orders, the engineering drawings shall be made available at the job site during erection or upon request by the Division.

(3) All required ties to the structure shall be installed as soon as the scaffold has been completed to the tie-in area during erection.

(4) Ties shall only be removed during dismantling as the work progresses downward unless other methods are used to prevent the scaffold from falling over.

(5) No structural members shall be removed from scaffolds during dismantling operations below the level being dismantled.

(6) Where work platforms are proposed, guardrails shall be installed before other work not directly related to scaffold erection is permitted to begin.

(7) The requirements of the General Section (k) (2) through (6), inclusive, may be temporarily suspended for short durations, provided adequate risk control is recognized and maintained under immediate, competent supervision.

(l) Removal of Braces. Scaffolds or falsework installations shall not be altered by removing uprights, braces, or supports unless other members providing equivalent strength are substituted.

(m) Loading. Scaffolds shall not be overloaded. Material shall not be allowed to accumulate to the extent that a scaffold is subjected to loading it is not designed to support.

(n) Access.

(1) A safe and unobstructed means of access, such as a walkway, stair, or ladder shall be provided to all scaffold platforms.

(2) Climbing ladders or stairways on scaffolds used for access and egress shall be affixed or built into the scaffold by proper design and engineering, and shall be so located that their use will not disturb the stability of the scaffold.

(A) If a ladder is used as a means of access to the scaffold, it shall be securely attached and shall comply with the Section on Ladders.

(B) Permanent stairways shall comply with the applicable provisions of the

General Industry Safety Orders. Prefabricated scaffold steps or stairs shall comply with the design, manufacture and installation requirements of ANSI A10.8-1988, scaffolding-Safety Requirements, which is hereby incorporated by reference.

(C) Horizontal members of end frames may be designed and used as a climbing device provided that the steps are:

1. Reasonably parallel and level.
2. Continuous climb as required in this chapter under the Metal Scaffolds Section (a)(8), using frames of the like configuration.
3. Provided with sufficient clearance to provide a good handhold and foot space.

(o) Sloped Platforms. Platforms shall not be sloped more than 2 feet vertically to 10 feet horizontally and shall be positively secured against slipping from supports.

(p) Slippery Conditions. No worker shall be permitted to work on a scaffold platform where slippery conditions exist unless such conditions are a necessary part of the work.

(q) Overhead Protection. Workers on scaffolds who are exposed to overhead hazards shall be provided with overhead protection or other means that will effectively eliminate the hazard.

(r) Bolted Connections. Bolts used in the construction of scaffolds shall be of a size and in sufficient numbers at each connection to develop the designed strength of the scaffold.

(s) Hoisting of Materials. Where materials are line-hoisted onto a scaffold, a tag line shall be used where necessary to control the load.

(t) Platform Planks at Corners. When a scaffold materially changes its direction, the platform planks shall be laid to prevent tipping. The planks that meet the corner ledger at an angle shall be laid first, extending over the diagonally placed ledger far enough to have a good safe bearing, but not far enough to involve any danger from tipping. The planking running in the opposite direction at an angle shall be laid so as to extend over and rest on the first layer of planking.

21.2 Light-Trade Wooden Pole Scaffolds.

(a) Pole scaffolds to be used by carpenters, lathers, shinglers, painters, plasterers, sheet metal workers, or other trades not using heavy tools or storing heavy materials on the scaffolds, shall be constructed as follows:

(b) Light-Trade Exterior Scaffolds.

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(1) Uprights. For heights not to exceed 20 feet, the uprights shall be 2-inch by 4-inch lumber or heavier, spaced not more than 3 feet between uprights at right angles to the wall and not more than 10 feet center to center, parallel to the wall. The inside uprights may be omitted and ledgers attached to the permanent structure, provided that the method of attaching the ledgers to the permanent structure will make the connection as secure as though the ledger were nailed to the upright with 5 8-penny nails. The splices of uprights shall be made with square butt joints, and scabs of 1-inch by 4-inch or heavier material at least 48 inches long shall be nailed on 2 sides of each upright with 6 nails in each 1/2 of each scab. If the uprights of the scaffold rest on a surface that might cause slipping, a continuous sill or other means shall be provided to hold the uprights in place. When the scaffold is resting on earth or other such material, the uprights shall rest on and be secured to the equivalent of a 2-inch by 10-inch by 10-inch wooden base.

NOTE: 1 1/8-inch by 10-inch by 10-inch piece of exterior grade plywood may be used in lieu of the wooden base mentioned above.

(2) Ledgers and Ribbons. The platforms of the scaffold shall be supported by ledgers. For ledgers spanning not more than 3 feet between uprights, use 2 pieces of 1-inch by 6-inch board, 1 being on each side of the uprights and fastened securely at each point of support. Single 2-inch by 4-inch ledgers are not permitted. Vertical spacing of ribbons and ledgers shall not exceed 7 feet. The ribbons shall be 1-inch by 6-inch or heavier material, placed on the outer uprights, directly under, and in contact with, the ledgers. The ribbons shall be long enough to extend from upright to upright without splices.

EXCEPTIONS:

1. When metal ledgers are used or when ledgers are bolted or when a 45-degree angle brace is nailed to the uprights between double ledgers, and ledgers also nailed to this brace, the ribbon may be placed at other elevations such as guardrail height, but they cannot be eliminated from the scaffold.

2. Metal ledgers and ribbons that are part of a patented scaffold system may be used when installed in accordance with the manufacturer's instructions.

(3) Ties and Braces. The scaffold shall be securely tied to the building or structure by means of a double looped No. 12 iron wire, or single looped No. 10 iron wire or 1-inch by 4-inch boards with at least 2 nails at each connection or equivalent means. Ties shall connect to the inside uprights and shall not be more than 20 feet apart horizontally and vertically. The outside line of uprights shall contain sufficient diagonal bracing of 1-inch by 6-inch material in a vertical plane across the entire face of the scaffold in both directions to prevent swaying, tipping, or collapsing. (See Appendix Plate B-18).

EXCEPTION: Bracing of 2-inch by 4-inch material may be used provided that the bracing extends from ledger to next higher or lower ledger or from ledger to sill in the form of an "X" in the end bays and in every third bay in between so that the "X" bracing also extends from the upper-most ledger to the sill, vertically, in each of these bays.

(4) Railing. Open sides and ends of intermediate working levels 7 1/2 feet or more above grade shall be guarded by a 2-inch by 4-inch top rail nailed to the

uprights so that the top edge is between 42 inches and 45 inches above the platform. Midrails of at least 2-inch by 4-inch material are required at all work levels. The uppermost platform shall be protected by a top rail consisting of double 2-inch by 4-inch members. One member shall be fastened in a flat position on top of the uprights and the other member shall be fastened in an edge-up position to the inside of the uprights and at the side of the top member. A single 2-inch by 4-inch member having an allowable bending stress of at least 1,900 psi may be used as a top rail.

(5) Platforms.

(A) Platform planks shall be of 2-inch by 10-inch or larger material and of such length that they overlap the ledgers at each end by at least 6 inches. A plank shall not overlap an unsupported end of another plank. The working platform shall cover the entire space between scaffold uprights, except for the open area under the backrailing, which shall not be more than 8 inches wide. Platforms shall be at least 20 inches wide and within 14 inches of the structure wall.

When moving platforms to the next level, the old platform shall be left undisturbed until the new ledgers have been set in place ready to receive the platform planks.

EXCEPTION: A single 2-inch by 10-inch plank may be used for light trades work up to a height of 4 feet.

(B) Working platforms for light-trades work may be made of 3/4-inch Douglas fir plywood instead of 2-inch plank if the platform is at least 2 feet wide, nailed in place and supported on cross members at 4-foot or closer intervals along its length.

(C) Light-Trade Interior Scaffolds.

(1) Loading. For scaffolds of the following design the imposed load on the platform area shall not apply more than 1,500 pounds to any 1 ledger or a single upright, and the total load on the whole platform area shall not average more than 15 pounds per square foot.

(2) Uprights.

(A) For heights not to exceed 20 feet the uprights shall be 2-inch by 4-inch lumber, or heavier. For heights between 20 feet and 60 feet, the uprights shall be 3-inch by 4-inch lumber, or heavier, except for the top 20 feet which may be 2-inch by 4-inch material. The horizontal distance between uprights shall not exceed 10 feet measured either parallel or at right angles to the direction of the platform planks.

(B) If uprights are spliced, the joints must conform to that described in subsection 1640(b)(1), and they shall be located near a point where ribbons are attached or where equivalent lateral support is provided. Pairs of horizontal ribbons at right angles to one another are required at vertical intervals of 7 feet, or less.

(3) Ledgers and Ribbons. The platform of the scaffold shall be supported by ledgers made of one piece of 2-inch by 10-inch or heavier material, placed with the edge upward. The ribbons shall be 1-inch by 6-inch or heavier material, placed on all uprights directly under and in contact with the ledgers. Additional horizontal ribbons, in pairs at right angles to one another, shall be

provided at lower levels in order to provide lateral support for all uprights at vertical intervals not greater than 7 feet.

(4) Diagonal Braces. Each line of uprights shall contain sufficient diagonal bracing of 1-inch by 6-inch material in vertical planes, lengthwise and crosswise, to prevent swaying, tipping, or collapsing. If the scaffold extends to and bears against the walls of the building, the horizontal ribbons and ledgers may provide adequate support without diagonal braces, but provision must always be made for adequate lateral stability.

(5) Platforms.

(A) The platform shall consist of 2-inch by 10-inch or larger planks laid closely together. There shall be no other openings in the platform except those necessary for the passage of employees and material. Unless nailed in place, planks shall be of such length that they overlap the ledgers at each end by at least 6 inches. A plank shall not overlap an unsupported end of another plank.

(B) Working platforms shall cover the entire space between scaffold uprights, except for the open area under the backrailing which shall not be more than 8 inches.

(C) Platforms shall extend within 14 inches of the finished face of the building.

(D) Douglas fir plywood that is 3/4 inch thick, or thicker, may be used for platforms if the panels are 4 feet wide, or wider, and are supported on ledgers or crossmembers at 4-foot or closer intervals.

(6) Railings. Open sides of working levels 7 1/2 feet or more above grade shall be provided with top rails and midrails as specified in Light Tade Wooden Pole Scaffolds Subsection (b)(4).

When scaffold platforms are erected in sections it is necessary for workers to travel between these sections, such sections shall be provided with connecting runways equipped with railings as described in the Standard Railing Section.

21.3 Heavy-Trade Wooden Pole Scaffolds.

(a) Pole scaffolds to be used by bricklayers, stonemasons, concrete workers, or other trades using heavy tools or storing heavy material on the scaffold shall be constructed as follows:

(b) When buggies are used on scaffolds to transport concrete, a strong scaffold shall be designed that is capable of supporting a concentrated load equal to the weight of a loaded buggy at any point on girders, beams, or planking.

(c) Uprights. For heights not to exceed 20 feet, the uprights shall be of 4-inch by 4-inch lumber or heavier material, with a space of 4 feet between uprights at right angle to the wall and not more than 7 feet, center to center, parallel to the wall. The splices of 4-inch by 4-inch uprights shall be made with square butt joints, and scabs of 2-inch by 4-inch material at least 48 inches long shall be nailed in place on 2 sides with 6 nails in each 1/2 of each scab. Uprights laminated from 2-inch by 4-inch material are acceptable if the joints

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of each lamination are staggered, and either reinforced by scabs or so arranged that they occur at or near ribbon attachment points. If the uprights rest on a surface that might cause slipping, a continuous sill or other means shall be provided to hold the uprights in place. When the scaffold is resting on earth or other such material, the uprights shall rest on and be secured to the equivalent of a 2-inch by 10-inch by 10-inch wooden base.

Note: A 1 1/8-inch by 10-inch by 10-inch piece of exterior grade plywood may be used in lieu of the wooden base mentioned above.

(d) Ledgers and Ribbons.

(1) The platform shall be supported by ledgers and ribbons, nailed or bolted to the uprights. For ledgers spanning not more than 4 feet between uprights, use either 1 piece of 2-inch by 6-inch lumber securely fastened at each point of support or 2 pieces of 1-inch by 6-inch board, 1 being on each side of the uprights and fastened securely at each point of support.

(2) Ribbons shall be 1-inch by 6-inch or heavier material securely fastened to both inside and outside uprights directly under and in contact with the ledgers. Vertical spacing of ribbons and ledgers shall not exceed 7 feet. Ribbons shall be long enough to extend from upright to upright without splices.

(e) Railing. Open sides and ends of working levels 7 1/2 feet or more above grade shall be provided with top rails and midrails as specified in the Light Trade Wooden Pole Scaffolds subsection (b)(4).

EXCEPTION: That side of bricklayers' and masons' scaffolds adjacent to the work under construction provided that the wall is higher than the adjacent work platform.

(f) Ties and Braces.

(1) The scaffold shall be rigidly tied to the building or structure by means of a double looped No. 12 iron wire, or single looped No. 10 iron wire or equivalent or stronger material used in combination with spacer blocks between inside uprights and the structure. Ties shall connect to the inside uprights, and they shall be not more than 15 feet apart vertically or horizontally.

(2) The entire scaffold shall be rigidly braced with 1-inch by 6-inch boards, and every part thereof so secured as to prevent swaying, tipping, or collapsing. The diagonal bracing shall extend in both directions across the entire outside vertical face.

(g) Platforms.

(1) The platform shall be not more than 4 feet wide, constructed of planks at least 2 inches thick and 10 inches wide, laid closely together. Platform planks that are butt-ended (not overlapped) must be nailed to ledgers consisting of 2-inch by 6-inch or heavier material. If the planks are not nailed, they shall be of such length that they overlap the ledgers at each end by at least 6 inches. A plank shall not overlap an unsupported end of another plank. The working platform shall cover the entire space between scaffold uprights except for the open area under the backrailing, which shall not be more than 8 inches.

(2) Platforms shall extend within 14 inches of the finished face of the

building, except those used primarily by bricklayers and stonemasons shall extend to within 7 inches of the finish face of the building on which the work is being performed.

(3) When moving platforms to the next level, the old platform shall be left undisturbed until the new ledgers have been set in place ready to receive the platform planks.

21.4 Schedules of Timber Scaffolds up to 60 Feet in Height.

(Listed lumber sizes are those required for the specified spans; other sizes may be used for different spans, if equivalent strength is provided.)

	Light Interior	Heavy Trades	Trades
Uprights for scaffolds not over 20'in height.....	2"x4"	2"x4"	4"x4"
Uprights for scaffolds 20' to 60'in height.....	3"x4"	3"x4"	4"x6"
Ribbons directly under ledgers..	1"x6"	1"x6"	1"x6"
Ledgers.....	2"x10"	2--1"x6"	2--1"x6" or 1--2"x6"
Spacing uprights, transverse, at right angles to platform planks.....	10'	3' in clear	4' in clear
Spacing uprights, longitudinal, parallel to direction of platform planks.....	10'	10'	7'
Spacing ribbons or ledgers, vertical.....	7'0" max.	7'0" max.	7'0" max.
Splice pieces 48" long (for uprights).....	2--1"x4"	2--2"x4"	(2--2"x4")
Braces.....	1"x6"	1"x6"	1"x6"
Railing.....	2"x4"	2"x4"	2"x4"
Toeboard.....	1"x4"	1"x4"	1"x4"
Width of platform.....	10'	3' max.	4' max.
Planking	2" thick and at least 10" wide		

21.5 Scaffolds over 60 Feet in Height.

All wooden pole scaffolds over 60 feet in height shall be designed by a Civil Engineer currently registered in this State and constructed and erected in accordance with such design.

21.6 Metal Scaffolds.

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(a) General.

(1) Metal scaffolds shall be designed to support all dead, live, and wind loads to which they will be subjected.

(2) No metal scaffold equipment that is broken or deteriorated to the extent that its section is structurally weakened shall be used.

(3) All stationary scaffold legs, including those of outriggers, shall rest upon base plates available from the manufacturer for this service. Each base plate shall have support adequate to sustain the load and prevent horizontal movement.

When the scaffold or outrigger is resting on earth or soft material, the base plate shall rest on and be secured to the equivalent of a 2-inch by 10-inch by 10-inch wooden base.

NOTE: A 1 1/8-inch by 10-inch by 10-inch piece of exterior grade plywood may be used in lieu of the wooden base mentioned above.

(4) Platform planks shall not be placed on guardrails to obtain greater height.

(5) Metal scaffolds shall be securely tied to the building or structure by means of a double looped No. 12 iron wire, or single looped No. 10 iron wire or equivalent at intervals not to exceed 30 feet horizontally and subject to the following:

(A) Ties shall be required at the free ends of the scaffold when the height of the scaffold platform exceeds 3 times the least base dimension. The remaining ties of the first row shall be required when the height of the scaffold platform is four times the least base dimensions.

(B) Ties for subsequent levels shall be installed at 26-foot intervals vertically, with the last tie no further from the top than four times the least base dimension.

(C) As an alternate means, scaffolds shall be guyed or outriggers shall be used to prevent tipping or upsetting.

(D) Wind Loading. When scaffolds are partially or fully enclosed, specific precautions shall be taken to assure the frequency and adequacy of ties attaching the scaffolding to the building.

(6) Securely attached railings as provided by the scaffold manufacturer, or other material equivalent in strength to the standard 2- by 4-inch wood railing made from "selected lumber" (see definition), shall be installed on open sides and ends of work platforms 7 1/2 feet or more above grade. The top rail shall be located at a height of not less than 42 inches nor more than 45 inches measured from the upper surface of the top rail to the platform level. A midrail shall be provided approximately halfway between the top rail and the platform.

NOTE: Toeboards or side screens may also be required.

(A) "X" bracing is acceptable as a toprail if the intersection of the "X" occurs at 45 inches (plus or minus 3 inches) above the work platform, provided a horizontal rail is installed as a midrail between 19 and 25 inches above the work platform. The maximum vertical distance between the "X" brace members at the uprights shall not exceed 48 inches.

(B) "X" bracing is acceptable as a midrail if the intersection of the "X" falls between 20 inches and 36 inches above the work platform.

EXCEPTIONS:

(1) Railings are not required on that side of bricklayers' and masons' scaffold adjacent to the work under construction provided the wall is higher than the adjacent work platform.

(2) For end rail openings less than 3 feet, double wrapped iron wire at least No. 12 gauge in thickness, or wire rope at least ¼ inch minimum diameter is permitted, provided the wire or wire rope is securely fastened.

(7) Platform planks shall be of 2-inch by 10-inch or wider material and of such length that they overlap the ledgers at each end by at least 6 inches.

A plank shall not overlap an unsupported end of another plank.

The working platform shall cover the entire space between scaffold uprights, except for the open area under the back railing. Such open area shall not exceed 10 inches in width.

The inboard edge of the work platform shall be no more than 16 inches from the building or structure wall except for those scaffolds used by bricklayers and stonemasons the platforms of which shall extend to within 7 inches of the finish face of the building or structure on which the work is being performed.

(8) All ladders used for access shall conform to ladders. When only a part of the width of the metal scaffold frame conforms to ladder spacing, then these frames must be erected in a manner that makes a continuous ladder bottom to top, with ladder sides of the frames in a vertical line.

(b) Tube and Coupler Scaffolds.

(1) A light duty tube and coupler scaffold shall have all posts, ledgers, ribbons and bracing of nominal 2-inch O. D. steel tubing. The posts shall be spaced no more than 6 feet apart by 10 feet along the length of the scaffold. Other structural metals when used must be designed to carry an equivalent load. No dissimilar metals shall be used together.

(2) A medium duty tube and coupler scaffold shall have all posts, ribbons and bracing of nominal 2-inch O. D. steel tubing. Posts spaced not more than 6 feet apart by 8 feet along the length of the scaffold shall have ledgers of nominal 2 1/2-inch O. D. steel tubing. Posts spaced not more than 5 feet apart by 8 feet along the length of the scaffold shall have ledgers of nominal 2-inch O. D. steel tubing. Other structural metals, when used, must be designed to carry an equivalent load. No dissimilar metals shall be used together.

(3) A heavy duty tube and coupler scaffold shall have posts, ribbons, and bracing of nominal 2-inch O. D. steel tubing, with the posts spaced not more than 6 feet by 6 feet 6 inches. Other structural metals, when used, must be designed to carry an equivalent load. No dissimilar metals shall be used together.

(4) Tube and coupler scaffolds shall be limited in heights and working levels to those permitted in Tables 1, 2, and 3. Drawings and specifications of all tube and coupler scaffolds above the limitations in Tables 1, 2, and 3 shall be designed by a Civil Engineer currently registered in this State.

(5) All tube and coupler scaffolds shall be constructed and erected to support 4 times the maximum intended loads as set forth in Tables 1, 2, and 3, or as set forth in the specifications by a Civil Engineer currently registered in this State.

Table 1
Light Duty Tube and Coupler Scaffolds

 Uniformly distributed load.....Not to exceed 25 p.s.f.
 Post spacing (longitudinal).....10'0"
 Post spacing (transverse).....6'0"

Working Levels	Additional Planked Levels	Maximum Height
1	8	125'
2	4	125'
3	0	91'0"

Table 2
Medium Duty Tube and Coupler Scaffolds

 Uniformly distributed load..... Not to exceed 50 p.s.f.
 Post spacing (longitudinal)..... 8'0"
 Post spacing (transverse)..... 6'0"

Working Levels	Additional Planked Levels	Maximum Height
1	6	125'
2	0	78'0"

Table 3
Heavy Duty Tube and Coupler Scaffolds

 Uniformly distributed load.....Not to exceed 75 p.s.f.

Post spacing (longitudinal)..... 6'6"
 Post spacing (transverse)..... 6'0"

Working Levels	Additional Planked Levels	Maximum Height
1	6	125'

(6) Posts shall be accurately spaced, erected on suitable bases, and maintained plumb.

(7) Ribbons shall be erected along the length of the scaffold, located on both the inside and the outside posts at even height. Ribbons shall be interlocked to the inside and the outside posts at even heights. Ribbons shall be interlocked to form continuous lengths and coupled to each post. The bottom ribbons shall be located as close to the base as possible. Ribbons shall be placed not more than 6 feet 6 inches on centers.

(8) Ledgers shall be installed transversely between posts and shall be securely coupled to the posts bearing on the ribbon coupler. When coupled directly to the ribbons, the coupler must be kept as close to the posts as possible.

(9) Ledgers shall be at least 4 inches but not more than 12 inches longer than the post spacing or ribbon spacing.

(10) Cross bracing shall be installed across the width of the scaffold at least every third set of posts horizontally and every fourth ribbon vertically. Such bracing shall extend diagonally from the inner and outer ribbons upward to the next outer and inner ribbons.

(11) Longitudinal diagonal bracing on the inner and outer rows of poles shall be installed at approximately a 45 degree angle from near the base of the first outer post upward to the extreme top of the scaffold. Where the longitudinal length of the scaffold permits, such bracing shall be duplicated beginning at every fifth post. In a similar manner, longitudinal diagonal bracing shall also be installed from the last post extending back and upward toward the first post. Where conditions preclude the attachment of this bracing to the posts, it may be attached to the ribbons.

(c) Tubular Welded Frame Scaffolds.

(1) Metal tubular frame scaffolds, including accessories such as braces, brackets, trusses, screw legs, ladders, etc., shall be designed, constructed, and erected to safely support four times the maximum rated load. The scaffold manufacturer's erection instructions shall be followed on all installations.

(2) Spacing of panels or frames shall be consistent with the loads imposed.

(3) Panels or frames shall be braced by horizontal bracing, cross bracing, diagonal bracing or any combination thereof for securing vertical members together laterally, and the cross braces shall be of such length as will automatically square and align vertical members so that the erected scaffold is always plumb, square, and rigid. All brace connections shall be made secure.

(4) Panel or frame legs shall be set on adjustable bases or plain bases placed on mud sills or other foundations adequate to support the maximum anticipated load.

(5) Panels or frames shall be placed one on top of the other with coupling or stacking pins to provide proper vertical alignment of the legs.

NOTE: Where an intervening ledge prevents the vertical stacking of legs, the ledge may be used as a base provided that an equally safe installation is obtained.

(6) Where uplift may occur, panels shall be locked together vertically by pins or other equivalent suitable means.

(7) Drawings and specifications for all frame scaffolds over 125 feet in height above the base plates shall be designed by a Civil Engineer currently registered in This State.

21.7 Outrigger and Bracket Scaffolds.

(a) Heavy Trades.

(1) Outrigger beams of outrigger scaffolds for use by bricklayers, stonemasons, or other heavy trades shall be made of "selected lumber," or better. Those of the following sizes shall not project more than 6 feet beyond the outer support; shall be securely anchored and braced to prevent tipping or turning; and shall be spaced at centers of 7 feet 6 inches, or closer.

The inboard end of outrigger beams, measured from the fulcrum point to anchorage point, shall not be less than 1 1/2 times the outboard end in length. The fulcrum point of the beam shall rest on a secure bearing at least 6 inches square.

(2) On continuous scaffolds, where the beams may receive load from work platforms on each side, such beams shall not be less than 3 inches by 16 inches in cross section. For single scaffolds, consisting of a platform between 2 beams, the outrigger beams may have a smaller cross section, but not less than 3 inches by 12 inches. The platforms shall consist of planks, at least 2 inches by 10 inches, covering the full width of the projection. Planking shall be nailed or bolted or otherwise secured to outriggers.

The ends of the planks shall not project more than 18 inches beyond the outrigger, and not less than 6 inches, unless they are nailed in place. Every outrigger scaffold 7 1/2 feet or more in height shall be provided with a railing and toeboard. The top rail shall consist of double 2-inch by 4-inch members. One member shall be fastened in a flat position on top of the posts and the other member shall be fastened in an edge-up position to the inside of the posts and at the side of the top rail.

Additional protection in the form of screen enclosing the opening between rail and toeboard shall be provided if material on the scaffold is piled higher than the toeboard.

(3) Where additional working levels are required to be supported by the outrigger method, the plans and specifications of the outrigger and scaffolding structure shall be prepared by a Civil Engineer currently registered in

this State.

(b) Figure Four or Light Outrigger Scaffolds. Figure Four or light outrigger frames shall be spaced not more than 10 feet apart, and shall be constructed as follows from sound lumber:

The outrigger ledger shall consist of 2 pieces of 1-inch by 6-inch or heavier material nailed on opposite sides of the vertical and angle braces. Ledgers shall project not more than 3 feet 6 inches from the outside wall line and shall be substantially braced and secured to prevent tipping or turning. The knee or angle brace shall intersect the beam at least 3 feet from the wall at an angle of 45 degrees, and the lower end shall be nailed to a vertical brace near the point where it contacts the wall. The platform shall consist of 2 or more 2-inch by 10-inch planks, which shall be of such length that they extend at least 6 inches beyond ledgers at each end. Unsupported projecting ends of planks shall be limited to an overhang of 18 inches, or less.

Each wooden bracket shall be hooked over a well-secured and adequately strong supporting member.

Every Figure Four or light outrigger scaffold 7 1/2 feet or more in height shall be provided with a railing and toeboard. The top rail shall consist of double 2-inch by 4-inch members. One member shall be fastened in a flat position on top of the posts and the other member shall be fastened in an edge-up position to the inside of the posts and at the side of the top member.

(c) Stud Jacks. Stud-jack scaffold supports shall have ledgers of at least 2-inch by 6-inch materials, or equal, not longer than 5 feet, and each jack shall attach to not less than 2 sound, adequately fastened, 2-inch by 4-inch wall studs of normal length. Stud-jack scaffolds shall not be used at elevations of 7 1/2 feet or higher above the ground, unless so designed that a substantial backrail may be easily attached.

(d) Bracket Scaffolds. The use of bracket scaffolds shall be permitted only when through-bolted to walls, with at least 5/8-inch diameter bolts; welded to steel tanks; secured with a metal stud attachment device; or, hooked over a well-secured and adequately strong supporting member.

NOTE: This Order does not prohibit the use of bracket scaffolds that are an integral part of movable form panels or similar construction.

All form scaffolds shall be designed and erected with a minimum safety factor of 4, computed on the basis of the maximum rated load; i.e., the total of all loads including the working load, the weight of the scaffold, and such other loads as may be reasonably anticipated.

(1) Spacing of brackets shall be such that they are not more than 10 feet apart horizontally.

(2) If brackets are secured to walers held by snap-tie or she-bolts, they must extend through both wall forms and be properly secured.

(3) Railings shall be installed on bracket scaffolds for all heights 7 1/2 feet

or more above the ground.

(4) The platform shall consist of two or more 2-inch by 10-inch planks, laid closely together, and shall be of such length that they overlap the ledgers at each end by at least 6 inches. Unsupported projecting ends of planks shall be limited to an overhang of 18 inches or less.

(5) Wooden bracket form scaffolds shall be an integral part of the form panel and shall not be used to support loads exceeding 25 pounds per square foot, unless specifically designed for a heavier loading. Ledgers shall be made from 2-inch by 6-inch or heavier material and shall not project more than 3 feet 6 inches from the form panel. Uprights shall consist of 2-inch by 4-inch or heavier material. Scaffold planks shall be either nailed, wired or bolted to the ledgers. Planks shall overlap the ledgers at each end by at least 6 inches. Unsupported projecting ends of platform planks shall be limited to a maximum overhang of 18 inches. Ledgers shall not be spaced more than 8 feet on centers.

(6) Bracket scaffolds installed on metal tanks larger than 40 feet in diameter for the use of those engaged in tank erection operations, shall have platforms that are at least 30 inches wide, with the open ends and sides protected by a substantial railing, with midrail, which may be altered by the substitution of 3/8-inch wire rope for the top and middle rails. Platforms on 40-foot or smaller diameter tanks will be acceptable if not less than 24 inches in width, consisting normally of two 2-inch by 12-inch planks side by side, protected by railings as described above.

(e) Carpenters' Bracket Scaffolds.

(1) The brackets shall consist of a triangular wood frame not less than 2 x 3 inches in cross section, or of metal of equivalent strength. Each member shall be properly fitted and securely joined.

(2) Each bracket shall be attached to the structure by means of one of the following:

(A) A bolt, no less than 5/8-inch in diameter, which shall extend through to the inside of the building wall;

(B) A metal stud attachment device;

(C) Welding to steel tanks;

(D) Hooking over a well-secured and adequately strong supporting member.

(3) The brackets shall be spaced no more than 10 feet apart.

(4) No more than two employees shall occupy any given 10 feet of a bracket scaffold at any one time. Tools and materials shall not exceed 75 pounds in addition to the occupancy.

(5) The platform shall consist of not less than two 2- x 10-inch nominal size planks extending not more than 18 inches or less than 6 inches beyond each end support.

21.8 Tower Scaffolds and Rolling Scaffolds, Wood or Metal.

(a) The minimum dimension of the base of any free-standing tower or rolling scaffold shall not be less than 1/3 the height of the scaffold unless such

scaffold is securely guyed or tied. For restrictions when worker rides scaffold see paragraph (f) following.

(b) Construction and Erection.

(1) The uprights, ledgers, ribbons, braces, and splices shall be equivalent to the standards specified in other applicable Sections of these Orders. Railings are required if the platform is 7 1/2 feet or more above grade. Railings shall be installed in accordance with the provisions of Section Metal Scaffolds(a)(6).

NOTE: Toeboards or side screens may also be required.

(2) The screw jack shall extend into its leg tube at least 1/3 its length, but in no case shall the exposed thread exceed 12 inches.

(3) The uprights (legs of rolling scaffolds) shall not exceed 24 inches without being braced according to the manufacturer's specifications.

(c) Wheels or casters of rolling scaffolds shall be provided with an effective locking device, and kept locked when workers are climbing or working on the scaffold. At least 2 of the 4 casters or wheels shall be a swivel type. All wheels or casters shall be properly designed for strength and dimension to support at least 4 times the maximum intended load.

(d) Joints of metal scaffolds shall be locked together with lock pins, bolts or equivalent fastening, including caster joints. Lock pins used must be of a locking type.

EXCEPTION: Screw jacks and guardrail posts.

(e) Platform planks on rolling or tower scaffolds shall not project farther than 18 inches past supports at the edges of the scaffold. An effective method of preventing platform planks on rolling scaffolds from slipping off must be provided. The nailing of cleats of 1-inch material on the underside of each projecting end, or other equivalent means, will be acceptable. Platforms shall be tightly planked for the full width of the scaffold except for any necessary entrance openings.

NOTE: Refer to Standard Railings and Scaffolds – General Requirements (f) for regulations on required plank and platform sizes.

(f) Riding. Employees may ride on rolling scaffold moved by others below if the following conditions exist:

(1) The floor or surface is within 3 degrees of level, and free from pits, holes, or obstructions.

(2) The minimum dimension of the scaffold base, when ready for rolling, is at least 1/2 of the height. Outriggers, if used, shall be installed on both sides of staging.

(3) The wheels are equipped with rubber or similar resilient tires. For towers 50 feet or over metal wheels may be used.

(g) Ladders. Ladders or other unstable objects shall not be placed on top of rolling scaffolds to gain greater height.

(h) Scaffolds on Vehicles. When scaffolds are built on motor trucks or vehicles, they must be rigidly attached to the truck or vehicle. The attachment must be made in a manner that will develop the full strength of the scaffold in resisting an overturning force.

(i) Trucks or vehicles that have scaffolds attached to them shall have a device in use whenever employees are on the scaffold that prevents swaying or listing of the platforms.

21.9 Horse Scaffolds.

(a) General. (1) Lumber for construction of scaffolded horses shall be of "selected lumber" grade.

NOTE: The lumber sizes specified are nominal sizes for which standard finished sizes may be substituted.

(2) The members of horses used for scaffolds shall be securely nailed or bolted together, and well braced to prevent collapse.

(3) The distance between the bottoms of adjacent legs measured perpendicular to the ledger shall be approximately 1/2 the horse height.

(4) The shimming of horse ledgers to obtain added height is prohibited.

(5) Horses or parts which have become weak or defective shall not be used.

(6) When horse legs are extended by splicing, the joints must be butt-ended, and scabs not less than 18 inches long and of the same cross section as the leg shall be nailed on each side of the joint. As an alternative, new legs of adequate length may be installed, provided that they completely overlap the original legs and are well secured to them from top to bottom. Vertical extensions shall not be used to extend height of metal folding horses if the stability of the horse is impaired.

(7) When arranged in tiers, each horse shall be placed directly over the horse in the tier below.

(8) On all scaffolds arranged in tiers, the legs shall be nailed down or otherwise secured to the planks to prevent displacement or thrust and each tier shall be substantially cross braced.

(9) Railings meeting the requirements shall be installed on all open sides and ends of work platforms 7 1/2 feet or more above the ground, floor or level underneath.

(b) Light Trades.

(1) Horses for light-trade scaffolds shall have top horizontal members or ledgers of 2-inch by 4-inch lumber or material of equivalent strength, if the

distance between the leg connections is 4 feet or less. Ledgers of 2-inch by 6-inch lumber or material of equivalent strength are required if the distance between the leg connections is greater than 4 feet but does not exceed 8 feet. If the distance between leg connections exceeds 8 feet, the ledger strength must be increased in proportion to the amount by which the 8-foot distance is exceeded.

(2) The legs of horses for light-trade scaffolds shall be 1-inch by 6-inch lumber or material of equivalent strength for horses not exceeding 4 feet in height and 2-inch by 4-inch lumber or material of equivalent strength for horses between 4 feet and 10 feet in height. Horse scaffolds shall not be constructed or arranged more than two tiers or 10 feet in height.

(c) Heavy Trades.

(1) Horses for heavy-trade scaffolds shall have top horizontal members or ledgers of 3-inch by 4-inch lumber or material of equivalent strength, if the distance between the leg connections is 4 feet or less. Ledgers of 2-inch by 6-inch lumber or material of equivalent strength are required if the distance between the leg connections is greater than 4 feet but does not exceed 8 feet. If the distance between leg connections exceeds 8 feet, the ledger strength must be increased in proportion to the amount by which the 8-foot distance is exceeded.

(2) The legs of horses for heavy-trade scaffolds shall be 1-inch by 8-inch lumber or material of equivalent strength, for horses not exceeding 4 feet in height, and 2-inch by 4-inch lumber or material of equivalent strength, for horses between 4 feet and 10 feet in height.

(d) Collapsible Types.

(1) Collapsible horses constructed of well-braced frames hinged at the top may be used in place of the specified rigid horses, if construction is such that equivalent strength is provided.

(2) Adjacent legs of a collapsible horse shall be connected near the bottom with securely attached chains, hinged brackets, or other suitable links to prevent the legs from spreading beyond the distance intended. The height of collapsible horse scaffolds shall not exceed 6 feet.

(e) Platforms.

(1) Scaffold platforms shall not be supported by single horses having a total height exceeding 10 feet. Tiered horse scaffolds shall be limited to 10 feet in height made from no more than 2 tiers of horses. All horse scaffolds shall be substantially constructed and braced both transversely and laterally.

(2) Platforms shall be not less than 20 inches wide for light trades, and 4 feet wide for bricklayers, stonemasons, stone cutters, or concrete workers. Platforms used primarily by bricklayers or stonemasons shall extend to within 5 inches of the building face upon which the work is being performed. A single 2-inch by 10-inch plank may be used for light trades work up to a height of 4 feet.

(3) Planks used for platforms shall not be less than 2 inches by 10 inches, and

the distance between supports shall not exceed 10 feet for light trades and 7 feet 6 inches for heavy trades.

(4) For horse scaffolds up to a height of 6 feet, platform planks shall not be more than 2 inches apart. Platform planks on higher scaffolds shall be laid closely together. Planks shall be of such length that they overlap the supports at each end by at least 6 inches. A plank shall not overlap an unsupported end of another plank. Unsupported projecting ends of planks shall be limited to an overhang of 18 inches or less.

(5) Douglas fir plywood that is 3/4 inch thick or thicker may be used for platforms if the panels are 4 feet wide or wider and are supported on cross members at 4-foot or closer intervals for light trades and 2-foot intervals for heavy trades.

(6) Provide standard ladder or other safe, unobstructed means of access to all

21.10 Ladder-Jack Scaffolds.

(a) Ladder-jack scaffolds shall not be used when the platform is over 16 feet above the ground. Not more than two employees shall be allowed on a scaffold of this type. The ladders shall be secured against displacement.

(b) The platform shall be at least 14 inches wide consisting of ladder staging, "structural plank" or equivalent, free from damage that affects the strength. The ladders shall not be placed over 16 feet center to center, and where the platform consists of a single-dressed 2-inch by 14-inch plank, the spacing shall not be greater than 12 feet. Both metal and wood platform planks shall overlap the bearing surface by at least 12 inches.

(c) Drop lines of at least 3/4-inch diameter Manila rope or other rope of equivalent diameter and strength shall hang from secure overhead anchorages where the working platform is 7 1/2 feet high or more. An independently anchored line shall be provided for and used by each employee in accordance with the provisions of Safety Belts and Nets of this manual.

(d) All ladders used in connection with ladder jack scaffolds shall be heavy-duty ladders and shall be designed and constructed in accordance with the General Industry Safety Orders, Job-built ladders shall not be used for this purpose.

(e) The ladder jack shall be so designed and constructed that it will bear on the side rails in addition to the ladder rungs, or if bearing on rungs only, the bearing area shall be at least 10 inches on each rung.

21.11 Bricklayers' Square Scaffolds.

(a) The squares shall not exceed 5 feet in width and 5 feet in height.

(b) Members shall be not less than those specified in the Schedule below:

Minimum Dimensions for Bricklayers' Square Scaffold Members	
Members	Dimensions
Ledgers or horizontal members.....	2 x 6 in.
Legs.....	2 x 6 in.
Braces at corners.....	1 x 6 in.
Braces diagonally from center frame.....	1 x 8 in.

(c) The squares shall be reinforced on both sides of each corner with 1- x 6-inch gusset pieces. They shall also have diagonal braces 1 x 8 inches on both sides running from center to center of each member, or other means to secure equivalent strength and rigidity.

(d) The squares shall be set not more than 5 feet apart for medium duty scaffolds, and not more than 8 feet apart for light duty scaffolds. Bracing, 1 x 8 inches, extending from the bottom of each square to the top of the next square, shall be provided on both front and rear sides of the scaffold.

(e) Platform planks shall be at least 2- x 10-inch nominal size. The ends of the planks shall overlap the ledgers of the squares and each plank shall be supported by not less than three squares.

(f) Bricklayers' square scaffolds shall not exceed three tiers in height and shall be so constructed and arranged that one square shall rest directly above the other. The upper tiers shall stand on a continuous row of planks laid across the next lower tier and be nailed down or otherwise secured to prevent displacement.

(g) Scaffolds shall be level and set upon a firm foundation.

(h) For guardrailing requirements see Standard Railings.

21.12 Window Jack Scaffolds.

(a) Window jack scaffolds shall be used only for the purpose of working at the window opening through which the jack is placed.

(b) Window jacks shall not be used to support planks placed between one window jack and another or for other elements of scaffolding.

(c) Window jack scaffolds shall be provided with guardrails unless safety belts and lanyards are provided for and used by employees.

(d) Not more than one employee shall occupy a window jack scaffold at any one

time.

21.13 Pump Jack Scaffolds.

(a) Pump jack scaffolds shall:

- (1) Be limited to a maximum working load of 500 pounds; and
- (2) Have a Safety Factor of at least four times the maximum intended load.
- (3) The manufactured components shall not be loaded in excess of the manufacturer's recommended limits.

(b) Pump jack brackets, braces, and accessories shall be fabricated from metal plates and angles. Each pump jack bracket shall have two positive gripping mechanisms to prevent any failure or slippage.

(c) The platform bracket shall be fully decked and the planking secured. Planking, or equivalent, shall conform with the section in this chapter on General Requirements.

(1) When wood scaffold planks are used as platforms, poles used for pump jacks shall not be spaced more than 10 feet center to center. When fabricated platforms are used that fully comply with all other provisions of this Order, pole spacing may exceed 10 feet center to center.

(2) Poles shall not exceed 30 feet in height.

(3) Poles shall be secured to the work wall by rigid triangular bracing, or equivalent, at the bottom, top, and other points as necessary, to provide a maximum vertical spacing of not more than 10 feet between braces. Each brace shall be capable of supporting a minimum of 225 pounds tension or compression.

(4) For the pump jack bracket to pass bracing already installed, an extra brace shall be used approximately 4 feet above the one to be passed until the original brace is reinstalled.

(d) All poles shall bear on mud sill or other adequate firm foundations.

(e) Pole lumber shall be two 2 x 4's, of Douglas fir, or equivalent, straight-grained, clear, free of cross-grain, shakes, large loose or dead knots, and other defects which might impair strength.

(f) When poles are constructed of two continuous lengths, they shall be 2 x 4's, spiked together with the seam parallel to the bracket, and with 10d common nails, no more than 12 inches center to center, staggered uniformly from opposite outside edges.

(g) If 2 x 4's are spliced to make up the pole, the splices shall be so constructed as to develop the full strength of the member.

(h) Not more than two employees shall be permitted at one time upon a pump jack scaffold between any two supports.

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(i) Pump jacks scaffolds shall be provided with standard guardrails as described in Article 16 but no guardrail is required when safety belts with lanyards are provided for and used by employees.

(j) When a work bench is used at an approximate height of 42 inches, the top guardrail may be eliminated, if the work bench is fully decked, the planking secured, and is capable of withstanding 200 pounds load in any direction.

(k) Employees shall not be permitted to use a work bench as a scaffold platform.

Chapter 22 - Safety Belts and Nets

22.1 Safety belts, lifelines, and lanyards.

This section covers Chapter 29 of CFR 1926.104 – 1926.107. For Fall Arrester Systems Required and Personnel Platforms see under the chapter titled “Ladders & Scaffolds”.

Lifelines, safety belts, and lanyards shall be used only for employee safeguarding. Any lifeline, safety belt, or lanyard actually subjected to in-service loading, as distinguished from static load testing, shall be immediately removed from service and shall not be used again for employee safeguarding.

Lifelines shall be secured above the point of operation to an anchorage or structural member capable of supporting a minimum dead weight of 5,400 pounds.

Lifelines used on rock-scaling operations, or in areas where the lifeline may be subjected to cutting or abrasion, shall be a minimum of 7/8-inch wire core manila rope. For all other lifeline applications, a minimum of 3/4-inch manila or equivalent, with a minimum breaking strength of 5,400 pounds, shall be used.

Safety belt lanyard shall be a minimum of 1/2-inch nylon, or equivalent, with a maximum length to provide for a fall of no greater than 6 feet. The rope shall have a nominal breaking strength of 5,400 pounds.

All safety belt and lanyard hardware shall be drop forged or pressed steel, cadmium plated in accordance with type 1, Class B plating specified in Federal Specification QQ-P-416. Surface shall be smooth and free of sharp edges.

All safety belt and lanyard hardware, except rivets, shall be capable of withstanding a tensile loading of 4,000 pounds without cracking, breaking, or taking a permanent deformation.

22.2 Safety nets.

Safety nets shall be provided when workplaces are more than 25 feet above the ground or water surface, or other surfaces where the use of ladders, scaffolds, catch platforms, temporary floors, safety lines, or safety belts is impractical.

Where safety net protection is required by this part, operations shall not be undertaken until the net is in place and has been tested.

Nets shall extend 8 feet beyond the edge of the work surface where employees are exposed and shall be installed as close under the work surface as practical but in no case more than 25 feet below such work surface. Nets shall be hung with sufficient clearance to prevent user's contact with the surfaces or structures below. Such clearances shall be determined by impact load testing.

It is intended that only one level of nets be required for bridge construction.

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The mesh size of nets shall not exceed 6 inches by 6 inches. All new nets shall meet accepted performance standards of 17,500 foot-pounds minimum impact resistance as determined and certified by the manufacturers, and shall bear a label of proof test. Edge ropes shall provide a minimum breaking strength of 5,000 pounds.

Forged steel safety hooks or shackles shall be used to fasten the net to its supports.

Connections between net panels shall develop the full strength of the net.

22.3 Working over or near water

Employees working over or near water, where the danger of drowning exists, shall be provided with U.S. Coast Guard-approved life jacket or buoyant work vests.

Prior to and after each use, the buoyant work vests or life preservers shall be inspected for defects which would alter their strength or buoyancy. Defective units shall not be used.

Ring buoys with at least 90 feet of line shall be provided and readily available for emergency rescue operations. Distance between ring buoys shall not exceed 200 feet.

At least one lifesaving skiff shall be immediately available at locations where employees are working over or adjacent to water.

See the chapter titled, Working Over or Near Water for further details.

22.4 Definitions

"Contaminant" means any material which by reason of its action upon, within, or to a person is likely to cause physical harm.

"Lanyard" means a rope, suitable for supporting one person. One end is fastened to a safety belt or harness and the other end is secured to a substantial object or a safety line.

"Lifeline" means a rope, suitable for supporting one person, to which a lanyard or safety belt (or harness) is attached.

"O.D." means optical density and refers to the light refractive characteristics of a lens.

"Radiant energy" means energy that travels outward in all directions from its sources.

"Safetybelt" means a device, usually worn around the waist which, by reason of its attachment to a lanyard and lifeline or a structure, will prevent a worker from falling.

Chapter 23 - Standard Railings

23.1 Design of Temporary Railing.

Railings required by these Orders, except as otherwise provided, shall conform to the following standards:

(a) Railings shall be constructed of wood, as follows, or in an equally substantial manner from other materials, and shall consist of a top rail not less than 42 inches or more than 45 inches in height measured from the upper surface of the top rail to the floor, platform, runway or ramp level and a midrail. The midrail shall be halfway between the top rail and the floor, platform, runway or ramp. "Selected lumber" (see definitions), free from damage that affects its strength, shall be used for railings constructed of wood.

(b) Wooden posts shall be not less than 2 inches by 4 inches in cross section, spaced at 8-foot or closer intervals.

(c) Wooden top railings shall be smooth and of 2-inch by 4-inch or larger material. Double, 1-inch by 4-inch members may be used for this purpose, provided that one member is fastened in a flat position on top of the posts and the other fastened in an edge-up position to the inside of the posts and the side of the top member. Midrails shall be of at least 1-inch by 6-inch material.

(d) The rails shall be placed on that side of the post which will afford the greatest support and protection.

(f) All guardrails, including their connections and anchorage, shall be capable of withstanding a load of 13 pounds per linear foot applied either horizontally or vertically downward at the top rail.

(g) Railings receiving heavy stresses from employees trucking or handling materials shall be provided additional strength by the use of heavier stock, closer spacing of posts, bracing, or by other means.

(h) Other types, sizes, and arrangements of railing construction are acceptable, provided they meet the following conditions:

(1) A smooth-surfaced top rail at a height above floor, platform, runway, or ramp level of not less than 42 inches or more than 45 inches.

(2) Protection between top rail and floor, platform, runway, ramp, or stair treads, equivalent at least to that afforded by a standard midrail.

(3) Elimination of overhang of rail ends unless such overhang does not constitute a hazard.

(i) Handrails that are not a permanent part of the structure being built shall have a minimum clearance of three (3) inches between the handrail and walls or other objects.

23.2 Railings and Toeboards.

(a) Unless otherwise protected, railings as set forth in Section 1620 shall be provided along all unprotected and open sides, edges and ends of all built-up scaffolds, runways, ramps, rolling scaffolds, elevated platforms, surfaces, wall openings, or other elevations 7 1/2 feet or more above the ground, floor, or level underneath.

EXCEPTIONS:

- (1) Float and ladder jack scaffolds.
- (2) Bricklayers' and masons' scaffolds used in accordance with the Sections under Scaffolds outlining Heavy-Trade Wooden Pole Scaffolds sub-part (e) and Metal Scaffolds sub-part(a)(6).
- (3) During demolition on the floor or surface being demolished.

(b) A standard toeboard shall be 4 inches (nominal) minimum in vertical height from its top edge to the level of the floor, platform, runway, or ramp. It shall be securely fastened in place and have not more than 1/4-inch clearance above floor level. It may be made of any substantial material, either solid, or with openings not over one inch in greatest dimension. Toeboards shall be provided on all open sides and ends of railed scaffolds at locations where persons are required to work or pass under the scaffold and at all interior floor, roof, and shaft openings.

NOTE: Except for structural steel crafts.

(c) Where material is piled to such height that a standard toeboard does not provide protection, paneling or screening from floor to intermediate rail or top rail shall be provided. Where such paneling or screening extend to the toprail, midrails may be omitted.

Chapter 24 - Tool Box Talks

24.1 Purpose

The purpose of Tool Box Talks/Work Group Safety Meetings is to provide a method for the dissemination of information to all employees regarding safety and health issues.

24.2 Regular Tool Box Talks

Regular Tool Box Talks/Work Group Safety Meetings demonstrate the Pickering Associates, Inc.'s concern for the lives and well being of its employees. Tool Box Talks/Work Group Safety Meetings help build a cooperative climate by providing employees with the opportunity to contribute ideas, and to make suggestions that may improve quality, productivity, morale, and safety.

Safety education is required of all employees *at all levels* within the organization. Pickering Associates, Inc. will have a formalized safety training program to prevent accidents and to train employees to do their job safely. Scheduled, Tool Box Talks/Work Group Safety Meetings, will be conducted Quarterly just prior to starting work or at times deemed necessary by the Responsible Safety Officer or supervisory personnel.

24.3 Responsibilities

The Vice President of Operations will provide the direction and motivation to ensure that all managers conduct regular Tool Box Talks/Work Group Safety Meetings.

Managers and Supervisory Personnel that conduct safety discussions will maintain a log of what was discussed and who attended the meeting. This information shall be turned over to the Responsible Safety Officer on a weekly basis.

The Responsible Safety Officer shall be a resource for safety and health discussion topics, and shall keep all documentation of all training at a central location.

Employees are required to attend all Tool Box Talks/Work Group Safety Meetings. In the event an employee misses a Tool Box Talk/Work Group Safety Meeting, the employee shall be given individual instruction by their supervisor concerning what was discussed/covered. The supervisor shall document this "training session" and will provide the Responsible Safety Officer with this documentation.

24.4 Procedure:

The Tool Box Talk/Work Group Safety Meeting is a method used by this Company to develop the employees' safety awareness.

24.5 Conducting Tool Box Talks/Work Group Safety Meetings

For greatest effectiveness, cover subjects that most interest the employees. These topics might include accidents, inspection results, the safety program, or a work procedure.

These safety meetings should last no longer than 15-30 minutes. Ideally, the meeting would include time for active participation by employees; at the least, there should be a question and answer session.

Schedule meetings at the beginning of new operations to ensure that all of the employees are familiar with safe job procedures and the requirements of the upcoming work. These meetings save a lot of time in the long run.

Tool Box Talks/Work Group Safety Meetings may be either motivational or instructional. The motivational meeting creates awareness and aims at worker self protection. The instructional meeting covers a particular job task or procedure.

The supervisor is the key management communicator for work groups, because he or she is most familiar with the individual workers and their work requirements.

Chapter 25 - Environmental Safety

25.1 Introduction

From iron workers to pastry bakers, Americans work in a wide variety of hot or hot and humid environments:

- Outdoor operations in hot weather, including surface mining, roofing, road repair and construction, dam building, life guarding and other construction
- Farming operations
- Iron, steel and nonferrous foundries
- Brick-firing and ceramics operations
- Glass products manufacturing plants
- Rubber products manufacturing plants
- Electrical utilities (particularly boiler rooms)
- Bakeries
- Confectioneries
- Restaurant kitchens
- Laundries
- Food canneries
- Mines
- Smelters
- Steam tunnels

Being uncomfortable is not the major problem with working in high temperatures and humidities. Workers who are suddenly exposed to working in a hot environment face additional and generally avoidable hazards to their safety and health. The company should provide detailed instructions on preventive measures and adequate protection necessary to prevent heat stress.

25.2 How the Body Handles Heat

The human body, being warm blooded, maintains a fairly constant internal temperature, even though it is being exposed to varying environmental temperatures. To keep internal body temperatures within safe limits, the body must get rid of its excess heat, primarily through varying the rate and amount of blood circulation through the skin and the release of fluid onto the skin by the sweat glands. These automatic responses usually occur when the temperature of the blood exceeds 98.6°F and are kept in balance and controlled by the brain. In this process of lowering internal body temperature, the heart begins to pump more blood, blood vessels expand to accommodate the increased flow, and the microscopic blood vessels (capillaries) which thread through the upper layers of the skin begin to fill with blood. The blood circulates closer to the surface of the skin, and the excess heat is lost to the cooler environment. If heat loss from increased blood circulation through the skin is not adequate, the brain continues to sense overheating and signals the sweat glands in the skin to shed large

quantities of sweat onto the skin surface. Evaporation of sweat cools the skin, eliminating large quantities of heat from the body.

As environmental temperatures approach normal skin temperature, cooling of the body becomes more difficult. If air temperature is as warm as or warmer than the skin, blood brought to the body surface cannot lose its heat. Under these conditions, the heart continues to pump blood to the body surface, the sweat glands pour liquids containing electrolytes onto the surface of the skin and the evaporation of the sweat becomes the principal effective means of maintaining a constant body temperature. Sweating does not cool the body unless the moisture is removed from the skin by evaporation. Under conditions of high humidity, the evaporation of sweat from the skin is decreased and the body's efforts to maintain an acceptable body temperature may be significantly impaired. These conditions adversely affect an individual's ability to work in the hot environment. With so much blood going to the external surface of the body, relatively less goes to the active muscles, the brain, and other internal organs; strength declines; and fatigue occurs sooner than it would otherwise. Alertness and mental capacity also may be affected. Workers who must perform delicate or detailed work may find their accuracy suffering, and others may find their comprehension and retention of information lowered.

25.3 Safety Problems

Certain safety problems are common to hot environments. Heat tends to promote accidents due to the slipperiness of sweaty palms, dizziness, or the fogging of safety glasses. Wherever there exists molten metal hot surfaces, steam, etc., the possibility of burns from accidental contact also exists.

Aside from these obvious dangers, the frequency of accidents, in general appears to be higher in hot environments than in more moderate environmental conditions. One reason is that working in a hot environment lowers the mental alertness and physical performance of an individual. Increased body temperature and physical discomfort promote irritability, anger, and other emotional states which sometimes cause workers to overlook safety procedures or to divert attention from hazardous tasks.

25.4 Health Problems

Excessive exposure to a hot work environment can bring about a variety of heat-induced disorders.

25.4.a Heat Stroke

Heat stroke is the most serious of health problems associated with working in hot environments. It occurs when the body's temperature regulatory system fails and sweating becomes inadequate. The body's only effective means of removing excess heat is compromised with little warning to the victim that a crisis stage has been reached.

A heat stroke victim's skin is hot, usually dry, red or spotted. Body temperature is usually 105°F or higher, and the victim is mentally confused, delirious, perhaps in convulsions, or unconscious. Unless the victim receives quick and appropriate treatment, death can occur.

Any person with signs or symptoms of heat stroke requires immediate hospitalization. However, first aid should be immediately administered. This includes removing the victim to a cool area, thoroughly soaking the clothing with water, and vigorously fanning the body to increase cooling. Further treatment at a medical facility should be directed to the continuation of the cooling process and the monitoring of complications which often accompany the heat stroke. Early recognition and treatment of heat stroke are the only means of preventing permanent brain damage or death.

25.4.b Heat Exhaustion

Heat exhaustion includes several clinical disorders having symptoms which may resemble the early symptoms of heat stroke. Heat exhaustion is caused by the loss of large amounts of fluid by sweating, sometimes with excessive loss of salt. A worker suffering from heat exhaustion still sweats but experiences extreme weakness or fatigue, giddiness, nausea, or headache. In more serious cases, the victim may vomit or lose consciousness. The skin is clammy and moist, the complexion is pale or flushed, and the body temperature is normal or only slightly elevated.

In most cases, treatment involves having the victim rest in a cool place and drink plenty of liquids. Victims with mild cases of heat exhaustion usually recover spontaneously with this treatment. Those with severe cases may require extended care for several days. There are no known permanent effects.

25.4.c Employees with Heart Problems - Caution

Persons with heart problems or those on a low *sodium* diet who work in hot environments should consult a physician about what to do under these conditions.

25.4.d Heat Cramps

Heat cramps are painful spasms of the muscles that occur among those who sweat profusely in heat, drink large quantities of water, but do not adequately replace the body's salt loss. The drinking of large quantities of water tends to dilute the body's fluids, while the body continues to lose salt. Shortly thereafter, the low salt level in the muscles causes painful cramps. The affected muscles may be part of the arms, legs, or abdomen, but tired muscles (those used in performing the work) are usually the ones most susceptible to cramps. Cramps may occur during or after work hours and may be relieved by taking salted liquids by mouth.

CAUTION

Persons with heart problems or those on a low *low sodium* diet who work in hot environments should consult a physician about what to do under these conditions.

25.4.e Fainting

A worker who is not accustomed to hot environments and who stands erect and immobile in the heat may faint. With enlarged blood vessels in the skin and in the lower part of the body due to the body's attempts to control internal temperature, blood may pool there rather than return to the heart to be pumped to the brain. Upon lying down, the worker should soon recover. By moving around, and thereby preventing blood from pooling, the patient can prevent further fainting.

25.4.f Heat Rash

Heat rash, also known as prickly heat, is likely to occur in hot, humid environments where sweat is not easily removed from the surface of the skin by evaporation and the skin remains wet most of the time. The sweat ducts become plugged, and a skin rash soon appears. When the rash is extensive or when it is complicated by infection, prickly heat can be very uncomfortable and may reduce a worker's performance. The worker can prevent this condition by resting in a cool place part of each day and by regularly bathing and drying the skin.

25.4.g Transient Heat Fatigue

Transient heat fatigue refers to the temporary state of discomfort and mental or psychologic strain arising from prolonged heat exposure. Workers unaccustomed to the

heat are particularly susceptible and can suffer, to varying degrees, a decline in task performance, coordination, alertness, and vigilance. The severity of transient heat fatigue will be lessened by a period of gradual adjustment to the hot environment (heat acclimatization).

25.4.h Preparing for the Heat

One of the best ways to reduce heat stress on workers is to minimize heat in the workplace. However, there are some work environments where heat production is difficult to control, such as when furnaces or sources of steam or water are present in the work area or when the workplace itself is outdoors and exposed to varying warm weather conditions.

Humans are, to a large extent, capable of adjusting to the heat. This adjustment to heat, under normal circumstances, usually takes about 5 to 7 days, during which time the body will undergo a series of changes that will make continued exposure to heat more endurable.

On the first day of work in a hot environment, the body temperature, pulse rate, and general discomfort will be higher. With each succeeding daily exposure, all of these responses will gradually decrease, while the sweat rate will increase. When the body becomes acclimated to the heat, the worker will find it possible to perform work with less strain and distress.

Gradual exposure to heat gives the body time to become accustomed to higher environmental temperatures. Heat disorders in general are more likely to occur among workers who have not been given time to adjust to working in the heat or among workers who have been away from hot environments and who have gotten accustomed to lower temperatures. Hot weather conditions of the summer are likely to affect the worker who is not acclimatized to heat. Likewise, workers who return to work after a leisurely vacation or extended illness may be affected by the heat in the work environment. Whenever such circumstances occur, the worker should be gradually reacclimatized to the hot environment.

25.4.i Lessening Stressful Conditions

Many industries have attempted to reduce the hazards of heat stress by introducing engineering controls, training workers in the recognition and prevention of heat stress, and implementing work-rest cycles. Heat stress depends, in part, on the amount of heat the worker's body produces while a job is being performed. The amount of heat produced during hard, steady work is much higher than that produced during intermittent or light work. Therefore, one way of reducing the potential for heat stress is

to make the job easier or lessen its duration by providing adequate rest time. Mechanization of work procedures can often make it possible to isolate workers from the heat sources (perhaps in an air-conditioned booth) and increase overall productivity by decreasing the time needed for rest. Another approach to reducing the level of heat stress is the use of engineering controls which include ventilation and heat shielding.

Number and Duration of Exposures

Rather than be exposed to heat for extended periods of time during the course of a job, workers should, wherever possible, be permitted to distribute the workload evenly over the day and incorporate work-rest cycles. Work-rest cycles give the body an opportunity to get rid of excess heat, slow down the production of internal body heat, and provide greater blood flow to the skin.

Workers employed outdoors are especially subject to weather changes. A hot spell or a rise in humidity can create overly stressful conditions.

The following practices can help to reduce heat stress:

Postponement of nonessential tasks,

Permit only those workers acclimatized to heat to perform the more strenuous tasks, or

Provide additional workers to perform the tasks keeping in mind that all workers should have the physical capacity to perform the task and that they should be accustomed to the heat.

Thermal Conditions in the Workplace

A variety of engineering controls can be introduced to minimize exposure to heat. For instance, improving the insulation on a furnace wall can reduce its surface temperature and the temperature of the area around it. In a laundry room, exhaust hoods installed over those sources releasing moisture will lower the humidity in the work area.

In general the simplest and least expensive methods of reducing heat and humidity can be accomplished by:

- Opening windows in hot work areas
- Using fans
- Using other methods of creating airflow such as exhaust ventilation or air blowers.

Rest Areas

Providing cool rest areas in hot work environments considerably reduces the stress of working in those environments. There is no conclusive information available on the ideal

temperature for a rest area. However, a rest area with a temperature near 76/F appears to be adequate and may even feel chilly to a hot, sweating worker, until acclimated to the cooler environment. The rest area should be as close to the workplace as possible. Individual work periods should not be lengthened in favor of prolonged rest periods. Shorter but frequent work-rest cycles are the greatest benefit to the worker.

25.4.j Drinking Water

In the course of a day's work in the heat, a worker may produce as much as 2 to 3 gallons of sweat. Because so many heat disorders involve excessive dehydration of the body, it is essential that water intake during the workday be about equal to the amount of sweat produced. Most workers exposed to hot conditions drink less fluids than needed because of an insufficient thirst drive. A worker, therefore, should not depend on thirst to signal when and how much to drink. Instead, the worker should drink 5 to 7 ounces of fluids every 15 to 20 minutes to replenish the necessary fluids in the body. There is no optimum temperature of drinking water, but most people tend not to drink warm or very cold fluids as readily as they will cool ones. Whatever the temperature of the water, it must be palatable and readily available to the worker. Individual drinking cups should be provided--never use a common drinking cup.

Heat acclimatized workers lose much less salt in their sweat than do workers who are not adjusted to the heat. The average American diet contains sufficient salt for acclimatized workers even when sweat production is high. If, for some reason, salt replacement is required, the best way to compensate for the loss is to add a little extra salt to the food. Salt tablets *should not* be used.

CAUTION

Persons with heart problems or those on a low sodium diet who work in hot environments should consult a physician about what to do under these conditions.

25.4.k Protective Clothing

Clothing inhibits the transfer of heat between the body and the surrounding environment. Therefore, in hot jobs where the air temperature is lower than skin temperature, wearing clothing reduces the body's ability to lose heat into the air. When air temperature is higher than skin temperature, clothing helps to prevent the transfer of heat from the air to the body. However, this advantage may be nullified if the clothes interfere with the evaporation of sweat.

In dry climates, adequate evaporation of sweat is seldom a problem. In a dry work environment with very high air temperatures, protective clothing could be an advantage to the worker. The proper type of clothing depends on the specific circumstance. Certain work in hot environments may require insulated gloves, insulated suits, reflective

clothing, or infrared reflecting face shields. For extremely hot conditions, thermally conditioned clothing is available. One such garment carries a self-contained air conditioner in a backpack, while another is connected a compressed air source which feeds cool air into the jacket or coveralls through a vortex tube. Another type of garment is a plastic jacket which has pockets that can be filled with dry ice or containers of ice.

25.4.l Awareness is Important

The key to preventing excessive heat stress is educating the company and worker on the hazards of working in heat and the benefits of implementing proper controls and work practices. The company should establish a program designed to acclimatize workers who must be exposed to hot environments and provide necessary work-rest cycles and water to minimize heat stress.

25.4.m Special Considerations During Prolonged Heat Spells

During unusually hot weather conditions lasting longer than 2 days, the number of heat illnesses usually increases. This is due to several factors, such as progressive body fluid deficit, loss of appetite (and possible salt deficit), buildup of heat in living and work areas, and breakdown of air-conditioning equipment. Therefore, it is advisable to make a special effort to adhere rigorously to the above preventive measures during these extended hot spells and to avoid any unnecessary or unusual stressful activity. Sufficient sleep and good nutrition are important for maintaining a high level of heat tolerance. Workers who may be at a greater risk of heat illnesses are the obese, the chronically ill, and older individuals.

When feasible, the most stressful tasks should be performed during the cooler parts of the day (early morning or at night). Double shifts and overtime should be avoided whenever possible. Rest periods should be extended to alleviate the increase in the body heat load.

The consumption of alcoholic beverages during prolonged periods of heat can cause additional dehydration. Persons taking certain medications (e.g., medications for blood pressure control, diuretics, or water pills) should consult their physicians in order to determine if any side effects could occur during excessive heat exposure. Daily fluid intake must be sufficient to prevent significant weight loss during the workday and over the workweek.

25.5 Protecting Workers in Cold Environments

To help protect companies and employees need to avoid prolonged exposure to frigid temperatures.

Exposure to cold weather can be more than uncomfortable; it can be dangerous. More than 700 people die of hypothermia each year in the United States. Companies and workers need to know how to defend against hazards of working in extremely cold temperatures.

Wearing the right clothing is the most important step a person can take to fight the cold's harmful effects, and ultimately avoid cold-related injuries. Companies can take added steps to help protect their workers by having employees come out of the cold for periods of time, providing additional heat sources, and setting up systems to check more frequently on people working in the cold.

During cold weather about 60 percent of a person's body fuel is used to heat the body. When exposed to frigid temperatures, particularly for extended periods of time, a person will tire easily, and exposed skin will cool rapidly. This is prime breeding ground for the dangerous effects of the cold -- hypothermia and frostbite. Combine cold temperatures with water, including actual immersion, and trench foot becomes another potential serious ailment.

The following fact sheet entitled 'Protecting Workers in Cold Environments' defines the harmful effects of the cold and provides guidelines and recommendations for protecting workers in such industries as construction, commercial fishing and agriculture. Also included is immediate first aid measures to be taken to treat cold-related injuries or illnesses.

The National News Release from OSHA is on the Internet World Wide Web at <http://www.osha.gov/media/dec98/>. The fact sheet can also be found on the same web site on the Publications page at <http://www.osha-slc.gov/OshDoc/Additional.html>, under Fact Sheets.

Fact Sheet: Protecting Workers in Cold Environments
News Release: USDL 98-508; Released Wednesday, December 23rd, 1998 and again on Thursday, January 23rd, 2003 – USDL 03-33.

As the weather becomes "frightful" during winter months, workers who must brave the

outdoor conditions face the occupational hazard of exposure to the cold. Prolonged exposure to freezing temperatures can result in health problems as serious as trench foot, frostbite, and hypothermia. Workers in such industries as construction, commercial fishing and agriculture need to be especially mindful of the weather, its effects on the body, proper prevention techniques, and treatment of cold-related disorders.

25.5.a The Cold Environment

An individual gains body heat from food and muscular activity and loses it through convection, conduction, radiation and sweating to maintain a constant body temperature. When body temperature drops even a few degrees below its normal temperature of 98.6°F (37°C), the blood vessels constrict, decreasing peripheral blood flow to reduce heat loss from the surface of the skin. Shivering generates heat by increasing the body's metabolic rate.

The four environmental conditions that cause cold-related stress are low temperatures, high/cool winds, dampness and cold water. Wind chill, a combination of temperature and velocity, is a crucial factor to evaluate when working outside. For example, when the actual air temperature of the wind is 40°F (4°C) and its velocity is 35 mph, the exposed skin receives conditions equivalent to the still-air temperature being 11°F (-11°C)! A dangerous situation of rapid heat loss may arise for any individual exposed to high winds and cold temperatures.

25.5.b Major Risk Factors for Cold-Related Stresses

- Wearing inadequate or wet clothing increases the effects of cold on the body.
- Taking certain drugs or medications such as alcohol, nicotine, caffeine, and medication that inhibits the body's response to the cold or impairs judgment.
- Having a cold or certain diseases, such as diabetes, heart, vascular, and thyroid problems, may make a person more susceptible to the winter elements.
- Being a male increases a person's risk to cold-related stresses. Sad, but true, men experience far greater death rates due to cold exposure than women, perhaps due to inherent risk-taking activities, body-fat composition or other physiological differences.
- Becoming exhausted or immobilized, especially due to injury or entrapment, may speed up the effects of cold weather.
- Aging--the elderly are more vulnerable to the effects of harsh winter weather.

25.5.c Harmful Effects of Cold

Trench Foot

May 2, 2009

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Trench Foot is caused by long, continuous exposure to a wet, cold environment, or actual immersion in water. Commercial fisherman, who experience these types of cold, wet environments daily, need to be especially cautious.

Symptoms:

Symptoms include a tingling and/or itching sensation, burning, pain, and swelling, sometimes forming blisters in more extreme cases.

Treatment:

Move individuals with trench foot to a warm, dry area, where the affected tissue can be treated with careful washing and drying, rewarming and slight elevation. Seek medical assistance as soon as possible.

Frostbite

Frostbite occurs when the skin tissue actually freezes, causing ice crystals to form between cells and draw water from them, which leads to cellular dehydration. Although this typically occurs at temperatures below 30°F (-1°C), wind chill effects can cause frostbite at above-freezing temperatures.

Symptoms:

Initial effects of frostbite include uncomfortable sensations of coldness; tingling, stinging or aching feeling of the exposed area followed by numbness. Ears, fingers, toes, cheeks, and noses are primarily affected. Frostbitten areas appear white and cold to the touch. The appearance of frostbite varies depending on whether rewarming has occurred.

Deeper frostbite involves freezing of deeper tissues (muscles, tendons, etc.) causing exposed areas to become numb, painless, hard to the touch.

Treatment:

If you suspect frostbite, you should seek medical assistance immediately. Any existing hypothermia should be treated first (See Hypothermia below). Frostbitten parts should be covered with dry, sterile gauze or soft, clean cloth bandages. Do not massage frostbitten tissue because this sometimes causes greater injury. Severe cases may require hospitalization and even amputation of affected tissue. Take measures to prevent further cold injury. If formal medical treatment will be delayed, consult with a licensed health care professional for training on rewarming techniques.

General Hypothermia

General Hypothermia occurs when body temperature falls to a level where normal muscular and cerebral functions are impaired. While hypothermia is generally associated with freezing temperatures, it may occur in any climate where a person's body temperature falls below normal. For instance, hypothermia is common among the

elderly who live in cold houses.

Symptoms:

The first symptoms of hypothermia, shivering, an inability to do complex motor functions, lethargy, and mild confusion, occur as the core body temperature decreases to around 95°F (35°C).

As body temperature continue to fall, hypothermia becomes more severe. The individual falls into a state of dazed consciousness, failing to complete even simple motor functions. The victim's speech becomes slurred and his or her behavior may become irrational.

The most severe state of hypothermia occurs when body temperature falls below 90°F (32°C). As a result, the body moves into a state of hibernation, slowing the heart rate, blood flow, and breathing. Unconsciousness and full heart failure can occur in the severely hypothermic state.

Treatment:

Treatment of hypothermia involves conserving the victim's remaining body heat and providing additional heat sources. Specific measures will vary depending upon the severity and setting (field or hospital). Handle hypothermic people very carefully because of the increased irritability of the cold heart. Seek medical assistance for persons suspected of being moderately or severely hypothermic.

If the person is unresponsive and not shivering, assume he or she is suffering from severe hypothermia. Reduction of heat loss can be accomplished by various means: obtaining shelter, removal of wet clothing, adding layers of dry clothing, blankets, or using a pre-warmed sleeping bag.

For mildly hypothermic cases or those more severe cases where medical treatment will be significantly delayed, external rewarming techniques may be applied. This includes body-to-body contact (e.g., placing the person in a prewarmed sleeping bag with a person of normal body temperature), chemical heat packs, or insulated hot water bottles. Good areas to place these packs are the armpits, neck, chest, and groin. It is best to have the person lying down when applying external rewarming. You also may give mildly hypothermic people warm fluids orally, but avoid beverages containing alcohol or caffeine.

25.5.d Preventing Cold-Related Disorders

Personal Protective Clothing

Personal Protective Clothing is perhaps the most important step in fighting the elements is providing adequate layers of insulation from them. Wear at least three layers of clothing:

- An outer layer to break the wind and allow some ventilation (like Gore-Tex® or nylon);
- A middle layer of wool or synthetic fabric (Qualofil or Pile) to absorb sweat and retain insulation in a damp environment. Down is a useful lightweight insulator; however, it is ineffective once it becomes wet.
- An inner layer of cotton or synthetic weave to allow ventilation.

Pay special attention to protecting feet, hands, face and head. Up to 40 percent of body heat can be lost when the head is exposed. Footgear should be insulated to protect against cold and dampness. Keep a change of clothing available in case work garments become wet.

Engineering Controls

Engineering Controls in the workplace through a variety of practices help reduce the risk of cold-related injuries.

- Use an on-site source of heat, such as air jets, radiant heaters, or contact warm plates.
- Shield work areas from drafty or windy conditions.
- Provide a heated shelter for employees who experience prolonged exposure to equivalent wind-chill temperatures of 20°F (-6°C) or less.
- Use thermal insulating material on equipment handles when temperatures drop below 30°F (-1°C).

Safe Work Practices

Safe Work Practices such as changes in work schedules and practices, are necessary to combat the effects of exceedingly cold weather.

- Allow a period of adjustment to the cold before embarking on a full work schedule.
- Always permit employees to set their own pace and take extra work breaks when needed.
- Reduce, as much as possible, the number of activities performed outdoors. When employees must brave the cold, select the warmest hours of the day and minimize activities that reduce circulation.
- Ensure that employees remain hydrated.

- Establish a buddy system for working outdoors.
- Educate employees to the symptoms of cold-related stresses --heavy shivering, uncomfortable coldness, severe fatigue, drowsiness, or euphoria.

The quiet symptoms of potentially deadly cold-related ailments often go undetected until the victim's health is endangered. Knowing the facts on cold exposure and following a few simple guidelines can ensure that this season is a safe and healthy one.

25.6 Animals and Wildlife

Know your surroundings and be aware of the potential dangers around you. Never approach any type of animal that you may encounter while working in their environment. Always respect the animal's territory and never abuse or harm an animal you encounter.

Specific animal safety training will be covered by Ryan K. Taylor, before the onset of a new job. Ryan K. Taylor will let you know of any possible types of animals and the safety measures to take if an animal is encountered.

If you encounter an animal and are bitten or receive an injury immediately notify Ryan K. Taylor for treatment instructions or First Aide. If Ryan K. Taylor is not available have a co-worker contact help or call 911.

Chapter 26 - Off-Site Safety

26.1 Off-Site Operations

Off-site operations are those performed away from the Company and for which Pickering Associates, Inc. personnel have responsibility in one or more of the following fields: design, test, transportation, assembly, operation, maintenance, disassembly, and storage or removal of equipment. All off-site operations must be reviewed to determine if an Operational Safety Procedure (OSP) is required. The OSP will be reviewed by the Responsible Safety Officer. Personnel contemplating off-site operations must give written notification of the nature and scope of the project to the Responsible Safety Officer. This notification must be made as soon as possible after the project is approved. The OSP will be reviewed by the Responsible Safety Officer. The Responsible Safety Officer may visit off-site operations in order to: Observe local conditions. Inspect facilities prior to operation. Evaluate periodically operating procedures and modifications. Evaluate procedures for disassembly, transportation, and storage.

At any time during off-site work or when entering a new area or premises that are unknown or unfamiliar, the employees have the right, ability and requirement to decline the onset of work or entering the premises if you feel that it is unsafe. It is the responsibility of the Responsible Safety Officer to make any and all employees aware of any dangers or to train the employees of Pickering Associates, Inc. about any potential dangers or hazards.

When Pickering Associates, Inc. employees are injured or become ill during off-site operations, the following procedure should be used: Employees should obtain appropriate treatment by a nearby physician or hospital staff. Those rendering care should be informed that the injury is work related. The Responsible Safety Officer should be informed so the proper injury report can be prepared.

Chapter 27 - Hazard Signs / Warnings

27.1 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.

27.2 Contents and Configuration

Signs must conform to the colors, symbols, lettering size, and proportions as specified by Pickering Associates, Inc., 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

27.3 Danger Signs

Danger signs are used only where injury or damage is certain to occur if approved operating instructions and procedures are not followed. Personnel must be warned of the serious consequences of ignoring the message. The top of this sign says DANGER in white letters on a red oval that is edged by a rectangular black border. The body of the sign is white with the message printed in black.

27.4 Caution Signs

Caution signs are used where injury or damage is possible and employees must be on their guard. The top of this sign says CAUTION in yellow letters on a black rectangle. The body of the sign is yellow with the message printed in black.

27.5 Informational Signs

Informational signs are used where instructions are needed. The heading says NOTICE in white letters on a green rectangle when the message relates to safety and on a blue rectangle for other messages. The body of the sign is white with the message printed in black.

27.6 Directional Signs

Directional signs are used to indicate exits, fire escapes, evacuation routes, stairways, location of first aid, etc. The direction symbol appears near the top in white on a green

rectangle. The body of the sign must have a color contrasting with the general background.

27.7 Sign Selection

The sign portfolio maintained by the Responsible Safety Officer may be used to help in selecting suitable signs. The Responsible Safety Officer will also advise regarding the types needed and their sources of supply. The Responsible Safety Officer stocks some signs. Special signs are custom made in the Pickering Associates, Inc. shops or are purchased outside.

27.8 Warning Devices

Warning devices such as lights and audible alarms must be installed where they are needed to warn personnel against remaining in or entering hazardous areas. Personnel must be instructed about the meaning and the response required when an alarm sounds. An explanatory sign (describing hazard and action to take) must be posted near a warning light that when ON indicates danger, caution, high explosives, or radioactivity. In a highly illuminated area, the warning light should be surrounded by a disk or wide-angled cone of a contrasting color.

27.9 Evacuation Alarm

All buildings on site are equipped with a means of notifying personnel to leave the building, which is usually the public address system. Every dangerous operation area, indoor and outdoor, must be provided with devices to notify personnel to leave the area. The general evacuation alarm is a steady klaxon horn sound that means "Everyone leave the building immediately and go to the prearranged assembly point or as directed by the public address system." The extensiveness and reliability of the alarm system must be proportional to the magnitude of the credible accidents that could occur from the operations in or near the building.

27.10 Evacuation Alarm, Automatic

An automatic evacuation alarm must be installed that is triggered by a detector directly sensitive to the nature of the hazard for any operation in which an accident could rapidly endanger employees outside the immediate area. Such an operation must not proceed unless the alarm system is functional. Manual activation capability and a public address back-up system must be provided in the building. This alarm system must be protected by an automatic emergency power supply.

27.11 Manual Alarm System

A manually operated alarm system must be installed for operations in which accidents would not cause immediate danger to personnel outside the area of the incident but that could develop into dangerous situations. A public address system operable from the building and from the Fire Department and Protective Services must be provided.

27.12 Evacuation Alarm System

The facility supervisor and Responsible Safety Officer jointly decide the type of evacuation alarm system when needed.

Chapter 28 - Traffic and Transportation

28.1 Speed Limits

The speed limit on Pickering Associates, Inc. property is 25 miles per hour. However, conditions such as road repair, wet weather, poor visibility, and pedestrian traffic may require speeds much lower than 25 mph. All traffic laws are strictly enforced. As a result of high density traffic, limited parking, and general congestion, it is recommended that shuttle buses and transportation services be used whenever possible. These services are convenient and reduce exposure to potential motor vehicle accidents.

28.2 Official Vehicle Use

The Pickering Associates, Inc. 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.

28.3 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 the Motor Pool. 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.

28.4 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.

28.5 Accidents

Any accident involving Company vehicles (included 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 Pickering Associates, Inc.'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 Pickering Associates, Inc., 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 Pickering Associates, Inc. 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.

28.6 Warnings and Citations

Any operator of a vehicle at Pickering Associates, Inc. who violates the State Vehicle Code may be issued a written warning or citation. A warning will include a description of the violation and cite the relevant code section, date, time, location, and the name of the officer issuing the warning. A person who receives such a warning will be called to meet with the Responsible Safety Officer. If more than one warning is issued in a six-month period, the Responsible Safety Officer will normally suspend the offender's driving and parking privileges at the Company. The first suspension will be for a period of one month. If there is a repeat violation, the period of suspension will be for six months. Serious offenses may result in revocation of privileges and may include termination of employment.

28.7 Safety Hazards Correction

The Safety Committee reviews all accidents involving Company-furnished vehicles, whether on site or off site, and makes recommendations to have safety hazards corrected. The committee meets periodically to review accidents or to review and consider other issues relating to traffic safety. The committee is also the hearing board for drivers who are involved in vehicle accidents or who have received a warning notice for a moving violation, as noted above. Such drivers may appear before this committee to explain causes of accidents or violations.

28.8 Parking

Here are the parking designations in use at Pickering Associates, Inc.: Red Zones: No stopping, standing, or parking. Yellow Zones: Stopping only for the purpose of loading or unloading passengers or freight. Green Zones: Limited time parking. Government Vehicles: Official vehicles only. Reserved Parking: Vehicle with designated license number only. Time Zone Lanes: All vehicles must be prepared to move at the time indicated. Compact Car: Vehicle must not extend beyond rear limit line. General Parking: Vehicles must be parked in designated places only and must not extend beyond the edge of road, stripes, or rear limit lines. Violators of the above parking rules will be issued a warning notice, order-to-show cause, or citation.

Chapter 29 - Motor Vehicle Operations

MOTOR VEHICLE SAFETY

29.1 Driver Selection

The selection of employees who will be required to drive full or part-time should be done with care. Drivers of company vehicles can be considered qualified when they meet the following criteria:

1. Possess a valid West Virginia driver's license of the proper class.
2. A review of their traffic record shows that they do not pose an unreasonable risk.
3. Successfully pass a road test administered by the Safety Coordinator and/or their supervisor where required by their department.

29.2 Driver Training

All company drivers should be trained in safe driving habits through use of the National Safety Council's Defensive Driving Course or equivalent. The course should be given to each driver at least once every three years. The course teaches skills in:

1. Defensive driving.
2. Split-second decision making.
3. Backing-up rules.
4. Safe distances.
5. Intersection driving.
6. Poor condition driving in dust storms, rain, etc.

29.3 Preventive Maintenance

Establishment of a preventive maintenance program for all company vehicles is essential. Record jackets should be maintained on all vehicles so that a log can be maintained on all planned maintenance, as well as repairs made from noted defects.

29.4 Vehicle Inspection

Each vehicle or piece of equipment shall be inspected on a daily basis by the operator

before and after operation. Each operator is responsible for the safe condition of the equipment. Any vehicle having steering or brake problems is not to be operated until repairs have been made by a mechanic. Any other unsafe conditions are to be reported to the operator's supervisor as soon as possible.

29.5 Vehicle Operation

All company vehicles and equipment are to be operated in a safe manner and adhere to all applicable laws. The operator is totally responsible for the safe operation of the equipment. The vehicle operator shall report any accidents or damage to the supervisor.

DRIVER SAFETY PROGRAM

29.6 Introduction

The operation of vehicles is indispensable in conducting company business. The way in which each vehicle is handled will directly affect the loss picture of the entire company. Fleet losses are potentially one of the most costly type of losses that an operation can incur.

The types of exposure that involve the fleet program include: property damage, bodily injury, fatalities, liability suits, and Worker's Compensation cases.

The claims cost that would result from losses incurred can mount to dollars that will adversely affect our efforts to accomplish company objectives. To help prevent vehicle accidents and the type of loss exposures associated with them, the following guidelines have been established:

29.7 Policy

The success and the safety of our employees depends on the mutual cooperation of each employee who has been entrusted with the responsibility of driving a company vehicle or their own vehicle while conducting company business.

In order to reduce vehicle accidents and to limit the company's liability because of driver negligence, the company has adopted a Driver Safety Program.

29.8 Procedure

The procedures set forth in the Driver Safety Program will be the guidelines for management adherence to this policy.

29.9 Responsibility

The Supervisors have the primary responsibility for the Driver Safety Program. The Safety Coordinator will appoint a responsible representative to report all driver information requested by our Insurance broker.

29.10 Monitoring

The Safety Coordinator is to be responsible for the records of the Driver Safety Program. Duties will include, but not be limited to:

1. Be responsible for monitoring the driving record of those persons who operate the company vehicles or their own "personal" vehicle while on company business.
2. Monitor the Driver's Safety Program and report to management any suggestions for improvement or needed changes.
3. Monitor the maintenance policy of fleet vehicles so that they are kept in safe condition.
4. Review each vehicle accident report or infraction with management.
5. Monitor renewals of insurance records.

29.11 Drivers

Drivers of vehicles that are owned, rented, or leased by the company will be required to follow defensive driving techniques and practices. The basic defensive driving practice is to plan ahead and do everything that one can reasonably do to prevent an accident. This is to include the use of **seat belts**. The following guidelines will also be followed:

1. Drivers must possess a valid West Virginia driver's license in order to operate any company vehicle or their own personal vehicle on company business. The duties of drivers will be reviewed to see if they will involve the operation of vehicles that require a chauffeur's license or other special license. The requirement will be noted by the employee's supervisor or personnel staff at the time of hire. Job descriptions will state the requirements for a West Virginia driver's license to include the type of license.
2. The driver should be physically and mentally capable of driving the vehicle he/she is assigned to drive, whether the vehicle be a car, van, or truck.

29.12 Pre-Operation of Vehicles

Prior to the assignment of any vehicle to any employee or prior to allowing an employee

to drive THEIR OWN VEHICLE on company business, the following minimum standards will be implemented and records maintained to insure that the driver is qualified to drive the vehicle and minimize the risk of liability to the company:

29.13 Initial Assignment

1. Verification and recording of date and type of driver's license held, and renewal date noted;
2. A review of the driver's state Motor Vehicle Record for the most recent three-year period to include the following:
 - a. Review of the accident report history showing the dates and types of accident regardless who was at fault;
 - b. Review of the traffic violations for the last three years;

Unacceptable limits are 6 points accumulated or any major conviction during the past 36 months prior to employment. (See Point System below)

3. Confirmation of personal insurance for those driving their personal vehicle on company business.
4. Physical examinations when required by the state for the driving of specified vehicles or by funding and licensing contract.

29.14 Point System

The following criteria will be used in order to determine the acceptability of all drivers.

- 1 point - minor conviction of a moving violation
- 1 point - minor accident (no injuries)

NOTE: These will not be considered if a driver is able to remove the citation by going to a traffic school.

- 2 points - serious accident (those involving injury to any person which requires medical attention)

Continuing criteria as company driver:

- a. Points will be doubled if driving a company vehicle.

2 points will be applied for failure to report a violation or accident regardless of how

minor, involving a company vehicle to the driver's supervisor or fleet supervisor.

- c. A warning letter will be issued at 4 points or at the time of any preventable accident. At 6 points the matter will be investigated by the Safety Coordinator, corrective action will then be determined.
- d. The driver with a major conviction shall be immediately suspended from driving any company vehicle or their personal vehicle on company business.
- e. Driving a company vehicle while under the influence of drugs or alcohol will subject the employee to disciplinary action up to and including dismissal.

29.15 Annual Review

Once each year a request for current license information will be sent to each employee. Employees who drive a company vehicle or if they request mileage reimbursement for driving their personal vehicle on company business will have their personal driving record reviewed. It will be the responsibility of the employee to respond in a timely manner. Failure to respond to the requested information by personal vehicle drivers may result in the delay in mileage reimbursements.

A review of each driver's file and record will be made annually and will include all of the criteria above as appropriate for each employee. This will not preclude request of driver's records for review by the Safety Coordinator as deemed necessary.

29.16 Major Convictions

Major convictions include but are not limited to:

- a. driving while intoxicated or under the influence of alcohol or drugs;
- b. failure to stop and report an accident;
- c. homicide, manslaughter or assault arising out of the operation of a motor vehicle;
- d. driving during a period when license is suspended or revoked;
- e. reckless driving;
- f. possession of an open container of alcoholic beverage; speed contest, drag or highway racing; or
- g. attempting to elude a Peace Officer.

29.17 Minor Convictions

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Any moving traffic violation other than a major conviction except the following:

- a. Motor vehicle equipment, load or size requirements;
- b. Improper display or failure to display license plates provided such plates exist;
Failure to have in possession a valid driver's license.

29.18 Preventable Accident

A preventable accident is defined by the National Safety Council as "Any vehicle accident involving a vehicle which results in property damage and/or personal injury regardless of who was injured, what property was damaged, to what extent, or where it occurred in which the driver in question failed to exercise reasonable precaution to prevent the accident."

29.19 Chauffeur

According to the West Virginia Department of Transportation Motor Vehicle Division, chauffeur means a person who is employed by another for the principal purpose of driving a motor vehicle, or a person who drives a school bus transporting school children or any motor vehicle when in use for the transportation of persons or property for compensation, but does not include a car pool operator.

29.20 Vehicular Accident

Any accident occurring between a company vehicle (or private car when employee is on official company business and has been formerly authorized mileage) and another vehicle, pedestrian, animal or fixed object.

29.21 Special Note

Police shall be called to investigate all company vehicle accidents, and it is incumbent upon the supervisor to insure that all facts are obtained with respect to the driver. Under no circumstances should any employee make any statement relative to liability or draw any conclusions as to the facts asserted at the scene.

The occurrence of a vehicle accident may or may not be the fault of the employee. Therefore, it is imperative that the same investigative procedure which was outlined for the industrial accidents be used to determine the cause of accident and corrective action taken by the employee's immediate supervisor.

29.22 Questions to Determine if a Vehicle Accident was Preventable

One basic question in determining preventability is: "Did our employee take every reasonable precaution to avoid the auto accident?" If "No," our driver was not driving defensively and, thus, the accident should be judged "preventable." Please note that legal liability or any citations should never influence the decision of determining preventability of an accident.

Answer the following questions which adhere to the given situation(s):

29.23 Intersection Accidents

- a. Did our employee approach the intersection at a controlled speed which was reasonable for conditions?
- b. Was our driver prepared to stop before entering the intersection regardless of right of way?
- c. Did our driver avoid entering an intersection on the amber signal?
- d. Did our driver avoid overtaking or passing at the intersection?
- e. At a blind corner, did our driver approach slowly, with a foot on the brake pedal?
- f. Did our driver make certain all other drivers were stopping for a traffic light or stop sign?
- g. Was our driver alert for the turns of other vehicles?
- h. Did our driver signal his/her change in direction well in advance?
- i. Did our driver allow oncoming traffic to clear before making a left turn?
- j. Did our driver turn from the proper lane?

29.24 We Pulled from a Parked Position

- a. Did our driver look to the front and rear for approaching traffic immediately before pulling out?
- b. Did our driver look back, rather than depending upon the rear vision mirrors?
- c. Did our driver signal before pulling away from the curb?
- d. Did our driver start out only when an action would not require traffic to

change its speed or direction in order to avoid our vehicle?

- e. Did our driver continue to glance back while pulling out?

29.25 We Hit the Other Vehicle in the Rear

- a. Did our driver adjust speed to the conditions of the road, visibility, and traffic?
- b. Was our driver maintaining a safe following distance for conditions?
- c. If a vehicle pulled in front of our vehicle, did our driver drop back and re-establish the proper following distance?
- d. Did our driver approach the green traffic light cautiously, expecting the driver ahead to stop suddenly on a signal change?
- e. Did our driver look ahead of the vehicle in front for possible emergencies?

29.26 We were Backing

- 1. Was it necessary to back?
 - a. Did our driver have to park so close to the vehicle or obstacle ahead that backing was necessary when leaving the parking space?
 - b. Was it necessary to drive into a narrow street, dead-end, alley or driveway from which backing resulted?
- 2. If our driver could not see where to back:
 - a. Did the driver try to get someone as a guide?
 - b. Did the driver walk around the vehicle before getting in?
 - c. Did the driver back immediately after walking around?
 - d. If applicable, did the driver use the cone policy correctly?
 - e. Did the driver use the horn while backing?
 - f. Did the driver look to the rear without depending on the rear vision mirrors?
 - g. Did the driver back slowly?

29.27 We Skidded

- a. Did our driver travel at a speed safe for the conditions of weather and road?
- b. Was our driver keeping a safe following distance?
- c. Was our driver alert for loose gravel, sand, ruts, etc.?

29.28 Pedestrians

- a. Did our driver tap the horn to alert pedestrians of our vehicle approach?
- b. Did our driver pass through congested section anticipating that pedestrians might step in front of the car?
- c. Did our driver keep as much clearance between our vehicle and parked cars as conditions permitted?
- d. Did our driver interpret the pedestrian's next action or intention?
- e. Did our driver check the location of pedestrians before staring at a green signal?
- f. Did our driver give all pedestrians right of way?
- g. Did our driver refrain from passing a stopped school bus?
- h. Did our driver account for all children before starting up?
- i. Was our driver alert for signs of children who might run into the path (balls rolling into street, etc.)?

29.29 Others Hit Us While We Were Stopped or Parked

- a. Did our driver properly signal his/her intention to stop?
- b. Did our driver avoid coming to a sudden stop?
- c. Was our driver parked on the proper side of the road?

29.30 Note

In the event that the provisions of this safety manual conflict with the provisions of the

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company Vehicle Policy or any other company policy, rule or regulation, the provisions of such other policy, rule or regulation shall control.

Chapter 30 - Vehicle Maintenance

VEHICLE MAINTENANCE

30.1 General

In the normal activities of vehicle maintenance, it is essential that adequate safety standards be prescribed and observed by all shop and company personnel. This should help promote efficiency and reduce the possibility of personal injury and property damage.

Oil and grease-soaked rags or other waste should be disposed of in self closing metal waste cans approved (UL or FM) by nationally recognized fire protection laboratories.

30.2 Mechanical Hoist/Lifts

Every mechanical automotive hoist should have a brake that will automatically hold twice the rated load at whatever level it may be when lifting ceases.

Hydraulic lifts have devices that will hold the load independently of the lifting means at the maximum "up" position.

Hoists should never be used to lift vehicles which weigh beyond the rate lift's capacity or to lift one end of the vehicle only.

The condition of lifts should be checked monthly. Leaks should be repaired and oil levels maintained on hydraulic lifts.

Controls on lifts should require continuous pressure from the operator and at a distance so the operator will not be stuck by the falling load if the lift falls.

No person should stand in front of vehicles being driven onto the lifts and no person should remain in a vehicle being lifted. No bystanders should be allowed near equipment being lifted.

All lifts should have safety legs which will hold the load if the lift fails.

Employees must always place these legs properly before working under raised equipment.

Wearing safety goggles will save the annoyance of workers getting dust and an occasional serious injury from foreign particles in the eye.

Employees should never put their hands over grease gun nozzles (grease can be forced under the skin if the gun handle is pulled).

When lubricating springs, stand clear of lubricant spray to avoid inhalation.

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The tops of grease cylinders must be securely screwed or clamped in place to prevent blowing off under pressure.

30.3 Jacks

The rated load should be legibly and permanently marked in a prominent location on the jack by casting, stamping, or other suitable means.

30.4 Operations and Maintenance

In the absence of a firm foundation, the base of the jack should be blocked. If there is a possibility of slippage of the cap, a block should be placed in between the cap and the load.

The operator should watch the stop indicator, which should be kept clean, in order to determine the limit of travel. The indicated limit should not be overrun.

After the load has been raised, it should be cribbed, blocked, or otherwise secured at once.

Hydraulic jacks exposed to freezing temperatures should be supplied with an adequate antifreeze liquid.

30.5 Tire Repairs (Multi-Piece and Single Piece Rim/Wheels)

All employees will be instructed in and expected to follow the established safe operating procedures.

30.6 Employee Training

All employees who service rim wheels must be trained in the hazards involved and the safety procedures to be followed in a manner which the employee is able to understand.

Employees should demonstrate and maintain the ability to perform the following tasks:

Demounting of tires (including deflation);

Mounting of tires (including inflation with restraining device or other safeguard);

Use of the restraining device or barrier, and other equipment required;

Handling of rim wheels;

Inflation of the tire when a single piece rim wheel is mounted on a vehicle;

An understanding of the necessity of standing outside the trajectory both during inflation of the tire and during inspection of the rim wheel following inflation; and

Installation and removal of rim wheels.

Employees will be evaluated on their ability to perform the above-mentioned tasks and to service rim wheels safely. Additional training will be provided as necessary to assure employee proficiency is maintained.

30.7 Tire Servicing Equipment

A restraining device or barrier for inflating tires on multi-piece wheels and single piece wheels is provided, unless on the single piece wheels the rim wheel will be bolted onto a vehicle during inflation.

Each restraining device or barrier should have the capacity to withstand the maximum force that would be transferred to it during a rim wheel separation occurring at 150 percent of the maximum tire specification pressure for the type of rim wheel being serviced.

Restraining devices and barriers should be capable of preventing the rim wheel components from being thrown outside or beyond the device or barrier.

Restraining devices and barriers should be visibly inspected prior to each day's use after any separation of the rim wheel components or sudden release of contained air.

Any of the following defects exhibited on any restraining device or barrier should be removed from service:

- Cracks at welds;
- Cracked or broken components;
- Bent or sprung components;
- Pitting of components due to corrosion; or
- Other structural damage which would decrease its effectiveness.

Restraining devices or barriers removed from service should not be returned to service until they are repaired and reinspected. Any structural repairs such as component replacement or rewelding should not be returned to service until they are certified by either the manufacturer or a Registered Professional Engineer.

For inflating tires, an air line assembly should be provided and consist of the following:

1. A clip-on chuck;

2. An in-line valve with a pressure gauge or one that can be pre-set; and
3. A sufficient length of hose between the clip-on chuck and the in-line valve (if one is used) to allow the employee to stand outside the trajectory.

Current charts (rim manuals) should have instructions available in service areas for the types of wheels being serviced.

Only tools recommended in the rim manual for the type of wheel being serviced should be used to service rim wheels.

30.8 Wheel Component Acceptability

Multi-piece wheel components should not be interchanged, except as provided in the charts or in the applicable rim manual.

Multi-piece wheel components and single piece wheels should be inspected prior to assembly.

Any wheel or wheel component exhibiting damage or defects such as cracks, bands, corrosion, etc. should not be used, tagged unserviceable, and removed from the service area.

Damaged or leaky valves should be replaced.

Rim flanges, rim gutters, rings, bead seating surfaces, and the bead areas of tires should be free of any surface rust, scale or loose or flaked rubber build-up prior to mounting and inflation.

The size and type of both the tire and the wheel should be checked for compatibility prior to assembly of the rim wheel.

30.9 Controlling Moving Vehicles/Traffic

Movement of vehicles inside shops, and garages should be regulated by rigidly enforced traffic rules.

Vehicles with air brakes should not be moved until sufficient air pressure has been built up.

Mirrors should be installed at blind corners.

Vehicles should be moved in low gear and at low speed inside shop areas, especially up and down ramps.

Employees should stand out of the way of moving vehicles.

No vehicle should be backed in a garage without assistance from a signalman.

Mechanics should not work under vehicles while lying on "creepers" if there is any danger another vehicle will pass over the area where their legs are sticking out. If necessary, adjacent vehicles should be locked and tagged and/or adjacent spares should be blocked with barricades.

Mechanics should follow lockout procedures when working on vehicles to ensure that engines are not started and vehicles are not moved while they are at work.

Mechanics should:

1. Lockout the starting switch;
2. Place a warning tag on the starting control or steering wheel;
3. Block wheels and all moving parts during maintenance.

Tilt cabs and engine hoods should be propped up when not in place.

To prevent steam burns, all vehicles should be equipped with a safety petcock, which should be opened to bleed steam off before removing radiator caps.

Chapter 31 - Electrical Lockout/Tagout

29 CFR PART 1910.147
THE CONTROL OF HAZARDOUS ENERGY
(LOCKOUT/TAGOUT)

31.1 Definitions

Affected Employee

An employee whose job requires him/her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout or tagout, or whose job requires him/her to work in an area in which such servicing or maintenance is being performed.

Authorized Employee

A person who locks or implements a tagout system procedure on machines or equipment to perform the servicing or maintenance on that machine or equipment. An authorized employee and an affected employee may be the same person when the affected employee's duties also include performing maintenance or service on a machine or equipment which must be locked or a tagout system implemented.

Capable Of Being Locked Out

An energy isolating device will be considered to be capable of being locked out either if it is designed with a hasp or other attachment or integral part to which, or through which a lock can be affixed, or if it has a locking mechanism built into it. Other energy isolating devices will also be considered to be capable of being locked out, if lockout can be achieved without the need to dismantle, rebuild, or replace the energy isolating device or permanently alter its energy control capability.

Energized

Connected to an energy source or containing residual or stored energy.

Energy Isolating Device

A mechanical device that physically prevents the transmission or release of energy, including but not limited to the following: A manually operated electrical circuit breaker; a disconnect switch; a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors and, in addition, no pole can be operated independently; a slide gate; a slip bind; a line valve; a block; and any similar device used to block or isolate energy. The term does not include a push button, selector, and any other control circuit type devices.

Energy Source

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Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy.

Hot Tap

A procedure used in the repair, maintenance and services activities which involve welding on a piece of equipment (pipelines, vessels or tanks) under pressure, in order to install connections or appurtenances. It is commonly used to replace or add sections of pipeline without the interruption of service for air, gas, water, steam, and petrochemical distribution systems.

Lockout

The placement of a lockout device on an energy isolating device, in accordance with an established procedure, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

Lockout Device

A device that utilizes a positive means such as a lock, either key or combination type, to hold an energy isolating device in the safe position and prevent the energizing of a machine or equipment.

Normal Production Operations

The utilization of a machine or equipment to perform its intended production function.

Servicing and/or Maintenance

Workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying, and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning or unjamming of machines or equipment and making adjustments or tool changes, where the employee may be exposed to the unexpected energization or startup of the equipment or release of hazardous energy.

Setting Up

Any work performed to prepare a machine or equipment to perform its normal production operation.

Tagout

The placement of a tagout device on an energy isolating device, in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

Tagout Device

A prominent warning device, such as a tag and a means of attachment, which can be securely fastened to an energy isolating device in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

31.2 Scope

This standard covers the servicing and maintenance of machines and equipment in which the unexpected energization or start up of the machines or equipment, or release of stored energy could cause injury to employees. This standard establishes minimum performance requirements for the control of such hazardous energy.

This standard does not cover the following:

Construction, agriculture, and maritime employment.

Installations under the exclusive control of electric utilities for the purpose of power generation, transmission, and distribution, including related equipment for communication or metering.

Exposure to electrical hazards from work on, near, or with conductors or equipment in electrical utilization installations, which is covered by Subpart S of this part.

Oil and gas well drilling and servicing.

31.3 Application

This standard applies to the control of energy during servicing and/or maintenance of machines and equipment.

Normal production operations are not covered by this standard. Servicing and/or maintenance which takes place during normal production operations is covered by this standard only if:

- a. An employee is required to remove or bypass a guard or other safety device.
- b. An employee is required to place any part of his or her body into an area on a machine or piece of equipment where work is actually performed upon the material being processed (point of operation) or where an associated danger zone exists during a machine operating cycle.

31.4 Purpose

This section requires companies to establish a program and utilize procedures for affixing appropriate lockout/tagout devices to energy isolating devices, and to otherwise disable machines or equipment to prevent unexpected energization, start-up or release of stored energy in order to prevent injury to employees.

31.5 General Requirements

31.6 Energy Control Program

The company shall establish a program consisting of an energy control procedure and employee training to ensure that before any employee performs any servicing or maintenance on a machine or equipment where the unexpected energizing, start up, or release of stored energy could occur and cause injury, the machine or equipment shall be isolated, and rendered inoperative.

31.7 Lockout/Tagout

If an energy isolating device is not capable of being locked out, the company's energy control program shall utilize a tagout system.

After October 31, 1989, whenever major replacement, repair, renovation or modification of machines or equipment is performed, and whenever new machines or equipment are installed, energy isolating devices for such machines or equipment shall be designed to accept a lockout device.

31.8 Full Employee Protection

When a tagout device is used on an energy isolating device which is capable of being locked out, the tagout device shall be attached at the same location that the lockout device would have been attached, and the company shall demonstrate that the tagout program will provide a level of safety equivalent to that obtained by using a lockout program.

In demonstrating that a level of safety is achieved in the tagout program which is equivalent to the level of safety obtained by using a lockout program, the company shall demonstrate full compliance with all tagout related provisions of this standard together with such additional elements as are necessary to provide the equivalent safety available from the use of a lockout device. Additional means to be considered as part of the demonstration of full employee protection shall include the implementation of

additional safety measures such as removal of an isolating circuit element, blocking of a controlling switch, opening of an extra disconnecting device, or the removal of a valve handle to reduce the likelihood of inadvertent energization.

31.9 Energy Control Procedure

Procedures shall be developed, documented and utilized for the control of potentially hazardous energy when employees are engaged in the activities covered by this section.

The procedures shall clearly and specifically outline the scope, purpose, authorization, rules, and techniques to be utilized for the control of hazardous energy, and the means to enforce compliance including, but not limited to, the following:

A specific statement of the intended use of the procedure.

Specific procedural steps for shutting down, isolating, blocking and securing machines or equipment to control hazardous energy.

Specific procedural steps for the placement, removal and transfer of lockout devices or tagout devices and the responsibility for them.

Specific requirements for testing a machine or equipment to determine and verify the effectiveness of lockout devices, tagout devices, and other energy control measures.

31.10 Protective Materials and Hardware

Locks, tags, chains, wedges, key blocks, adapter pins, self-locking fasteners, or other hardware shall be provided by the company for isolating, securing or blocking of machines or equipment from energy sources.

Lockout/Tagout devices shall be singularly identified; shall be the only device(s) used for controlling energy; shall not be used for other purposes; and shall meet the following requirements:

1. Durable

Lockout/Tagout devices shall be capable of withstanding the environment to which they are exposed for the maximum period of time that exposure is expected.

Tagout devices shall be constructed and printed so that exposure to weather conditions or wet and damp locations will not cause the tag to deteriorate or the message on the tag to become illegible.

Tags shall not deteriorate when used in corrosive environments such as areas where acid and alkali chemicals are handled and stored.

2. Standardized

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a. Lockout/Tagout devices shall be standardized within the facility in at least one of the following criteria: Color; Shape; Size; and additionally, in the case of tagout devices, print and format shall be standardized.

3. Substantial

a. Lockout devices shall be substantial enough to prevent removal without the use of excessive force or unusual techniques, such as with the use of bolt cutters or other metal cutting tools.

b. Tagout devices including and their means of attachment, shall be substantial enough to prevent inadvertent or accidental removal. Tagout device attachment means shall be of non-reusable type, attachable by hand, self locking, and non-releasable with a minimum unlocking strength of no less than 50 pounds and having the general design and basic characteristics of being at least equivalent to a one-piece, all-environment-tolerant nylon cable tie.

4. Identifiable

a. Lockout/Tagout devices shall indicate the identity of the employee applying the device(s). Tagout devices shall warn against hazardous conditions if the machine or equipment is energized and shall include a legend such as: DO NOT START, DO NOT OPEN, DO NOT CLOSE, DO NOT ENERGIZE, AND/OR DO NOT OPERATE.

31.11 Periodic Inspections

The company shall conduct a periodic inspection of the energy control procedure at least annually to ensure that the procedure and the requirements of this standard are being followed.

The periodic inspection shall be performed by an authorized employee other than the one(s) utilizing the energy control procedure being inspected.

The periodic inspection shall be designed to correct any deviations or inadequacies observed.

Where lockout is used for energy control, the periodic inspection shall include a review, between the inspector and each authorized employee, of that employee's responsibilities under the energy control procedure being inspected.

Where tagout is used for energy control, the periodic inspection shall include a review, between the inspector and each authorized and affected employee, of that employee's responsibilities under the energy control procedure being inspected.

The company shall certify that the periodic inspections have been performed. The certification shall identify the machine or equipment on which the energy control procedure was being utilized, the date of the inspection, the employees included in the inspection, and the person performing the inspection.

31.12 Energy Isolation

Implementation of lockout or the tagout system shall be performed only by authorized employees.

31.13 Notification of Employees

Affected employees shall be notified by the company or authorized employee of the application and removal of lockout/tagout devices. Notification shall be given before the controls are applied, and after they are removed from the machine or equipment.

31.14 Lockout/Tagout Policies & Procedures

31.14.a Purpose

This procedure establishes the minimum requirements for the lockout/tagout of energy isolating devices. It shall be used to ensure that the machine or equipment are isolated from all potentially hazardous energy, and locked out/tagged out before employees perform any servicing or maintenance activities where the unexpected energization, start-up or release of stored energy could cause injury (Type(s) and Magnitude(s) of Energy and Hazards).

31.14.b Responsibility

Appropriate employees shall be instructed in the safety significance of the lockout/tagout procedure. Each new or transferred affected employee and other employees whose work operations are or may be in the area shall be instructed in the purpose and use of the lockout/tagout procedure.

31.14.c Preparation for Lockout/Tagout

Make a survey to locate and identify all isolating devices to be certain which switch(s), valve(s) or other energy isolating devices apply to the equipment to be locked or tagged out. More than one energy source (electrical, mechanical, or others) may be involved.

31.14.d Sequence of Lockout/Tagout System Procedure

Notify all affected employees that a lockout/tagout system is going to be utilized and the reason therefore. The authorized employee shall know the type and magnitude of energy that the machine or equipment utilizes and shall understand the hazards thereof.

If the machine or equipment is operating, shut it down by the normal stopping procedure (depress stop button, open toggle switch, etc.).

Operate the switch, valve, or other energy isolating device(s) so that the equipment is isolated from its energy source(s). Stored energy (such as flywheels, hydraulic systems, and air, gas, steam, or water pressure, etc.) must be dissipated or restrained by methods such as repositioning, blocking, bleeding down, etc.

Lockout/Tagout the energy isolating devices with assigned individual lock(s) or tag(s) (Method(s) Selected; i.e.: Locks tags, additional safety measures, etc.).

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After ensuring that no personnel are exposed, and as a check on having disconnected the energy sources, operate the push button or other normal operating controls to make certain the equipment will not operate.

CAUTION: Return operating control(s) to "neutral" or "off" position after the test. The equipment is now locked out or tagged out.

31.15 Restoring Machines or Equipment to Production Operations

1. After the servicing and/or maintenance is complete and equipment is ready for normal production operations, check the area around the machines or equipment to ensure that no one is exposed.
2. After all tools have been removed from the machine or equipment, guards have been reinstalled and employees are in the clear, remove all lockout/tagout devices to restore energy to the machine or equipment.

31.15.a Procedure Involving More Than One Person

In the preceding steps, if more than one individual is required to lockout/tagout equipment, each shall place his/her own personal lockout/tagout device on the energy isolating device(s). When an energy isolating device cannot accept multiple locks or tags, a multiple lockout/tagout device (hasp) may be used. If lockout is used, a single lock may be used to lockout the machine or equipment with the key being placed in a lockout box or cabinet. As each person no longer needs to maintain his/her lockout protection, that person will remove his/her lock from the box or cabinet.

31.15.b Basic Rules for Using Lockout/Tagout System Procedure

All equipment shall be locked out or tagged out to protect against accidental or inadvertent operation when such operation could cause injury to personnel. Do not attempt to operate any switch, valve, or other energy isolating device where it is locked or tagged out.

31.16 Equipment of Facilities

The worker or employee shall follow the following for Equipment or Facilities Lockout.Tagout.

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31.17 Lockout/Tagout Sequence

The worker places the tag on all controls to warn others that the equipment is not to be operated. The worker writes the reason on the tag(s), identifies the equipment and dates and signs each tag.

The worker will pull power switches and/or circuit breakers and place a lockout clip(s) and a lock(s) on the controls to make them inoperative. Other power sources such as air, steam, or hydraulic may require blinding, disconnection, or valve locking.

After the worker has tagged and locked the equipment, the equipment should then be tried to assure that it will not operate.

All company locks and tags should be installed first and removed last, if possible.

When other workers are required to work on equipment, they must place their personal locks and tags on each piece of equipment.

All workers must "try" equipment after installing their personal locks to assure, once again that it will not start.

Locks and tags must remain on controls until work has been completed and it is safe to start the equipment. If maintenance or electrical work is to continue into the next shift, persons going off shift must remove their "personal" lock and leave their tag on the equipment. Persons coming on shift must install their own personal lock(s) and tag(s) if they will be working on the equipment.

Upon completion of work, all other workers will remove their locks and tags first. All company locks and tags are to be removed last after it is determined that the equipment is safe to operate.

No equipment should be started by anyone (including bumping to check rotation) without permission from the Safety Coordinator or supervisor responsible for the equipment.

31.18 Application of Control

The established procedure for the implementation of lockout/tagout system procedures shall cover the following elements and actions and shall be done in the following sequence:

31.19 Preparation for Shutdown

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Before an authorized or affected employee turns off a machine or equipment, the authorized employee shall have knowledge of the type and magnitude of the energy, the hazards of the energy to be controlled, and the method or means to control the energy.

31.20 Machine or Equipment Shutdown

The machine or equipment shall be turned off or shut down using the procedures required by this standard. An orderly shutdown must be utilized to avoid any additional or increased hazard(s) to employees as a result of equipment deenergization.

31.21 Machine or Equipment Isolation

All energy isolating devices that are needed to control the energy to the machine or equipment shall be physically located and operated in such a manner as to isolate the machine or equipment from the energy source(s).

31.22 Lockout or Tagout Device

Lockout or Tagout devices shall be affixed to each energy isolating device by authorized employees.

Lockout devices, where used, shall be affixed in a manner to that will hold the energy isolating devices in a "safe" or "off" position.

Tagout devices, where used, shall be affixed in such a manner as will clearly indicate that the operation or movement of energy isolating devices from the "safe" or "off" position is prohibited.

31.23 Release from Lockout or Tagout

The following procedures shall be followed for each lockout/tagout device that shall be removed or released.

31.24 Lockout/Tagout Device Removal

Each lockout/tagout device shall be removed from each isolating device by the employee who applied the device. The only exception is when the authorized employee

is not available to remove it, that device may be removed under the direction of the company, provided that specific procedures and training for such removal have been developed, documented, and incorporated into the company's energy control program. The company shall demonstrate that the specific procedure provides equivalent safety to the removal of the device by the authorized employee who applied it. The specific procedure shall include at least the following elements:

Verification by the company that the authorized employee who applied the device is not at the facility.

Making all reasonable efforts to contact the authorized employee to inform him/her that his/her lockout/tagout device has been removed.

Ensuring that the authorized employee has this knowledge before he/she resumes work at that facility.

31.25 Outside Personnel

a. Whenever outside servicing personnel are to be engaged in activities covered by the scope and application of this standard, the on-site company shall inform each other of their respective lockout/tagout procedures.

b. The on-site company shall ensure that his/her personnel understand and comply with restrictions and prohibitions of the outside company's energy control procedures.

31.26 Shift or Personnel Changes

Specific procedures shall be utilized during shift or personnel changes to ensure the continuity of lockout/tagout protection, including provision for the orderly transfer of lockout/tagout devices between off-going and oncoming employees, to minimize exposure to hazards from the unexpected energization, start-up of the machine or equipment, or release of stored energy.

31.27 Locks

Only individual keyed locks will be used. The key will remain in the possession of the person placing the locks. A master series of locks to be used specifically for lockout may be provided to each department that requires them. Master keys for the department will remain in the possession of the Safety Coordinator.

31.28 Danger Tags

Danger tags are not to be considered as a positive means of securing equipment, but are to be used in conjunction with locks. Tags will be used only to identify that work is

being done on a valve, switch, or piece of equipment when injury or property damage could result from the operation. No work is to be done on any operable equipment until the operation of it is prevented by the use of this procedure.

31.29 Warning

Any person who operates a switch or device to which "DANGER" tags are attached or removes a tag without authorization will be subject to dismissal.

31.30 Employee Training

All employees who are responsible for following this procedure must receive training in the procedure. This includes all employees who perform the following duties: maintenance, repair, or construction personnel, janitorial or clean-up personnel. The company shall provide training to ensure that the purpose and function of the energy control program are understood by employees and that the knowledge and skills required for the safe application, usage, and removal of energy controls are required by employees. The training shall include the following:

- a. Each authorized employee shall receive training in the recognition of applicable hazardous energy sources, the type and magnitude of the energy available in the workplace, and the methods and means of necessary for energy isolation and control.
- b. Each affected employee shall be instructed in the purpose and use of the energy control procedure.
- c. All other employees whose work operations are or may be in an area where energy control procedures may be utilized, shall be instructed about the procedure, and about the prohibition relating to attempts to restart or re-energize machines or equipment which are locked out or tagged out.
When tagout systems are used, employees shall also be trained in the following limitations of tags:

- a. Tags are essentially warning devices affixed to energy isolating devices, and do not provide the physical restraint on those devices that is provided by a lock.
- b. When a tag is attached to an energy isolating means, it is not to be removed without authorization of the authorized person responsible for it, and it is never to be bypassed, ignored, or otherwise defeated.
- c. Tags must be legible and understandable by all authorized, affected and all other employees whose work operations are or may be in the area, in order to be effective.
- d. Tags and their means of attachment must be made of materials which will withstand the environmental conditions encountered in the workplace.

- e. Tags may evoke a false sense of security, and their meaning needs to be understood as part of the overall energy control program.
- f. Tags must be securely attached to energy isolating devices so that they cannot be inadvertently or accidentally detached during use.

Employee retraining shall be provided for all authorized and affected employees annually, or whenever there is a change in their job assignments, a change in machines, equipment or processes that present a new hazard, or when there is a change in the energy control procedures.

Additional retraining shall also be conducted whenever a periodic inspection, or whenever the company has reason to believe, that there are deviations from or inadequacies in the employee's knowledge or use of the energy control procedures.

The retraining shall reestablish employee proficiency and introduce new or revised control methods and procedures, as necessary.

The company shall certify that employee training has been accomplished and is being kept up to date. The certification shall contain each employee's name and the dates of training. Each training session shall include at minimum the following:

- a. Lecture regarding this procedure including its purpose, scope, and application.
- b. Visual support materials including but not limited to video or film presentation of "Lockout Safety Procedures".
- c. Written quiz to establish the proficiency of the student.

31.31 Enforcement/Inspection

Due to the severity of injury that could occur while not following these procedures, the company will strictly enforce this policy. The primary responsibility lies with each supervisor for monitoring performance of their workers. Those employees found to be in violation of this procedure will be subject to the "Disciplinary Policy".

All surveys of worker performance shall be documented on the District's "Safety Inspection Report" form. The "inspection" must include the following information:

- a. Identity of the machine or equipment on which the "Lock Out" procedure was being utilized
- b. Date of inspection
- c. Employees included in the inspection
- d. The person performing the inspection.

31.32 Lockout/Tagout Procedure Form

Entry No.

1.		Name of Company
2.		Type(s) and Magnitude(s) of energy and hazards
3.		Name(s)/Job Title(s) of employees authorized to lockout or tagout

4.		Name(s)/Job Title(s) of affected employees and how to notify
5.		Type(s) and Location of energy isolating means
6.		Type(s) of Stored Energy - methods to dissipate or restrain
7.		Method(s) Selected ie: Locks, Tags, additional safety measures, etc.
8.		Type(s) of Equipment checked to ensure disconnection
9.		Name(s)/Job Title(s) of employees authorized for group lockout or tagout

Chapter 32 - Laser Safety

32.1 Introduction

This chapter provides guidance for the safe use of lasers and laser systems. It is derived from ANSI Z136.1, Standard for the Safe Use of Lasers, prescribed by the Department of Energy and OSHA regulations. The ANSI Standard establishes a hazard classification scheme based on the ability of the laser beam to cause biological damage to the eye or skin. This scheme is used to place each laser into one of four classes; each laser must meet the laser safety requirements specified for its class.

32.2 Laser Safety Duties of RSO

The Responsible Safety Officer: Provides consulting services on laser hazards, safety controls, and training programs. Suspends, restricts, or terminates the operation of a laser or laser system if he/she considers that the laser hazard controls are inadequate. Maintains the necessary records required by applicable government regulations. Approves all protective equipment used for the control of laser hazards. Provides an adequate stock of eye protective equipment. Inspects all laser areas as frequently as considered necessary. Accompanies OSHA inspectors and documents any discrepancies noted. Ensures that corrective action is taken where required. Reviews new installations (and modifications to installations that may increase the hazard to personnel) to ensure that the hazard control measures are adequate. Investigates any known or suspected accident resulting from a laser operation and initiates appropriate action. Provides an adequate stock of warning signs. Assists supervisors in developing training programs.

32.3 Additional Duties for RSO

The Responsible Safety Officer also: Knows all applicable procedures pertaining to laser safety including training requirements, hazards, and control measures. Issues appropriate instructions and training materials on laser hazards and their control to all personnel prior to their work with lasers. Suspends the operation of a laser when there is inadequate control of laser hazards. Prepares an Operational Safety Procedure for Class 3 and Class 4 lasers and laser systems and ensures that they are provided to users of such lasers. Ensures that personnel using Class 3 and Class 4 lasers undergo a laser eye examination at the following times: (a) prior to participation in laser work and (b) immediately after a suspected eye injury. Performs all scheduling of personnel for the laser eye examination. Notifies the appropriate Medical Services provider immediately of any known or suspected accident resulting from the operation of a laser. Assists in obtaining the appropriate medical attention for any employee involved in a laser accident. Ensures that all plans for laser installations or modifications of installations are reviewed for safety prior to implementation.

32.4 Employee Responsibilities

Employees who work near a laser: Must not energize or work with or near a laser unless authorized by the Responsible Safety Officer or a supervisor. Must receive appropriate training and comply with the safety regulations prescribed by the supervisor and the Responsible Safety Officer. Must notify the supervisor immediately of any known or suspected accident involving a laser. (If the supervisor is not available, the employee must immediately notify the applicable Medical Services provider, or dial 911 for emergencies.)

32.5 User Responsibilities

It is the responsibility of the user to notify the Pickering Associates, Inc. Responsible Safety Officer whenever the decision is made to fabricate, purchase or otherwise acquire a laser. This will facilitate the proper functioning of the Company's laser safety program and afford the user the opportunity to be informed about the safety considerations appropriate to the laser he is acquiring, prior to its actual use. To help ensure that oversights do not occur, the Purchasing Department has been asked to refer each requisition for a laser to the Responsible Safety Officer to initial before an order is placed.

32.6 OPS for Class 3 and 4 Lasers

Each Class 3 or Class 4 laser or laser system must have an Operational Safety Procedure (OSP) located near the unit. It must contain at least the following information: Name of the laser system supervisor List of authorized users General description of the laser or laser system Specific safety control measures used Specific alignment procedures used, if applicable Eye protection required, if applicable Emergency instructions The Operational Safety Procedure will be prepared from the latest OSP preparation guide. The OSP is prepared initially by the Laser System Supervisor with the Assistance of the Responsible Safety Officer.

32.7 Injury Potential Evaluation

Injury potential from exposure to a laser beam is the basis of the following hazard classification scheme: A Class 1 laser is one that is considered to be incapable of producing damaging radiation levels and is, therefore, exempt from any control measures. As a matter of good practice, any needless direct exposure of the eye to a Class 1 laser should be avoided. A Class 2 laser emits accessible, visible radiation at levels where damage from chronic exposure is possible. Class 2 lasers must have a caution label affixed to the external surface of the device. A Class 3 laser requires control measures to prevent viewing of the direct beam since biological damage to human tissue is possible from acute exposure. Class 3 lasers are subdivided into two classes, Class 3a and Class 3b. A Class 4 laser requires the use of controls that prevent exposure of the eye and skin to the direct and diffusely reflected beams. Whenever possible, the entire beam should be controlled. Lasers or laser systems

certified for a specific class by a manufacturer in accordance with the Federal Laser Product Performance Standard may be considered as fulfilling all classification requirements of this regulation. In cases where the laser or laser system classification is not provided, or where the class level may change because of a change from the use intended by the manufacturer, or because of the addition or deletion of engineering control measures, the laser or laser system may be classified by the Responsible Safety Officer. Summary levels of power emissions for continuous-wave laser and laser system classification. Terms: Wavelength range, MPE limiting aperture, Emission duration, Ultraviolet, Visible, Near infrared, Far infrared, Submillimeter. Summary of levels (energy and radiant exposure emissions) for single-pulsed laser and laser system classification. Terms: Wavelength range, MPE limiting aperture, Emission duration, Ultraviolet, Visible, Near infrared, Far infrared, Submillimeter.

32.8 Control Measures

Control measures are applied after the laser has been properly classified. Control measures are divided into four categories: 1. Physical (enclosures, interlocks, beam stops, etc.) 2. Protective equipment (goggles, clothing, etc.) 3. Warning devices (signs, lights, labels, etc.) 4. Procedures Physical measures are almost always the preferred method for controlling access to laser radiation. Class 1: There are no control measures or warning labels required, but needless exposures of the eye should be avoided as a matter of good practice. Class 2: An appropriate warning label must be affixed to the laser housing or control panel and have a protective housing. Class 3: Class 3 lasers are divided into two groups, Class 3a and Class 3b. Class 3a lasers are those which have an accessible output power between 1 and 5 times the lowest appropriate Class 3 exposure level and which do not exceed the appropriate maximum permissible exposure limit. For Class 3 visible lasers, the output range is 1 - 5 mW laser beam with optical instruments. Class 3b lasers require the following additional control measures: Training: All persons must be duly informed about the hazards of their particular laser operation. Engineering Controls: Priority must be given to the appropriate safety mechanisms (i.e., shutters, interlocks, stops, beam enlarging systems, etc.) as an integral part of the system. Control Area: Only authorized personnel are allowed to operate laser systems. Spectators are not permitted into the area unless appropriate supervisory approval has been obtained and protective measures taken. If the laser beam is not enclosed, special emphasis must be placed on control of the path of the laser beam. The area must be posted with the appropriate warning sign(s). Alignment Procedures: Must be performed in such a manner that primary beam or a specularly reflected beam does not expose the level in excess of the maximum permissible exposure limit. Equipment Labeling: Warning labels with the appropriate statement must be affixed to a conspicuous place on the laser. Eye Protection: Eye protective equipment specifically designed to protect against radiation from the particular kind of laser must be used when engineering and procedural controls are inadequate. Class 4: High-power lasers require more rigid control measures because there is a greater risk of injury from hazardous diffuse reflections. The entire beam path capable of producing reflections must be controlled. Controls must rely primarily on positive engineering safeguards and secondarily on procedural controls. In addition to the control measures

outlined under Class 3 lasers, the following Class 4 control measures must be applied. Key-switch: All lasers must be provided with an operative, keyed, master interlock or switching device. The key must be removable, and the laser must not be operable when the key is removed. Control Area: Operations must be optically isolated in an area designated for laser(s), and access to the area must require appropriate authorization. The area must be posted with the appropriate warning sign(s). Interlocks: Safety latches or interlocks will usually be required to deactivate the laser in the event of an unexpected entry into laser- controlled areas. The design of interlocks must be such as to allow both rapid egress by the laser personnel and admittance under emergency conditions. For such emergency conditions a control-disconnect switch (panic button) must be available for deactivating the laser. Interlocks must not allow automatic re-energizing of the power supply, but be designed so that the power supply or shutter must be reset manually. The person in charge of the laser-controlled area is permitted to momentarily override the room access interlocks when continuous operation is necessary, but specification for the override must have the approval of the Responsible Safety Officer.

32.9 Laser Housing

The protective housing on any Class 2, Class 3, or Class 4 laser system must limit the maximum accessible laser radiation to that level which defines the classification desired. The control measures appropriate to the classification apply when the laser is in normal operation. Each enclosed laser system must be provided with a minimum of two operative safety interlocks for any portion of the protective housing, which, by design, can be removed or displaced during normal operation. In this manner, failure of any single mechanical or electrical component in the redundant interlock system will not prevent the total interlock system from functioning. Viewing windows incorporated into an enclosed laser must be of a suitable filter material which attenuates the laser radiation to levels below the maximum permissible exposure limit.

32.10 Additional Controls

Since infrared and ultraviolet radiations are invisible, particular care must be taken when using these laser systems. Thus, in addition to the control measures that apply to the laser hazard classification, the following controls also apply: Infrared lasers ($>0.7 \mu\text{m}$): The beam from a Class 3 laser should be terminated by a highly absorbent, non-specular backstop. Class 4 laser beams should be terminated by a fire resistant material. (Note: Many surfaces which appear dull visually can act as reflectors of infrared radiation.) Ultraviolet lasers ($<0.4 \mu\text{m}$): Exposure to ultraviolet radiation must be minimized by using shield material which attenuates the radiation to levels below the maximum permissible limit for the specific UV wavelength. Special attention must be given to the possibility of producing hazardous byproducts, such as ozone, and the formation of skin-sensitizing agents. For both infrared and ultraviolet lasers, a warning sign and light should be displayed in a conspicuous location, warning those in the area when the laser is being operated.

32.11 Protective Eyewear

Laser protective eye wear must be worn whenever operational conditions may result in a potential eye hazard. All protective eye wear must be clearly labeled with the optical density at the appropriate laser wavelength(s). Adequate optical density must be weighted with the need for adequate visible light transmission. Periodic inspection must be made to ensure that pitting, cracking, etc., will not endanger the wearer. The frame of the protective eye wear should also be inspected for mechanical integrity and light leaks. Contact the Responsible Safety Officer to select the appropriate laser eye wear.

32.12 Signs

All signs must be conspicuously displayed at entrances to controlled laser areas. In the space above the tail on the sunburst, place any pertinent precautionary instructions or protective actions which are required, such as: For Class 3a: "Laser Radiation - Do Not Stare into Beam or View Directly with Optical Instruments." For Class 3b: "Laser Radiation - Avoid Direct Exposure to Beam." For Class 4: "Laser Radiation - Avoid Eye or Skin Exposure to Direct or Scattered Radiation." Additional precautionary instructions or protective actions that may also be provided are: Invisible, Knock Before Entering, Do Not Enter When Light Is On, Restricted Area, etc. In the space below the tail on the sunburst, place the type of laser or laser system and its classification.

32.13 Medical Exams

The basic reasons for performing medical surveillance of personnel working in laser environments are to establish a baseline against which damage can be measured and to identify certain workers who might be at special risk from chronic exposures. Medical exams are given for personnel using Class 3 and Class 4 lasers. The exams are required prior to laser use and following suspected injury. Names of employees needing the special laser eye examination are submitted to the appropriate Medical Services agency or by the Responsible Safety Officer. Pickering Associates, Inc. schedules each regular laser user for a medical examination. The elements of the examination include: medical history, visual acuity, external ocular examination, examination by slit lamp, ophthalmoscopy manifest refraction. When indicated fundus photographs with dilation for pre-assignment exams and exams following a suspected injury. The examinations are performed by an optometrist under the supervision of a qualified physician. Any employee with a suspected eye injury is referred to an ophthalmologist directly. In addition, all fundus photographs are reviewed by an ophthalmologist. Employees with skin injuries are also seen by a physician. The Responsible Safety Officer is notified by the physician or optometrist when an examination has been completed. If an eye injury is found, the Responsible Safety Officer will be notified immediately.

32.14 Related Hazards

The operation of lasers and laser systems, like any industrial or technological process, involves possible related hazards. Potential hazards related to laser use include: electrical, explosion, fire, compressed gases, cryogenic liquids, toxic materials, noise, ultraviolet light, and ionizing radiation. It is beyond the scope of this chapter to expand on these hazards. Additional information and/or referrals can be obtained from other chapters in this manual or from the Responsible Safety Officer.

Chapter 33 - Gases

33.1 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.

33.2 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;

33.3 Relief Valves Required

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

33.4 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.

33.5 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.

33.6 Equipment Design

When designing equipment for flammable gas that does not involve intentional combustion, any possibility of ignition or explosion must be prevented.

33.7 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 Pickering Associates, Inc. security department and the local Fire Department immediately.

33.8 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 than 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

33.9 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 "pigtailed" can ignite spontaneously and may cause sufficient heat and over-pressure to burst the pigtail, valve, or manifold: don't leave pigtailed 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.

33.10 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.

33.11 Magic Gas

Magic Gas (magic gas II) has been used at Pickering Associates, Inc. in multi-wire proportional chambers. This particular 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. Pickering Associates, Inc. safety rules for high pressure cylinders and flammable gases apply to all uses of Magic Gas.

33.12 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 Pickering Associates, Inc. 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 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 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 Pickering

Associates, Inc. sites in commercial DOT cylinders and must not be transferred from one DOT cylinder to another. Gases mixed at Pickering Associates, Inc. must never be put into a Pickering Associates, Inc.- 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 common or contract carrier.

33.13 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. Pickering Associates, Inc. owns cylinders for most of the common industrial gases and uses 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.

33.14 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 (Pickering Associates, Inc.- 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 Pickering Associates, Inc., such as in fixed tube banks, must be pressure tested to 5/3 (1.67) of their DOT service pressure every 6 years.

33.15 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 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 F. 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.

33.16 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.

33.17 Cylinder Storage

Cylinders not actively in use inside of buildings must be stored outside in areas approved by 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 sub-surface 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.

33.18 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.

33.19 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.

33.20 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.

33.21 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 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. 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 (200liter) 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 than 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 34 - Pressure Safety

34.1 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 Pickering Associates, Inc. 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 that 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.

34.2 Standard Operating Procedures

Any Pickering Associates, Inc. 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.

34.3 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.

34.4 Low and High Hazards

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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.

34.5 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 tubebanks and tubetrailers 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 West Virginia 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.

34.6 High Hazards

The systems listed below are high-hazard (containing hazardous materials or employing pressures that involve high hazard) and must be evaluated by the Responsible Safety

Officer to determine if an OSP is required. A Safety Note is required, and the vessel must be approved by a Certified Pressure Inspector or by outside safety engineer. Responsible Safety Officer approval is required for systems containing flammable, irritant, toxic, infectious, and/or radioactive fluids. Fire Department approval is also required for systems containing oxygen or flammable and/or toxic fluids. All vessels and systems that contain irritant, toxic, infectious, and/or radioactive fluids at any pressure. All oxygen or flammable-fluid vessels and systems. All pressurized equipment and ASME-coded vessels that have been structurally modified and that operate at gas pressures over 1 MPa gauge (150 psig) or liquid pressures over 10 MPa gauge (1500 psig) or that contain over 100 kJ (75,000 ft-lb) of stored energy.

34.7 ASME

Pressure equipment must be designed, or specified, and reviewed by the Responsible Safety Officer. Pressure vessels within the scope of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section VIII, Pressure Vessels (over 6 in. in diameter and 15 to 3000 psi for unfired pressure vessels), must comply with this Code except for Pressure Vessels controlled- and low-use ancillary vessels, such as: Vacuum vessels subject to over pressure only during an emergency, Vessels designed for specific one-time or low-activity use, such as an external pressure test of a vacuum vessel, or Vessels used for vacuum impregnating magnet coils. Pressure vessels and systems made of commercial pipe or pipe fittings, or both, must not be used above their rated American National Standards Institute (ANSI) working pressures and must comply with all the rules of this Manual.

34.8 Protective Containments

This section covers protective containment designed, specified, or used by Pickering Associates, Inc. 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.

34.9 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.

34.10 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.

34.11 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.

34.12 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 1×10^{-8} atm cm³/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.

34.13 MAWP Statements

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

34.14 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 Pickering Associates, Inc.-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. Pickering Associates, Inc. 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.

34.15 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 hose.) 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, Pickering Associates, Inc. -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 arrester 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 arrester 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.

34.16 Designer Responsibilities

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

34.17 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."

34.18 Operator Qualifications

Pickering Associates, Inc. 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 arrester 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.

34.19 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.

34.20 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, 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 West Virginia Boiler and Fired Pressure Vessel Safety Orders. 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.

34.21 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 West Virginia 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.

34.22 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 Pickering Associates, Inc. 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 ft² 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.

34.23 ASME Standards

Code: The ASME Boiler and Pressure Vessel Codes and the ANSI Standards. Low-pressure boiler - a boiler that does not operate at steam pressure or with steam-safety valve settings exceeding 15 psi (low-pressure boiler) or (2) operate at water pressures exceeding 160 psi or water temperatures exceeding 250 degrees F (hot-water-heating boiler). [This definition is not intended to include domestic-type water heaters, provided the heater does not have a water capacity of more than 120 gal and is used only for heating service water.] Miniature boiler - a boiler that has (1) an inside shell diameter of 16 in. or less and (2) a gross volume of 5 ft³ or less, exclusive of casing and insulation. (This volume includes the total volume of the steam- and water-containing parts of the boiler plus the volume of the combustion space and gas passages up to the point of attachment of the smokestack or chimney breaching.) High-Temperature Water Boiler - a fired or unfired pressure vessel used to heat water to temperatures above 212 degrees F at pressures exceeding 160 psi or to temperatures exceeding 250 degrees F regardless of pressure. Power boiler - a steam boiler operated at pressures exceeding 15 psi.

34.24 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 Pickering Associates, Inc. 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.

34.25 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 non-radioactive 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.

34.26 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.

34.27 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).

34.28 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.

34.29 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 so 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.

34.30 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 re-inspected 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 re-inspected and retested, unless otherwise specified in an SN or OSP. Pressure re-inspection 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.

34.31 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.

34.32 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 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.

34.33 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.

34.34 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 West Virginia Administration Code (latest version). Boiler and Fired Pressure Vessel Safety Orders, State of West Virginia Administration Code (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 35 - Non-Ionizing Radiation

35.1 Non-Ionizing Radiation

This chapter is written from CFR 1910.97 as well as West Virginia state requirements.

35.2 Electromagnetic radiation.

The term "electromagnetic radiation" is restricted to that portion of the spectrum commonly defined as the radio frequency region, which for the purpose of this specification shall include the microwave frequency region.

35.3 Definitions.

Definitions applicable to this paragraph.

35.3.a Partial body irradiation.

Pertains to the case in which part of the body is exposed to the incident electromagnetic energy.

35.3.b Radiation protection guide.

Radiation level which should not be exceeded without careful consideration of the reasons for doing so.

35.3.c Symbol.

The word "symbol" as used in this specification refers to the overall design, shape, and coloring of the rf radiation sign shown in figure G-11.

35.3.d Whole body irradiation.

Pertains to the case in which the entire body is exposed to the incident electromagnetic energy or in which the cross section of the body is smaller than the cross section of the incident radiation beam.

35.3.e Radiation protection guide.

For normal environmental conditions and for incident electromagnetic energy of frequencies from 10 MHz to 100 GHz, the radiation protection guide is 10 mW/cm.⁽²⁾ (milliwatt per square centimeter) as averaged over any possible 0.1-hour period. This means the following:

Power density: 10 mW./cm.⁽²⁾ for periods of 0.1-hour or more.

Energy density: 1 mW.-hr./cm.⁽²⁾ (milliwatt hour per square centimeter) during any 0.1-hour period.

This guide applies whether the radiation is continuous or intermittent.

These formulated recommendations pertain to both whole body irradiation and partial body irradiation. Partial body irradiation must be included since it has been shown that some parts of the human body (e.g., eyes, testicles) may be harmed if exposed to incident radiation levels significantly in excess of the recommended levels.

35.3.f Warning symbol.

The warning symbol for radio frequency radiation hazards shall consist of a red isosceles triangle above an inverted black isosceles triangle, separated and outlined by an aluminum color border. The words "Warning - Radio-Frequency Radiation Hazard" shall appear in the upper triangle. See figure G-11 at the end of this chapter.

American National Standard Safety Color Code for Marking Physical Hazards and the Identification of Certain Equipment, Z53.1-1953 which is incorporated by reference as specified in Sec. 1910.6, shall be used for color specification. All lettering and the border shall be of aluminum color.

The referenced Section above 1910.6 states the following:

1910.6(e)(63)

ANSI Z53.1-67 Safety Color Code for Marking Physical Hazards and the Identification of Certain Equipment, IBR approved for §§1910.97(a)(3)(ii); 1910.145(d)(2), (4), and (6).

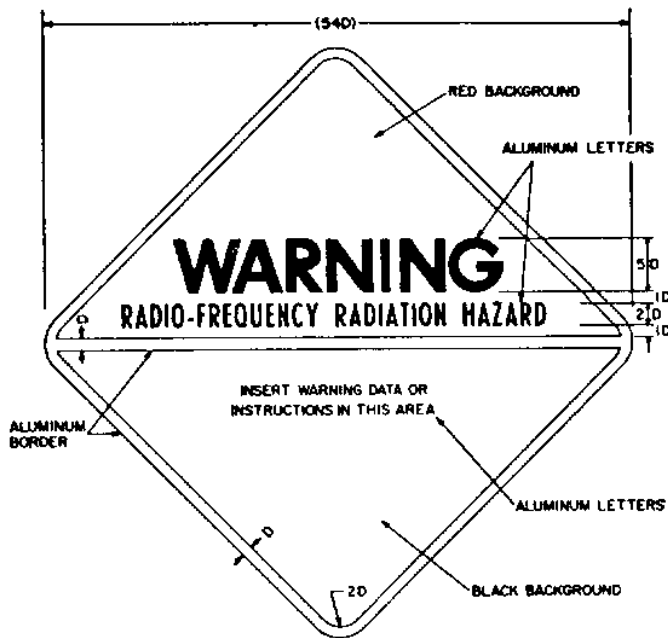
The inclusion and choice of warning information or precautionary instructions is at the discretion of the user. If such information is included it shall appear in the lower triangle of the warning symbol.

FIGURE G-11
RADIO-FREQUENCY RADIATION HAZARD WARNING SYMBOL

35.3.g Scope.

This section applies to all radiations originating from radio stations, radar equipment, and other possible sources of electromagnetic radiation such as used for communication, radio navigation, and industrial and scientific purposes. This section does not apply to the deliberate exposure of patients by, or under the direction of, practitioners of the healing arts.

**35.4 RADIO-FREQUENCY RADIATION HAZARD
WARNING SYMBOL**



1. Place handling and mounting instructions on reverse side.
2. D = Scaling unit.
3. Lettering: Ratio of letter height to thickness of letter lines.
 - Upper triangle : 5 to 1 Large
 - 6 to 1 Medium
 - Lower triangle 4 to 1 Small
 - 6 to 1 Medium
4. Symbol is square, triangles are right-angle isoseles.

Figure G-11

Radio-Frequency Radiation Hazard Warning Symbol

35.5 Radiofrequency and Microwave Radiation.

35.5.a Definitions.

Radiofrequency (RF) Energy. Electromagnetic energy restricted to that portion of the spectrum commonly defined as the radiofrequency or RF region with frequencies between 3 megahertz (MHz) and 300 Gigahertz (GHz) and which for the purposes of this specification shall include the microwave region with frequencies between 100 MHz and 300 GHz. (Hertz = 1 cycle/second, MHz = 1 million hertz, GHz = 1 billion hertz.)

Exposure. Irradiation of any part of the body by incident RF energy.

35.5.b Exposure Limits.

Employees shall not be exposed to RF energy from continuous wave or repetitively pulsed sources exceeding any of the following limits as averaged over any possible six minute (0.1 hour) period.

(1) Continuous exposure to an average maximum power density of 10 mW/cm² (milliwatts per square centimeter) or the equivalent free space average electric and magnetic field strengths of 200 V/M (volts per meter) rms and 0.5 A/M (amperes per meter) rms respectively.

(2) Exposure to interrupted or modulated RF energy shall not exceed:

(A) An average maximum energy density of 1 mW hr/cm² (milliwatt-hour per square centimeter);

(B) A mean squared electric field strength of 4×10^4 (V/M)² (volts squared per meter squared);

(C) A mean squared magnetic field strength of 0.25 (A/M)² (amperes squared per meter squared).

These energy densities and field strengths are approximately equivalent to a far field power density of 10 mW/cm².

35.5.c Information and Warning Signs.

In areas where employee exposure may exceed the limits specified in part (b) of this section, companies shall provide warning signs containing the following information in the following manner:

(1) Warning signs of RF radiation hazards, as described in ANSI C95.2-1966 "Radiofrequency Radiation Hazard Warning Symbol," containing the necessary information and description of required protective actions. (See Figure under section 4 of this chapter.)

(2) Signs shall be posted at all entrances to accessible areas containing RF radiation levels in excess of the exposure limits described in part (b).

(3) Warning signs shall be legible at a distance of ten (10) meters.

35.6 Non-Ionizing Radiation Requirements

(a) Only qualified and trained employees shall be assigned to install, adjust, and operate laser equipment.

(b) Proof of qualification of the laser equipment operator shall be available and in possession of operator at all times.

(c) Employees, when working in areas in which a potential exposure to direct or reflected laser light greater than 0.005 watt (5 milliwatts) exists, shall be provided with

antilaser eye protection devices as specified in Section 1516(e).

(d) Areas in which lasers are used shall be posted with laser warning signs and labels in accordance with American National Standards Institute (ANSI) Z136.1-1993, American National Standard for Safe Use of Lasers, Sections 4.7-4.9, which is hereby incorporated by reference.

(e) Beam shutters or caps shall be utilized, or the laser turned off, when laser transmission is not actually required. When the laser is left unattended for a substantial period of time, such as during lunch hour, overnight, or at change of shifts, the laser shall be turned off.

(f) Only mechanical or electronic means shall be used as a detector for guiding the internal alignment of the laser.

(g) The laser beam shall not be directed at employees.

(h) When it is raining or snowing, or when there is dust or fog in the air, the operation of laser systems shall be prohibited where practicable; in any event, employees shall be kept out of range of the area of source and target during such weather conditions.

(i) Laser equipment shall bear a label to indicate maximum output.

(j) Employees shall not be exposed to light intensities above:

(1) Direct staring: 1 micro-watt per square centimeter;

(2) Incidental observing: 1 milliwatt per square centimeter;

(3) Diffused reflected light: 2 1/2 watts per square centimeter.

(k) Employees shall not be exposed to microwave power densities in excess of 10 milliwatts per square centimeter.

35.7 Ultra-Violet Radiation.

Sterilizing lamps or other equipment producing ultra-violet radiation shall be so arranged or shielded that ultra-violet radiation, either direct or reflected, does not strike employees' eyes in harmful intensity; where such arrangement or shielding is not practicable, employees shall be provided with goggles of a type which will prevent such radiation from injuring the eyes.

Areas, rooms or locations where equipment producing such radiation is located shall be posted with warning signs or legends.

Chapter 36 - Ergonomics - Computers

36.1 Computer/Typing Comfort

Computer terminals are here to stay with more and more employees using them. You can prevent the minor muscle tension, stiffness, aches, fatigue and eyestrain that can result from sitting at your terminal for extended periods of time. Just follow this simple fitness and comfort program right at the terminal.

36.2 Good Posture

You can minimize unnecessary stress on your back by using good sitting posture - maintaining the three natural curves of your spine. You can maximize your comfort in your chair by learning a few practical posture comfort tips.

Use a lumbar support to relieve strain in your lumbar curve. You can use a lumbar roll or a towel rolled up to 4-6 inches. Place it in the small of your back.

Adjust your chair height so that your weight is shifted forward off your spine and your arms are at desk level. You may need a small wedge on your seat.

Shift your position throughout the day to keep your muscles loose and to relax away tension due to immobility. But be sure your spine stays aligned.

Keep your feet flat on the floor to help maintain good sitting posture and aid circulation in your legs. If they don't reach the floor, use a footrest.

36.3 Comfort Exercises

During a day of sitting in front of your computer with your arms extended to the keyboard, muscle tension and stiffness can build up in your neck, back, shoulders, hands, wrists, and even fingers. But it only takes minutes to prevent these discomforts with comfort exercises you can do at your terminal.

Warming Up helps you relax, loosens tense muscles and increases blood circulation. Deep breathing draws fresh air deep into your lungs, while reaching high stretches stiff muscles.

Deep Breathing: Inhale through your nose and exhale through your mouth, letting your stomach expand and contract. Repeat 6 times.

Reaching High: Raise your arms over your head, stretching as high as you can. Then bring your arms back down. Rest a moment. Repeat 2 times.

For The Neck: To relieve a stiff neck glide your head back, as far as it will go, keeping your head and ears level, (Doing it correctly creates a double chin). Now glide your head forward. Repeat 3 times.

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For The Upper Back: To relieve shoulder and back tension raise your hands to your shoulders. Using your arms, push your shoulders back. Keep your elbows down. Hold for 15 seconds. Repeat 3 times.

For The Lower Back: To relieve lumbar pressure lower your head and slowly roll your body as far as you can toward your knees. Hold for 10 seconds. Push yourself up with your leg muscles. Repeat 3 times.

For The Shoulders: To relieve shoulder stiffness raise your arms to the sides, elbows straight. Slowly rotate your arms in small circles forward, then backward. Lower your arms, then repeat 3 times.

For The Hands and Wrists: To relieve hand and wrist tension hold your right arm out, fingers pointed up. Take your left hand and gently bend your right hand back toward the forearm. Hold 5 seconds. Repeat on the other side.

For The Fingers: To relieve hand and finger tension hold your hands out in front of you, palms down. Spread your fingers apart as far as you can. Hold for 5 seconds, then make a tight fist. Repeat 3 times.

36.4 Eye Care

Using your eyes doesn't harm them. But focusing on a computer screen for long periods can cause temporary eye discomfort. The muscles that move and focus your eyes become strained. Your eyes become dry and itchy. So take care of them: get regular eye exams to be sure your eyes are healthy and vision problems are corrected. And practice eye comfort tips to prevent everyday eye strain.

Blinking: To keep your eyes moist, prevent itching, and aid in cleaning, blink them often.

Reducing Glare: To reduce reflection and glare from your screen, reposition your terminal, tilt the screen, or modify the lighting.

Palming: To rest your eyes from the light, shape your hands into shallow cups and place them lightly over your closed eyes. Hold them there for one minute.

Refocusing: To exercise the muscles that focus your lenses, periodically look away from the computer screen and focus on an object at least 20 feet away. Repeat three times.

Eye Rolling: To exercise the muscles that move your eyes, roll your eyeballs around clockwise 3 times, then counterclockwise 3 times. Make wide circles.

36.5 Use Comfort Tips for Life

The tips you've learned for comfort at the terminal or typewriter can help you be comfortable off the job, too. Whenever you're sitting for extended periods, you can use good posture. You can take a few moments to do your comfort exercises to prevent muscle strain and stiffness. And whenever you're focusing at close range a lot, you can use your eye comfort tips to reduce eyestrain and fatigue.

36.6 Preventing Repetitive Motion Injury

Bending your wrist, raising your arm above your head, or working with your elbow at an awkward angle - each is a simple movement you use to perform your job throughout the day. But if you repeat these or other motions over and over again while you work or play, you may develop repetitive motion injuries (also called cumulative trauma disorders or CTD). It could be days, months - even years - before symptoms of pain or tingling appear in your hand or arm. But if you know how to work and play smart, symptoms may never appear. And if they do, you can take steps to prevent them from getting worse.

Your Hand and Arm at Work

Think of your hand and arm as one of nature's more perfect inventions. Without much upkeep, this amazing, well designed "tool" made of muscles, nerves, tendons, and bones can help you do the hundreds of different motions needed to work or play. Whether you're tossing a jacket over your shoulder, turning a doorknob, writing, or holding a cup, your hand and arm perform constantly throughout the day.

Certain wrist and hand movements may increase your chances of developing repetitive motion problems. But by making a few small changes, you can break the movement patterns that could otherwise set you up for injury. One way to avoid problems is to work with well-designed tools, and know how to hold and use them. Also, learn how to modify the way you use your wrist and hand to avoid harming your muscles, nerves or joints.

The Right Size. Using tools that are the right size and length for your hand keeps you from having to "adjust" by using awkward positions to hold them.

The Best Shape. Use tools that are the right shape for the job you're doing, so you don't have to use too much force on the wrong part of your hand.

The Least Vibration. Use power tools with the least amount of vibration possible. Speak with your supervisor about taking steps to reduce vibration.

Know the Right Position. How you place yourself at your work station can determine the position of your wrist and hand. To work smart, stand above the object, or sit, if necessary, to work in the right position.

Keep Your Wrist Straight. Be sure to keep your wrist straight (neutral) when you work. By avoiding bent, extended, or twisted positions for long periods of time, you keep extra pressure off your wrist and hand.

Use your Whole Hand. Use as much of your hand as possible when holding an object, so you won't have to pinch with your fingers.

Use Both Hands. To give your hands a rest, try using one hand for a while, then the other.

Work Smart With Your Elbow and Shoulder

You can prevent repetitive motion injuries in your elbow and shoulder by knowing how to use and move them safely. And by knowing your "safety zone", you can avoid extreme movements and keep from straining your muscles and joints.

36.7 Safety Zone

You have a ready-made "safety zone" that lets you work or lift things with less chance of hurting your elbow and shoulder. To find your safety zone, stand up, then let your hands drop to your sides. Where your knuckles are is your **lower** safety limit. Your shoulder level is your **upper** safety limit. Work within this range to protect your elbow and shoulder.

Keep your arm close to your body, and avoid using back and forth movements with your elbow bent. Use less effort by using your entire arm to do the job. When possible, lift one item at a time. You're less likely to strain your muscles if you limit the weight of what you lift - even if it means lifting more times.

Self-Care Tips

Sometimes, despite your efforts to prevent repetitive motion injury, symptoms appear - and resting alone may not cure the aches in your hand or arm. Here are some easy self-care tips to help you feel more comfortable.

TAKE A BREAK: One of the best ways to recover is to take time out. Give your hand or arm time to rest. Take lunch or other scheduled breaks and, when possible, vary your activities.

36.8 Pain Relievers

Take pain relievers to reduce pain and swelling. Check with your doctor before taking any medications.

36.9 Ice

Apply ice to reduce pain and swelling.

36.10 Stretch and Relax

In between repetitions, give the overused parts of your hand and arm time to recover. Sometimes prevention and self-care alone do not stop repetitive motion symptoms. That's when it's time to see a doctor who specializes in occupational medicine.

You can prevent repetitive motion injuries by doing exercises that are designed to improve the movement of your hands and arms. Strength and endurance exercises will help you to stay healthy and be able to work comfortably for longer periods of time. Your doctor and physical therapist can help set up a daily exercise program for you.

Developing a general plan of action that helps you live a healthy lifestyle (both on and off the job) is another good move you can make to keep in shape. By doing simple exercises, eating well, and relaxing, you can give yourself a rest from your routine, and increase your odds of avoiding repetitive motion problems.

Chapter 37 - Ergonomics and Cumulative Trauma Disorders

37.1 Ergonomics & Cumulative Trauma Disorders

In recent years, there has been a significant increase in cumulative trauma disorders and other repetitive motion injuries due to ergonomic hazards. It has been estimated that currently approximately 30% of all workers' compensation claim can be attributed to cumulative trauma disorders. The Occupational Safety and Health Administration predicts that this figure will rise to 50% by the year 2005. These cumulative trauma disorders include disorders to musculoskeletal and nervous systems in the upper and lower extremities and back. These are caused and/or aggravated by repetitive motions, forceful exertions, working in sustained or awkward postures, mechanical compression of parts of the upper and lower extremities, vibration and other ergonomic stressors.

Some of this increase is due to increased awareness by industry, labor or government that ergonomic disorders have a connection to the work site. However, most ergonomic hazards and related disorders appear to be related to changes in technologies and production procedures, as well as incentive systems, pay by piece work and voluntary overtime.

37.2 Purpose

To establish an ergonomics program to adapt the job and workplace to the worker by designing task and tools that are within the workers' capabilities and limitations.

37.3 Objective

To prevent injuries by removing their causes. For ergonomic hazards, this can be achieved through taking steps to eliminate or reduce worker exposure to conditions that lead to cumulative trauma disorders and related injuries.

37.4 Definitions

The following definitions are provided to clarify the terms used by OSHA in the ergonomic standards.

Administrative Controls Risk control measures which include, but are not limited to, modification of work tasks, job enlargement, adjustment of work pace, job rotation, workload reduction, exercise and use of rest periods to interrupt activities which pose a CTD risk to the employee.

Cumulative Trauma Disorders (CTD) Any physical disorder that develops from or is aggravated by repeated biomechanical stress due to ergonomic hazards. CTD's are a class of musculoskeletal disorders involving damage to the tendons, tendon sheaths, synovial lubrication of the tendon sheaths and the related bones, muscles and nerves of the hands, wrists, elbows, shoulders, neck and back. The more

frequently occurring occupationally induced disorders include carpal tunnel syndrome, other nerve compression syndromes, epicondylitis, tendinitis, tenosynovitis, synovitis, low back pain and other muscle strains.

CTD Risk Conditions of a job, process or operation that contribute to the risk of developing CTD'S:

Frequency: rate at which specific physical motions or exertions are repeated

Force: physical exertion or pressure applied to any part of the body

Duration: length of work activity which poses a CTD risk

Posture: position of a body part during work activity

Vibration: exposure to localized or whole-body vibration

Cold Temperatures: exposure of hands and feet to cold temperatures which cause discomfort

CTD Symptom Occurrence of any of the following when persisting or recurring: pain from movement, pressure or from exposure to cold or vibration; change in skin color on exposure to cold or vibration; numbness or tingling in an arm, leg or digit; decreased range of motion; decreased grip strength; swelling of a joint or part of an arm, leg or digit.

Engineering Controls Risk control measures which include, but are not limited to, devices (adjustable work stations, tables, chairs, equipment and tools) and physical modifications to work stations, equipment, tools, production processes or any other aspect of the work environment.

Ergonomics The study of the design of requirements of work in relation to the physical and psychological capabilities and limitations of workers. Ergonomics seeks to fit the job to the person rather than the person to the job.

Feasible Engineering and Administrative Controls Control measures which are technologically capable of being implemented, except where they would impose an undue hardship on the company.

Medical Evaluator A licensed physician or chiropractor or any of the following who have received training in the medical evaluation of CTD'S: nurse practitioner, registered nurse or physician assistant.

Personal Protective Equipment (PPE) Clothing, gloves, padding, devices, equipment and other items worn on or attached to the body and used for the purpose of controlling CTD risk (does not include splints).

A rigid device worn on or attached to a limb which keeps a body part in a fixed position.

Visual Display Terminal (VDT) A device or set of devices not designed for handheld use, which involves use of a keyboard and cathode ray tube or other electronic devices for entry or display of data such as words, numbers and symbols.

VDT Operator An employee who routinely works at a VDT for a cumulative total of 4 or more hours, inclusive of breaks, during a 12-hour period.

37.5 Program Philosophy

An ergonomic program should prevent, eliminate and/or reduce occupational exposure to ergonomic hazards on the job. This will be accomplished through identification and intervention by the company and through implementation by employees.

37.6 Recognition of Ergonomic Problems

Systematic approaches to job analysis are needed to identify ergonomic problems.

1 Records Review

a. One-Time Records Review: An company shall perform a one-time review of its existing records for the three year period ending on the date the review is initiated to determine whether employees have reported symptoms or been diagnosed with any CTD or whether records indicate that a CTD risk exists at the workplace. The OSHA 300 log review should contain information about what kinds of injuries have occurred on which jobs. These may need to be supplemented with information from "First Report of Injury", Workers' Compensation or safety records.

b. Reporting: An company will implement an effective procedure to encourage employees to report, verbally or in writing, CTD symptoms or risk without fear of reprisal or discrimination. If any employee is unable to write, the company will transcribe the verbal report to writing. All written reports and documentation shall be maintained for a period of at least 3 years.

2. Worksite Evaluation

An company will promptly perform an ergonomic evaluation when an employee reports a CTD symptom that is likely to be work-related, an employee is diagnosed with a CTD as indicated from the records review or the company obtains information that identifies CTD risk for a specific job task in the workplace. The purpose of this evaluation is to ensure that the company recognizes any ergonomic problems that exist and to identify areas for potential improvement. The worksite evaluation can be accomplished in several ways to include:

1. Walk-throughs and observation of jobs
2. Job checklists
3. Photographs or videotape of selected jobs/activities
4. Formal job analysis including methods analysis, risk factor identification and detailed ergonomic evaluations.

Worksite evaluations need to be repeated if control measures are implemented which affect any work activity in the workplace, new processes, procedures or work activities which may increase CTD risk are introduced into the workplace or if the company acquires information that the initial worksite evaluation was deficient.

3. Employee Surveys/Interviews

In conjunction with a worksite evaluation, employee surveys and/or interviews should be conducted to determine if they have recently experienced or are experiencing CTD symptoms related to CTD risk at the workplace. This inquiry should include the nature of the symptoms and which work activities, if any, seem to precipitate these symptoms.

37.7 Ergonomic Program Elements

Program elements are to be adapted, as appropriate, to the size and resources of the work place.

1. Hazard Prevention and Control

After ergonomic hazards are identified through records review and worksite analysis, the next step is to design measures to prevent or control these hazards. Controls measures are necessary when any work-related CTD risk causes or aggravates CTD symptoms or when job activities are substantially likely to result in the development of a CTD. Control measures include:

- a. Engineering Controls: Engineering controls are the preferred method of control as possible. The goal of an ergonomics program is to design the job to fit the worker, not to force the worker to fit the job. This can be accomplished by designing or modifying the work station, work methods and tools to eliminate awkward postures, to eliminate excessive exertion and to decrease repetitive motion.
- b. Work Practice Controls:- Key elements of a good work practice program for ergonomics include proper work techniques, employee conditioning, regular monitoring and feedback, adjustment and modifications and enforcement.
- c. Administrative Controls- A good ergonomics program includes administrative controls that decrease the duration, frequency and severity of exposures to ergonomic

stressors. Administrative controls include: decreasing the number of repetitions per employee by reducing production rates and limiting overtime hours, providing scheduled rest pauses, using job rotation to rotate employees among other jobs that use different muscle-tendon groups, increasing the number of employees assigned to perform tasks, job enlargement to increase scope of assigned tasks, etc.

d. Personal Protective Equipment (PPE): PPE should not be used as a substitute for engineering, work practice and administrative controls. Appropriate PPE should accommodate the physical requirements of the worker and jobs and be available in a range of sizes. Proper fit is essential. Protection against extreme cold (lower than 40 degrees Fahrenheit) should be provided to minimize stress on joints.

2. Medical Management

An company shall make available, at no cost to employees, effective medical management when any employee reports a CTD symptom. Methods to identify and treat employees with CTD symptoms should be developed. Early recognition is important since the sooner the symptoms are identified, the better the chances for effective and less costly treatment.

Methods of symptom identification include: employee training sessions in which employees are instructed to identify problems, employee surveys or periodic physical examinations. Steps should be taken to ensure that once an employee reports symptoms, standardized procedures are followed for evaluation and treatment. Medical management will include early detection and evaluation of work-related CTD's and CTD symptoms by a qualified medical evaluator.

3. Training and Education

The purpose of training and education is to ensure that employees are informed about basic ergonomic hazards to which they may be exposed so that they are able to participate actively in their own protection. Training allows managers, supervisors and employees to understand ergonomic and other job hazards, prevention and control of hazards and medical consequences. This program should be designed and implemented by qualified individuals.

General Training These training sessions should be given to employees who are potentially exposed to ergonomic risks to provide basic information about CTD symptoms and ergonomic principles used to prevent injuries.

Job Specific Training Each newly hired employee should receive training in proper work procedures and in safe use of machines/equipment. Training should also be provided to employees where there are changes in work procedures, when new machines or equipment are used and when changes have been made after an

ergonomic evaluation.

37.8 Written Program

Effective implementation of the ergonomic program requires written documentation of policies for job safety, health and ergonomics that is endorsed by the highest level of management.

37.9 Employee Involvement

Employees often have special insights into ways of improving their own jobs, especially if given training in ergonomic principles. Participation often helps pave the way to accept change.

Methods to include employee input include:

Suggestion/complaint system to allow workers to voice concerns to management and to provide feedback without fear of reprisal.

Interviews with employees when job evaluations of their work stations are made

Employee surveys to identify symptoms

Documented procedure that encourages prompt and accurate reporting of signs and symptoms of CTD by employees so that they can be evaluated and treated as needed.

37.10 Program Review and Evaluation

Procedures should be developed to evaluate the implementation of the ergonomic program and to monitor progress. Semiannual reviews by management are recommended to evaluate the program's success in meeting its goals and objectives.

Methods of review include:

1. Analysis of trends in injury rates
2. Employee surveys
3. Surveys/evaluations of job/worksites after changes
4. Review of company evaluations
5. Updated logs of attempted or implemented job improvements

37.12 Employee Survey

Symptoms Survey

Please answer each question by indicating how often you have experienced each of the described physical problems within the last six (6) months:

	NEVER	SOMETIMES	FREQUENTLY	CONSTANTLY
PAIN OR STIFFNESS IN YOUR ARMS	1	2	3	4
PAIN OR STIFFNESS IN YOUR SHOULDERS	1	2	3	4
PAIN OR STIFFNESS IN YOUR NECK	1	2	3	4
PAIN OR STIFFNESS IN YOUR BACK	1	2	3	4
EYESTRAIN OR BURNING EYES	1	2	3	4
HEADACHES	1	2	3	4
KNEE OR LEG PAIN	1	2	3	4
WORK ENVIRONMENT SURVEY	1	2	3	4

Please indicate whether any of the following conditions contribute to physical problems in your job:

	NEVER	SOMETIMES	FREQUENTLY	CONSTANTLY
CHAIR COMFORT	1	2	3	4
WORK STATION LAYOUT	1	2	3	4
LEG ROOM	1	2	3	4
TABLE/DESK HEIGHT	1	2	3	4
COMPUTER KEYBOARD HEIGHT	1	2	3	4
LIFTING/CARRYING	1	2	3	4
LIGHTING	1	2	3	4
GLARE/REFLECTIONS	1	2	3	4
TEMPERATURE	1	2	3	4

Other (describe) _____

37.13 Worksite Ergonomic Evaluation

Indicate whether any of the following situations are present in the work place.

37.14 Workplace Characteristics

- _____ Extended reaches, beyond normal arm reach
- _____ Inadequate clearance for legs, chairs at work station
- _____ Poor seating; difficult to adjust, inadequate back support
- _____ Dials and displays that are difficult to read or reach
- _____ Large number of controls needed to perform the job
- _____ Inefficient motions due to work station layout
- _____ Inadequate space at the work station
- _____ No adjustability built into the work station

37.15 Environment

- _____ Noise that interferes with conversation, that is annoying or distracting
- _____ Vibration that is annoying
- _____ Temperature/humidity that is uncomfortable, distracting or interferes with the job
- _____ Poor air circulation
- _____ Inadequate lighting for the job
- _____ Glare that interferes with performing the job
- _____ Wet or slippery floor surfaces
- _____ Floors that are uneven (drains, pit marks, etc.)
- _____ Poor housekeeping (crowded aisles, debris on floor, etc.)
- _____ Hot surfaces
- _____ Conditions that require protective clothing

37.16 Physical Demands

- _____ Frequent heavy lifting (40 lbs. or greater)
- _____ Occasional very heavy lifting or force exertion (50 lbs. or greater)
- _____ Constant handling of materials/items
- _____ Handling items that are difficult to grasp
- _____ Awkward lifts or carries that are near or on the floor, above the shoulders or far in front of the body
- _____ Exertion of force in awkward positions (to the side, overhead, extended reaches)
- _____ Sudden movements during manual handling tasks Handling over-sized objects, including a two-person lift
- _____ Lack of handling aids (dolly, carts, pallet jack, etc.)
- _____ Unavailability of help for heavy lifting or pushing/pulling
- _____ Work in a cold environment where frequent lifting or awkward postures are required
- _____ Low working heights requiring the worker to bend or crouch frequently
- _____ Repeated or sustained work over shoulder level
- _____ Twisting the upper trunk in order to reach or see something
- _____ Short duration, heavy effort tasks
- _____ Moderate to heavy effort sustained throughout the shift
- _____ Constant standing with little opportunity to change positions
- _____ Constant sitting with little opportunity to stand up or walk around
- _____ High-precision movements in hands
- _____ Contact pressure from sharp or thin edges on the hands or wrists
- _____ Awkward postures in arms/hands (elbows elevated, wrist deviated or

bent)

_____ Repetitive movement of hands/wrists

_____ Use of hand tools/power equipment that are difficult to grasp

_____ Use of vibrating power equipment

37.17 Mental Load

_____ Highly complex operations

_____ Tracking of multiple factors simultaneously

_____ Demands for performance in designated time frame

_____ Highly repetitive, monotonous work tasks

_____ Critical tasks that involve high accountability where errors are not tolerated

37.18 Perceptual Load

_____ Awkward postural requirements of visual tasks

_____ Poor quality or inadequate quantity of lighting, glare or shadows

_____ Small size of objects being viewed

_____ Object movement during viewing

_____ Multiple types of defects to detect

_____ Need to discriminate parts/items by touch

_____ Fine color differences to be discriminated

_____ Need to judge distance critically

_____ Poor legibility or definition of objects to be read or seen

_____ Difficult to hear auditory signals

37.19 Training Log

Date of Training Session _____
Title of Training Session _____
Presenter _____ Title _____
Summary of Training Session _____

Attendee Name	Position	Department
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Presenter Signature _____ Date _____

Chapter 38 - Carcinogens

38.1 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.

38.2 Categories of Carcinogens

OSHA has divided this list of carcinogens into the following three categories: 1. Human Carcinogens: Those materials for which there is sufficient evidence of carcinogenicity from studies of humans to indicate a causal relationship between the agents and human cancer. 2. Human Suspect Carcinogens: Those materials with limited evidence of carcinogenicity in humans and generally substantiated evidence as animal carcinogens. 3. Animal Carcinogens: Those materials that have sufficient evidence of carcinogenicity from studies of experimental animals cancer in humans and/or animals. However, since many are not well studied, less hazardous than one designated as a human carcinogen. Below is a partial list of chemical carcinogens which may be found in use at Pickering Associates, Inc.. A complete list is available from the Responsible Safety Officer.

Chemical Name/ Reference Confirmed Human Carcinogens: ACRYLONITRILE OSHA AMINODIPHENYL; 4- IARC, NTP, ACGIH ARSENIC AND ARSENIC COMPOUNDS IARC, NTP, OSHA ASBESTOS IARC, NTP, ACGIH BENZENE IARC, NTP BENZIDINE IARC, NTP, ACGIH BIS(CHLOROMETHYL)ETHER IARC, NTP, ACGIH CHLORAMBUCIL IARC, NTP CHLOROMETHYL METHYL ETHER IARC, NTP CHROMIUM (VI) COMPOUNDS IARC, NTP, ACGIH DIBROMO-3-CHLOROPROPANE; 1,2- OSHA NAPHTHYLAMINE; 2- IARC, NTP, ACGIH NITRODIPHENYL; 4- ACGIH VINYL CHLORIDE IARC, NTP, ACGIH Suspected Human Carcinogens: ACETYLAMINOFLUORENE; 2- OSHA AFLATOXINS IARC, NTP, ACGIH BENZO(A)PYRENE ACGIH, IARC BERYLLIUM AND BERYLLIUM COMPOUNDS IARC, NTP, ACGIH BUTADIENE; 1,3- ACGIH CADMIUM AND CADMIUM COMPOUNDS NTP CARBON TETRACHLORIDE ACGIH CHLOROFORM ACGIH DICHLOROBENZIDINE; 3,3'- ACGIH, OSHA DIMETHYL SULFATE ACGIH, IARC DIMETHYLAMINOAZOBENZENE; 4- OSHA

38.3 Responsibilities

The responsibilities of various groups involved with chemical safety at Pickering Associates, Inc. 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.

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Updates and transmits list of carcinogens to the Purchasing Department Authorizes issue of carcinogens stocked at the Pickering Associates, Inc. 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.

38.4 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, apply cosmetics 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

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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 on contents or description written on an official Hazardous Material packing list. To obtain blank packing lists, contact the Responsible Safety Officer.

38.5 Chlorinated Hydrocarbons

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

38.6 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 nonflammable; however, there are exceptions. The Table below lists important characteristics of some of the common chlorinated hydrocarbon solvents. TLV Volatility*

Common name	Chemical name	(ppm)**	(mm Hg)	Flammability	Acetylene
dichloride	1,2-dichloroethylene	200	200	Moderate	Carbon tetrachloride***
Tetrachloromethane	5	115	Nonflammable	Chloroform***	Trichloromethane
10	200	Nonflammable	Ethylene dichloride	1,2-dichloroethane	10 80 Moderate
Methyl chloroform	1,1,1-trichloroethane	350	132	Nonflammable	Methylene chloride
Dichloromethane	100	435	Nonflammable	Perchloroethylene	
Tetrachloroethylene	50	18	Nonflammable	Tetrachloroethane	1,1,2,2-
tetrachloroethane	1	8	Nonflammable	Trichloroethane	1,1,2,-trichloroethane
10	25	Nonflammable	Trichloroethylene	Trichloroethylene	50 76

* The threshold limit value (TLV) is expressed as parts of pure solvent vapors per million parts (ppm) of air. ** The vapor pressure at 77F (25C). *** Designated as a carcinogen by OSHA. 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.

38.7 Precautions

The above table includes information on the TLV, the volatility, and the flammability of the compounds listed. These three characteristics 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 Pickering Associates, Inc. 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.

38.8 Fiberglass

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

38.9 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.

38.10 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.

38.11 Flammable Liquids

Class B combustibles are flammable and combustible liquids (including oils, greases, tars, oil base 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.

38.12 Classifications

Flammable and combustible liquids are defined and divided into classes as shown below. Flammable Liquids (Class I). Liquids having flash points below 100F (37.8C) and having vapor pressures not exceeding 40 pounds per square inch (absolute) at 100F (37.8C). 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 (22.8C) 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.

38.13 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.

38.14 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.

38.15 Containers

The maximum allowable sizes of containers and portable tanks are identified in the table below:

	Flammable liquids Class II	Flammable liquids Class III	Combustible liquids Class I	Combustible liquids Class II	Combustible liquids Class III	Combustible liquids Class IA	Combustible liquids Class IB	Combustible liquids Class IC
Department of Transportation (DOT) drums	1 pt*	1 qt*	1 gal	1 gal	1 gal	1 gal	1 gal	1 gal
Safety cans**	2 gal	5 gal	5 gal	5 gal	5 gal	5 gal	5 gal	5 gal
Metal drums	60 gal	60 gal	60 gal	60 gal	60 gal	60 gal	60 gal	60 gal
Approved portable tanks	660 gal	660 gal	660 gal	660 gal	660 gal	660 gal	660 gal	660 gal

* Glass or approved plastic containers of no more than 1 gallon capacity may be used for Class IA or IB flammable liquids if (1) such liquid either would be rendered unfit for its intended use by contact with metal or would excessively corrode a metal container so as to create a leakage hazard or (2) the user's process either would require more than 1 pint of a Class IA liquid or more than 1 quart of a Class IB liquid, of a single assay lot, to be used at one time. ** Approved safety cans of various materials and capacities are available through the Pickering Associates, Inc..

38.16 Cabinets

Storage cabinets must be designed and approved for the anticipated usage. Approved metal storage cabinets are available in various sizes from Pickering Associates, Inc. stock. Not more than 120 gallons of Class I, Class II, and Class IIIA liquids, combined, may be stored in a storage cabinet. Of this total, not more than 60 gallons may be of Class I and Class II liquids, combined, and not more than three such cabinets may be located in a single fire-separation area.

38.17 Refrigerators

Ordinary domestic refrigerators must not be used for the storage of flammable liquids because they contain certain built-in ignition sources (such as electrical contacts). These sources of ignition may initiate a fire or an explosion if flammable vapors are present. In special cases, ordinary refrigerators have been modified to specifications approved for storage of flammable liquids. Refrigerators are now available commercially that are specifically designed and approved for storage of flammable materials. Refrigerators must bear an appropriate label as supplied by the Responsible Safety Officer.

38.18 Allowable Quantities

To adequately manage the exposure hazards in each building, or fire-separation area in each building, it is necessary to consider the needs of all users, and/or of user groups in aggregate, for each building or fire-separation area. The restrictions set forth below provide guidance for lower usage levels. In general, quantities in excess of three-months usage should not be stored. If the need for larger quantities is anticipated, contact the Responsible Safety Officer for assistance. The maximum allowable quantities of Class B combustibles outside designated and approved storage rooms or facilities are listed below: Less than one gallon of Class I and Class II liquids combined, in glass or plastic containers, is the maximum allowed outside of approved storage cabinets when not actually in use. One gallon is the maximum allowable container size for general dispensing of Class I and Class II liquids unless in an approved safety can. Where more than one laboratory unit is located in a single fire-separation area, all Class I and Class II liquids must be stored in approved storage cabinets or approved safety cans. Ten gallons of Class I and Class II liquids, combined, in approved safety cans, is the maximum allowable outside of approved storage cabinets. Five gallons of Class IIIA liquids is the maximum allowable outside of approved storage cabinets or safety cans. For single fire-separation areas, 10 gallons of Class I and Class II liquids, combined, is the maximum quantity allowable outside of approved storage cabinets or approved safety cans. For single fire-separation areas, 25 gallons of Class I and Class II liquids, combined, is the maximum allowable quantity outside of approved storage cabinets. For single fire-separation areas, 60 gallons of Class IIIA liquids is the maximum allowable outside of approved storage cabinets.

38.19 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.

38.20 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 nonflammable.

38.21 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.

38.22 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 Pickering Associates, Inc., 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 Pickering Associates, Inc. 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.

38.23 Mercury

The most widely used form of mercury at Pickering Associates, Inc. is elemental mercury. Mercury also exists as a salt and as an organic compound. From the standpoint of risk to human health, the most important forms of mercury are elemental mercury vapor and short-chain organoalkylmercurials such as methylmercury and ethylmercury.

38.24 Hazards

Mercury can enter the body through the lungs, the skin, and the digestive system. Because mercury vaporizes at room temperature, inhalation of its vapors is the most likely route of entry. Short exposures to high levels of mercury vapor can cause acute poisoning characterized by tightness and pain in the chest, difficulty in breathing, inflammation of the mouth and gums, fever, and headaches. Acute poisoning, however, is rare. Much more common among workers is chronic poisoning caused by long-term exposure to lower levels of mercury. Steady exposure can cause a slow build-up of mercury in the body that can result in illness, personality changes, and eventual disability. Symptoms of chronic poisoning include inflammation of the mouth and gums, weakness, loss of appetite and weight, shaking (particularly in the hands), and irritability. During an ordinary laboratory spill of metallic mercury, clean-up effort need not be either hasty or heroic since a long duration of exposure to the vapors would be required before any adverse symptoms would occur. However, at elevated temperatures, the concentration of mercury vapor rises rapidly and poisoning can occur within a short period of time.

38.25 Precautions

Avoid skin contact. Keep mercury containers closed when not in use. Use plastic or metal catch cans under all mercury apparatus that is likely to break or spill; make transfers over a catch pan. Provide adequate ventilation, especially if mercury is heated above room temperature. Use a label similar to that below on all equipment and vessels containing mercury. Store in protected area in closed, labeled containers, preferably plastic. If a glass bottle is used, place in a secondary container. Dispose of mercury by placing in sealed, labeled containers. Send unused mercury to a licensed salvage company. If mercury is used, call the Responsible Safety Officer. Do not pour mercury down any drains. If Mercury is spilled at room temperature notify the Responsible Safety Officer as soon as possible to obtain clean-up equipment and a mercury vapor survey. If mercury is released at elevated temperatures, evacuate the area immediately and

notify the emergency dispatcher at the Fire Department, call 911. Equipment being sent to the warehouse for storage must be drained of mercury, properly secured, and tagged with a mercury label.

38.26 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.

38.27 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.

38.28 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.

38.29 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.

38.30 Precautions

Ethers containing an inhibitor should be purchased when possible. Ethers should be kept in cans rather than glass bottles. Ethers should be stored in as cool a location as feasible (but not stored in refrigerators unless explosion-proof). Ethers should always be tested for peroxide content before any distillation procedure and, of course, should not

be used if peroxides are found to be present. Safety shields should be placed in front of reaction vessels or distillation apparatus in hoods when they involve ethers. At least 10% bottoms in distillation should be left. Any container of uncertain age or condition must not be opened, particularly when the cap or stopper is tightly stuck. Suspected containers must not be removed or disposed of. Contact the Responsible Safety Officer. Containers of isopropyl ether must have the red label shown below, indicating the date of purchase, attached to the outside surface. These labels should be applied by storeroom personnel. When the container is opened, the opening date should also be recorded on this label. These containers must be disposed of one year after purchase, or three months after opening. Call the Responsible Safety Officer for pick-up of containers for disposal.

38.31 Polychlorinated Biphenyls (PCBs)

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

38.32 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.

38.33 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 Pickering Associates, Inc.. **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 39 - Hazardous Spill Prevention Control and Countermeasure Program

39.1 Hazardous Spill Control and Spill Prevention Control and Counter Measure Program

39.2 General Information

1. FACILITY INFORMATION

NAME OF FACILITY: **Pickering Associates, Inc.**

MAILING ADDRESS:

TELEPHONE NO.:

PLANT MANAGER:

OPERATIONS:

2. OWNER INFORMATION

OWNER NAME:

MAILING ADDRESS:

TELEPHONE NO.:

3. STORAGE CAPACITY AND TYPE OF MATERIAL STORED

Below Ground Tanks: NONE

Above Ground Tanks: NONE

Miscellaneous Laboratory Chemicals including:

Ethanol - 5 gallon containers

Formic Acid - 100 gallon container.

4. DATE OPERATION BEGAN

Pickering Associates, Inc. has not begun full operations at this facility yet.

5. SCHEMATIC DIAGRAM

See attached Exhibit A.

39.3 Past History of Spills and Possible Causes of Future Spills

1. PAST HISTORY OF SPILLS

There have been no spills since Pickering Associates, Inc. started any operations at this facility.

2. POSSIBLE CAUSES OF FUTURE SPILLS

No spills are anticipated. Care is taken in the storage and use of any chemicals.

39.4 Preventable Measures

The following preventative measures have been included in Pickering Associates, Inc.'s spill prevention program:

1. TRAINING

All employees, including supervisors and any maintenance personnel, will be advised by the management staff of procedures to be followed in case of emergency (see Section IV). This includes possible pollution hazards, drainage and personnel to be contacted should an emergency arise. All pertinent information is posted in the supervisor's office.

2. SECURITY

The facility operates 8 hours per day, five days per week.

The facility is protected by a Central Station Burglar/Fire Alarm System.

3. INSPECTIONS

An inventory is taken weekly of the quantity of material and chemical on site.

Storage cabinets are check and maintained as above.

Records of inspections are retained at the facility.

39.5 Contingency Plan

The following is a summary of the complete plan. Please refer to the 'CONTINGENCY AND EMERGENCY PLAN' for complete details.

A. EMERGENCY PROCEDURE

In the event of any spill, the following emergency action is to be taken:

1. Contain any spilled material by the use of absorbent material and/or manually pumping the spilled material into container.
2. Contact one of the following in the order listed:
 - a. (Coordinator's name)
 - b. (Name)
3. (Coordinator's name) will contact the FIRE DEPARTMENT @ 911 immediately and assist them however possible. He will also notify the STATE OFFICE OF EMERGENCY SERVICES (800) 852-7550 and report the following:
 - a. Name and telephone number;
 - b. Company name and address;
 - c. Time and type of incident;
 - d. Name and quantity of materials;
 - e. Extent of injuries, if any; and
 - f. Possible hazards to others or the environment.
 - g. When the emergency situation is under control, cleanup or neutralization can begin using appropriate tools, safety equipment, and outside services as necessary, depending on the type of emergency. All hazardous materials must be cleaned up, stored properly or hauled to an appropriate dump sight for disposal.
 - h. Before normal operations begin again, all tools, emergency equipment and devices listed on the Emergency Equipment List must be operational and ready for use. The **(address) COUNTY ENVIRONMENTAL HEALTH DEPARTMENT** must also be notified.
 - i. Within 15 days after an emergency that requires implementing the contingency plan, a written report must be completed and sent to the **(address) COUNTY ENVIRONMENTAL HEALTH DEPARTMENT** and a copy will be kept for our files. See Exhibit "B" for this report.

The report must contain the following:

- a. Owner's Name, address, and telephone number;
- b. Company name, address, and telephone number;
- c. Date, time, and type of emergency;
- d. Name and quantity of materials involved;
- e. Extent of injuries, if any;
- f. Assessment of actual or potential hazards to human health

or the environment, if applicable; and

g. Estimated quantity and disposition of waste resulting from the emergency situation.

B. CLEAN-UP OF SPILL

1. Formic Acid, etc.

All spilled liquid acid material is to be covered with absorbent material and sufficient amounts of water until the pH of the solution becomes neutral (estimated 5 gallons of water/container). The residue is then to be placed into a closed durable container and disposed of at an approved landfill.

2. Ethanol

This flammable material and any other similar liquids are to be covered with absorbent material and spread to soak up any remaining spilled material. The contaminated absorbent material is to be swept up and placed into a closed durable container and disposed of at an approved landfill for off-site disposal.

3. A "Spill Event Record" is to be completed. See attached Exhibit B.

EXHIBIT B

39.6 Spill Event Record

1. NAME OF PERSON REPORTING

2. ADDRESS OF PERSON REPORTING

3. TELEPHONE NUMBER OF PERSON REPORTING

4. EXACT LOCATION OF SPILL

5. COMPANY NAME AND LOCATION

6. MATERIAL SPILLED

7. ESTIMATED QUANTITY

8. SOURCE OF SPILL

9. CAUSE OF SPILL

10. NAME OF BODY OF WATER INVOLVED

11. ACTION TAKEN FOR CONTAINMENT AND CLEAN-UP

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EXHIBIT C

39.7 Clean-Up Procedure

39.8 General

A. All spills, regardless of the quantity, must be contained if there is any danger of the discharge reaching a storm drain, sanitary sewer or causing damage to the environment.

B. After the spill has been contained, the Emergency Coordinator should be contacted to determine if any agencies must be notified and to provide assistance with clean-up procedures. Emergency Coordinator will need to be provided with the following information:

1. material spilled, 2. quantity spilled, 3. area where spill occurred, 4. time spill occurred, 5. action already taken to contain or clean up spill.

C. The following "Spill Clean-Up Procedures" for different types of spills are to be used as guidelines. It must be remembered that any spill clean-up requires fast action and common sense.

D. In order to contain and clean up any spill, the facility must have certain equipment. The following is a suggested list of materials to be available at the facility:

1. absorbent material, Sand, etc. - 200 pounds total
2. oil absorbent brooms, such as those manufactured by 3M
3. air-operated diaphragm pump, complete with suction and discharge hose - 1 pump
4. Dike material, such as Plug and Dike (available from 3WS Distributors, Inc.)

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39.9 Flammable Liquid Spill

(SOLVENT)

Caution: Keep open flame, sparks or anything which might cause ignition away from spill area.

Procedure:

- A. Minor spill (less than 25 gallons)
1. Turn off all equipment which might cause ignition.
 2. Apply sufficient quantity of sand or noncombustible absorbent material to collect the spill.
 3. Open doors, windows, etc. for ventilation.
 4. Collect absorbent and place in drum/container for disposal.

Note: Even though the liquid/solvent has been absorbed, the absorbent material may now be flammable so care should be taken not to ignite the material.

- B. Major spill (over 25 gallons)
1. Turn off all equipment which might cause ignition.
 2. Open doors, windows, etc. for ventilation.
 3. Construct a temporary waterproof dike around the spill using oil absorbent booms, Plug and Dike or similar material.
 4. Construct a dike around any sanitary or storm sewer drain in the area to prevent the spilled liquid/solvent from entering the sanitary sewer or storm drain.
 5. From the diked area, the spilled material must be collected using mops, air-operated pumps, etc., and place in drums for disposal.
 6. Collect any contaminated residue and place in drum/container for disposal.

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39.10 Acid/Chemical Spill

Caution: Do not allow spilled material to come in contact with skin or eyes.

Procedure:

A. Caustic spill (pH greater than 7.0*): Caustic materials include:

Caustic Soda (Sodium Hydroxide)
Oil Base Sweep #20

1. Contain the spilled material using a dike of sand or other noncombustible absorbent material.
2. Neutralize the spilled material with water or cover the spilled material with sand if there is a danger of the spill causing damage to the environment.
3. Small spills may be diluted with water and discharged through the wastewater treatment system.
4. Collect any contaminated residue, sand and/or absorbent and place in drum/container for disposal.

B. Acidic spill (pH less than 7.0*): Acidic materials include:

Formic Acid

1. Contain the spilled material using a dike of sand or other noncombustible absorbent material.
2. Neutralize the spilled material with absorbent.
3. Collect any contaminated soil, sand and/or absorbent material and place in drums for disposal.

*If unsure of the pH, check with pH indicator.

Chapter 40 - Emergency Plan for Hazardous Spills

40.1 Emergency Plan for Hazardous Spills

NAME OF FACILITY: _____
MAILING ADDRESS: _____
TELEPHONE NO: _____
FACILITY MANAGER _____
OPERATIONS: _____

EPA ID NO. _____

Emergency Coordinators (To be contacted in order listed) _____

Primary Coordinator: _____
Alternates: _____

Emergency Response Contact: _____

Fire Department _____
Police Department _____
Hospital _____

STATE OFFICE OF EMERGENCY SERVICES (800) 852-7550 _____

40.2 Types of Hazardous Waste Handled at this Facility

Description & Hazard Class: _____
EPA Hazard Waste No.: _____
Where stored: _____

No. of Wastes Stored on Site: _____

Notes: _____

There is little hazard with regard to the waste material handled in this facility. The waste solution holds only a minimal amount of Ethanol in solution with copious amounts of water. The resultant waste is not flammable corrosive, or an irritant.

40.3 Purpose of Emergency Plan

This Emergency Plan is designed to minimize hazards to human health and the environment from any release of hazardous waste.

Since a small portion of the chemicals at this facility is flammable, one of the concerns of this Emergency Plan is to protect the employees from fire and to be certain that the material does not enter the environment from any release.

All facility personnel are familiar with the Emergency Plan from discussions during Safety Meetings and the Emergency Plan is available in the main office.

40.4 Emergency Procedures

All employees who handle the chemicals or hazardous waste have been informed of the following emergency procedure:

1. Contain the release (spill or leak). Absorbent material and heavy-duty rubber gloves are located in the storeroom. The rubber gloves are to be put on immediately and check to make sure that the release is contained within a diked area. If not, the area around the release is to be diked using the absorbent material.
2. Contact the Emergency Coordinator. Notify the front office telephone operator. Request the Emergency Coordinator to come immediately to the area of the release.

40.5 Emergency Coordinators

1. To be called first:
2. If unavailable, call:

The Emergency Coordinator will arrive at the scene immediately and determine the extent of the emergency. The following actions will then be taken by the Emergency Coordinator. Unnecessary people will be kept away from the area.

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40.6 Inside Release Emergency Action

1. DO NOT TOUCH RELEASED MATERIAL WITHOUT RUBBER GLOVES. Rubber gloves and absorbent material are located in the storeroom.
2. Stop the release if possible. If the release is caused by a hole in the container, stuff a rag into the hole. Rags are located in the spill control cabinet.
3. Dike the area around the release to prevent material from reaching any drains or spreading. Absorbent to use for the dike is located in the storeroom.
4. Fire extinguishers are located throughout the facility.
5. Spread absorbent material on the release. Allow absorbent to soak up released material.
6. Transfer any remaining non-released material into a clean empty container. An empty clean container is located in the spill control storage area.
7. Sweep absorbent material into a clean container for off-site disposal at an EPA approved secure landfill. All rags used for clean-up should also be placed in this container.
8. Scrub the area of the release with detergent and water. Clean-up water is to be collected in a container for off-site disposal at an EPA approved treatment or disposal facility. If the release has leached into the sealed concrete, steam clean the area, collecting the water as above.
9. Label all containers of release collected material with the "Hazardous Waste" label.
10. Arrange for off-site disposal of all containers of material resulting from the release. All material must be shipped as "Hazardous Waste" and sent to an EPA approved treatment, storage or disposal site.
11. Complete a report of the release incident including:

What material was released, reason for the release, quantity of material released, clean-up procedure used and disposition of clean-up waste.
12. 911 emergency equipment used (rubber gloves, portable fire extinguishers, etc.) are to be cleaned and ready for reuse.

40.7 Outside Release Emergency Action

NO HAZARDOUS WASTES ARE STORED OUTSIDE

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40.8 Arrangements with Emergency Response Agencies

1. Fire Department

Letters were sent to the Fire Department, detailing the hazardous waste at the plant. The Fire Department would be available to control the fire.

2. Police Department

The Police Department would be available for crowd control if needed. Letters were sent to the Police Department, detailing the hazardous waste at the plant.

3. Hospital

The hospital was contacted by letter, detailing the hazardous waste at the plant. The hospital would be prepared to treat all types of injuries and refer serious burns to other facilities.

The Emergency Plan will be sent to the local Emergency Agencies. Any responses from the Agencies will be documented as Appendices to the Emergency Plan. Any future verbal communications with the Agencies will be documented in the Emergency Plan to keep all responses up-to-date.

Attached **Exhibit "A"** is the cover letter to be sent to the Emergency Agencies with a copy of the Emergency Plan. We are also requesting that each agency sign a Certification of Receipt of Emergency Plan so that we can be certain that each agency is aware of the hazardous waste handled by the facility.

40.9 Material Safety Data Sheets

Material Safety Data Sheets (MSDS) are available by copier. The first aid procedures for all materials used at the facility are listed in the MSDS. The MSDS also provides for spill procedures. These would be useful in the event of a release.

40.10 Emergency Equipment

Attached **Exhibit "B"** is a listing of Emergency Equipment which would be required if any hazardous waste was released. Fire extinguishers are checked monthly to ensure proper operation.

As new equipment is purchased or old equipment is replaced or the location is changed, the Emergency Equipment list is updated.

Attached **Exhibit "C"** is a layout drawing of the facility which indicates where hazardous waste is stored, and points out some of the areas referred to in the Emergency Plan

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where Emergency Equipment is located.

40.11 Duties of Emergency Coordinator

1. Arrive at the scene of the release immediately.
2. Direct EMERGENCY RELEASE ACTION
3. Determine extent of emergency. If the release can be easily contained and cleaned up without possibility of damage to human health or the environment then no evacuation or notification to agencies is required. There are no floor drains near the hazardous waste area.
4. If the release of hazardous waste could threaten health and/or the environment or the release cannot be contained or cleaned up without possible threat to human health or the environment, then the Emergency Coordinator must activate the Evacuation Plan (**Exhibit D**).
5. The Emergency Coordinator must use his best judgment as to which agencies can best respond to the emergency. Since some of the hazardous waste is/may be flammable, the fire department (911) would probably be contacted first.

All emergency telephone numbers are listed on the first page of the Emergency Plan for easy reference.

EXHIBIT A
Page 1 of 2

40.12 Draft Letter

RE: Hazardous Waste Emergency Plan and Procedures
Pickering Associates, Inc.
11283 Emerson Ave.
Parkersburg, West Virginia 26104
(phone)
(coordinator's name)

Enclosed is a copy of the Emergency Plan and Procedures for the above-referenced facility. This document was prepared in accordance with the applicable hazardous waste regulations. These regulations require hazardous waste generators to describe arrangements agreed to by local police departments, fire departments, hospitals, contractors, and state and local emergency response teams to coordinate emergency

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services during an emergency involving hazardous materials and/or wastes.

This facility generates a minimal amount of waste materials which are non-corrosive and not flammable. All hazardous waste is stored less than 90 days in an inside container storage area.

The contingency plan details the layout of the facility and the procedures for responding to an emergency.

Please sign the certification of Receipt of Emergency Plan form which is enclosed so that we can document our arrangements with local authorities. We would appreciate any comments you may wish to make concerning our Emergency Plan.

Sincerely,

(coordinator's name)

enclosures

EXHIBIT A
Page 2 of 2

40.13 Certification of Receipt of Emergency Plan

Pickering Associates, Inc.

I hereby certify that I have received a copy of the Emergency Plan from:

Pickering Associates, Inc.
11283 Emerson Ave.
Parkersburg, West Virginia 26104

which explains in detail the Hazardous Waste generated at this facility and also the procedures which will be utilized in the event of a Hazardous Waste release.

Signature

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Print Name

Agency Name

Agency Address

Agency Telephone

Please sign this Certification and return to:
Pickering Associates, Inc.
11283 Emerson Ave.
Parkersburg, West Virginia 26104
Fax Number

Ryan K. Taylor

Phone and

in the stamped envelope provide

EXHIBIT B

40.14 Emergency Equipment

EQUIPMENT	QUANTITY	LOCATION	DESCRIPTION OF CAPABILITIES
Absorbent	4 - 25# bags	Storeroom	Absorbs spills, dike around spills, dike around drains.
Rubber Gloves (elbow length, acid resistant)	2 pair	Storeroom	Protect hands/arms from contact with hazardous waste
Plastic Aprons	3	Storeroom	Used to protect employees' clothing against contact of hazardous waste or materials.
Pump (hand pump)	1	Storeroom	Used to pump material into drums if spilled.
Shovels	1	Storeroom	Used to shovel up used absorbent during clean-up.
Broom	1	Storeroom	Used to sweep up absorbent material during clean-up.
Face Mask	2	Storeroom	Used to protect employee's face and eyes from splash of hazardous waste.
Respirators	2	Storeroom	To be used if spill of acid or extreme vapors to prevent employees from inhaling toxic vapors
Respirator Cartridges	4	Storeroom	
Communication System	1	Facility	Paging system throughout facility.
Mops	1	Storeroom	Used to mop up small leaks or spills.

EXHIBIT "C"

This Page contains a layout drawing of the facility which indicates where hazardous waste is stored, and points out some of the areas referred to in the Emergency Plan where Emergency Equipment is located.

Chapter 41 - Form