

W.L. HICKEY SONS, INC
PLUMBING / MECHANICAL CONTRACTORS

HEALTH AND SAFETY PROGRAM MANUAL
(Illness and Injury Prevention Program)

Table of Contents

Chapter One - Written Plan	5
Introduction to Our Program	5
Safety First Priority	5
Individual Cooperation Necessary	5
Safety Program Goals	5
Safety Policy Statement	5
Safety Rules for All Employees.....	6
Responsible Safety Officer	6
Designated	6
Duties.....	7
Employee Compliance	7
Agreement to Participate	7
Accident Free Workplace	7
Employee Safety Suggestion Box.....	7
Training	8
Safety & Health Training.....	8
Periodic Safety Training Meetings	8
Employee Responsibility for Training.....	8
Communication.....	9
Accident Prevention Policy Posting	9
Accident Prevention Policy Posting	9
Safety Meetings	9
Hazard Identification & Abatement.....	9
Safety Audits	9
Workplace Inspections.....	10
Accident Investigation	10
Records	11
OSHA Records Required.....	11
General Statement on Safety.....	11
Safety Equipment.....	11
Protective Clothing	12
Smoking & Fire Safety	12
Reporting	12
Chapter Two - General Code of Safe Work Practices	13
General Fire Safety	13
Machine Guarding	13
Lockout-Blockout Procedures	13
Welding, Cutting & Brazing.....	14
Compressors & Compressed Air	15
Compressed Gas & Cylinders.....	15
Industrial Trucks - Forklifts.....	15
Confined Spaces	15
Hazardous Chemical Exposures	16
Hazardous Substances Communication	17
Electrical	17
Piping Systems.....	18
Material Handling.....	18
Transporting Employees & Materials.....	18
Safety Posters.....	19
Licenses & Permits	19
Personal Protective Equipment Clothing	19
Hard-hats	20
Work Environment, General.....	20
Work Area, General.....	20

Driving.....	20
Vehicle Maintenance	21
Cleanliness	20
Tool Maintenance	21
Ladders	21
Portable Power Tools.....	22
Mechanical Lockout-Tagout.....	22
First Aid Kits	24
Chapter Three - Chemical Safety	25
Introduction	24
Hazcom Plan.....	24
Responsibilities of Supervisors/Management	24
Employees must:	24
The following general safety precautions should be observed when working with chemicals:	25
Task Evaluation	26
Supervisor Responsibility	26
Safety Equipment.....	26
Labels.....	27
Chemical Storage.....	27
Emergencies.....	27
Disposal of Chemicals	27
Routine Disposal of Chemicals.....	27
Chapter Four - Confined Spaces	29
Definitions	29
Hazardous Conditions.....	29
Hazard Prevention	29
Chapter Five - Electrical Safety	30
Policy	30
Employee Responsibility	30
Procedures	30
Working with Energized Equipment	31
Type of Hazards.....	32
Class A Hazard	32
Class B Hazard	32
Class C Hazard	32
Employee Attitude	32
Safety Glasses.....	33
Personal Protective Devices.....	33
Elevated Locations.....	33
Chain of Command	33
Protective Systems.....	33
Safety Practices.....	33
Safety Practices.....	34
Chapter Six - Gases	35
Introduction	35
Hazards	35
Relief Valves Required.....	35
Operational Safety Procedures.....	35
Oxygen.....	35
Acetylene	35
Cylinders.....	36
Compressed Gases	36
Inspections	37
Cylinder Handling	37
Working with Gases	37

Cylinder Storage	38
Supervisor Responsibilities.....	38
Diaphragm Failure	39
Regulators, Vacuum Service.....	39
Compressed Air	39
Chapter Seven - Mechanical Guarding	40
Introduction & Standards.....	40
Electrical Tag Out Procedure.....	40
Re-Energizing	40
Chapter Eight - Materials Handling	42
Introduction	42
Lifting & Moving	42
Rigging	42
Manual Lifting Rules	42
Mechanical Lifting.....	43
Inspections	43
Load Path Safety.....	43
Truck Loading	43
Clean Work Areas.....	43
Forklift Operators	44
OSHA Standards for Forklifts	44
Forklift Maintenance	44
Forklift Extension	44
Chapter Nine - Protective Equipment	46
Introduction	46
Protective Shoes.....	46
Protective Gloves.....	46
Head Protection	46
Eye Protection.....	46
Respiratory Protection	46
Responsibilities.....	46
Chapter Ten - Pressure Safety	48
Definitions	48
Standard Operating Procedures	48
Piping Standards	48
Signs	49
OSHA Standards.....	49
Pressure Testing Standards	49
Pressure Testing.....	50
Pressure Testing Procedures	50
Standards for Low Pressure Vessels.....	50
Leak Testing Required.....	50
Leak Repairs	50
Inspections & Re-Testing	51
Inspections & Testing	51
Pressure Testing on Site.....	51
Pressure Testing with Liquids.....	51
Pressure Testing with Gas	51
Chapter Eleven - Ladders & Scaffolds	53
Ladders	53
Scaffolds	53
Chapter Twelve - Tools	54
Company Provided Tools	54
Grounding.....	54
Shop Rules.....	54

Chapter Thirteen - Traffic & Transportation	55
Official Vehicle Use	55
Responsibility	55
Safety Belts	55
Accidents	55
Chapter Fourteen - Hazard Warnings	56
Introduction	56
Contents & Configuration.....	56
Chapter Fifteen - Trenching & Excavation Safety	57
Introduction	57
General Requirements.....	57
Surface Encumbrances & Underground Installations Safety Guidelines	57
Protection from Hazards Associated with Water Accumulation	57
Access & Egress from Excavations	57
Trench Safety.....	58
Stability of Adjacent Structures	58
Protection of Employees from Loose Rock or Soil	58
Fall Protection.....	59
Protection of Employees in Excavations	59
Applicable Definitions	60

CHAPTER ONE

WRITTEN PLAN

Every employer should have a written Injury and Illness Prevention plan. This is our plan. Please read it carefully. While no plan can guarantee an accident free 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.

INTRODUCTION TO OUR PROGRAM

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

Safety First Priority

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

Individual Cooperation Necessary

W. L. Hickey 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 employer and employee, but between the employee and all co-workers. Only through such a cooperative effort can a safety program in the best interest of all be established and preserved. Safety is no accident; think safety and the job will be safer.

Safety Program Goals

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

Safety Policy Statement

It is the policy of W. L. Hickey that accident prevention shall be considered of primary importance in all phases of operation and administration. It is the intention of W. L. Hickey's management to provide safe and healthy working conditions and to establish and insist upon safe practices at all times by all employees.

The prevention of accidents is an objective affecting all levels of our company and its operations. It is, therefore, a basic requirement that each supervisor make the safety of all employees an integral part of his or her regular management function. It is equally the duty of each employee to accept and follow established safety regulations and procedures.

Every effort will be made to provide adequate training to employees. However, if an employee is ever in doubt about how to do a job or task safely, it is his or her duty to ask a qualified person for assistance. Employees are expected to assist management in accident prevention activities. Unsafe conditions must be reported immediately. Fellow employees that need help should be assisted. Everyone is responsible for the housekeeping duties that pertain to their jobs.

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

Safety Rules for All Employees

It is the policy of W. L. Hickey 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.
2. All employees shall report all unsafe conditions or practices to the proper authority, including the supervision on the project, and, if corrective action is not taken immediately, a governmental authority with proper jurisdiction over such practices.
3. The Superintendent 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.
4. Good housekeeping must be practiced at all times in the work area. Clean up all waste and eliminate any dangers in the work area.
5. Suitable clothing and fooywtwear must be worn at all times. Personal protection equipment (hard-hats, respirators, eye protection, etc.) will be worn whenever needed for the task preformed.
6. All employees will participate in a safety meeting conducted by their supervisor once every ten working days.
7. 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.
8. Horseplay, scuffling, and other acts which tend to have an adverse influence on safety or well-being of other employees are prohibited.
9. Work shall be well planned and supervised to avoid injuries in the handling of heavy materials and while using equipment.
10. 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.
11. There will be no consumption of liquor or beer on the job.
12. 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 Superintendent.
13. 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.
14. All injuries should be reported to the Superintendent so that arrangements can be made for medical or first aid treatment.
15. When lifting heavy objects, use the large muscles of the leg instead of the smaller muscles of the back. Also, avoid twisting / turning while carrier heavy objects.
16. 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.
17. Do not wear shoes with thin or torn soles.

Responsible Safety Officer

The identity of the person who is responsible for the W. L. Hickey safety program is Adam Hickey. 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.

Designated

In accordance with W. L. Hickey's safety and injury prevention program, Adam Hickey has been designated as the Responsible Safety Officer, and has responsibility and authority to do the following in the name of W. L. Hickey:

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 W. L. Hickey 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 W. L. Hickey is Adam Hickey. W. L. Hickey 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.

Duties

Overall responsibility and authority for implementing the injury and illness prevention program is vested in Adam Hickey, 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.

Employee Compliance

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

Agreement to Participate

Every employer is required to provide a safe and healthful workplace. W. L. Hickey is committed to fulfilling this requirement. A safe and healthful workplace is one of the highest priorities of W. L. Hickey.

The information in this manual constitutes a written injury and illness prevention program. While W. L. Hickey 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 Superintendent. 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 acknowledgment at the end of this handbook, each employee promises to read and implement this injury and illness prevention program. If you don't understand any policy, please ask your supervisor.

Accident Free Workplace

To help us all meet our goal of an accident free workplace, we have instituted a contest: we will offer a 'Safety Man of the Year' award at the end of each 'Safety Year'. The honor will be awarded at the annual company picnic (a.k.a. the Hickey Picnic) and accompanied with an additional monetary bonus. In addition the recipient's name will be engraved on a blank prominently displayed at the company's headquarters. The winner of the 'Safety Man of the Year' award will be determined by a committee of manager's at W.L. Hickey Sons, Inc.

Employee Safety Suggestion Box

From time to time, W. L. Hickey will award a prize for the best safety suggestion. 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.

Training

Employee safety training is another requirement of an effective injury and illness prevention program. While W. L. Hickey believes in skills training, we also want to emphasize safety training. All employees should start the safety training by reading this manual and discussing any problems or safety concerns with your direct supervisor. You may wish

to make notes in the margins of this manual where it applies to your work.

Safety & 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 W. L. Hickey'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 W. L. Hickey's injury and illness prevention program. They have primary responsibility for actually implementing the injury and illness prevention program, especially as it relates directly to the workplace. Supervisors are responsible for being familiar with safety and health hazards to which employees are exposed, how to recognize them, the potential effects of these hazards, and rules and procedures for maintaining a safe workplace. Supervisors shall convey this information to the employees at the workplace, and shall investigate accidents according to the accident investigation policies contained in this manual.

Periodic Safety Training Meetings

W. L. Hickey has safety meetings every ten (10) working days. 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. Prior to the bi-weekly meeting, the Superintendent will select the safety topic to be reviewed and will distribute "Tailgate Topics" regarding the topic to all field employees located at job sites. All field employees are required to sign the bottom of the "Tailgate Topic" acknowledging their receipt and understanding of the topic and return the signature portion of the sheet to the Safety Officer.

Employee Responsibility for Training

Teaching safety is a two-way street. W. L. Hickey can preach safety, but only employees can practice safety. Safety education requires employee participation.

Every two weeks, 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 (aka P.P.E.) must be used when and where required. All such equipment must be properly maintained.

Communication

Employers should communicate to employees their commitment to safety and to make sure that employees are familiar with the elements of the safety program. W. L. Hickey communicates with its employees orally, in the form of directions and statements from your supervisor, written, in the form

of directives and this manual, and by example. If you see a supervisor or management do something unsafe, please tell that person. We sometimes forget actions speak louder than words.

Accident Prevention Policy Posting

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

Your responsibilities include the following:

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

Accident Prevention Policy Posting

A copy of this manual will be posted in the work area.

It is the policy of W. L. Hickey to provide a safe and clean workplace and to maintain sound operating practices. Concentrated efforts shall produce safe working conditions and result in efficient, productive operations. Safeguarding the health and welfare of our employees cannot be stressed too strongly.

Accident prevention is the responsibility of all of us. Department heads and supervisors at all levels shall be responsible for continuous efforts directed toward the prevention of accidents. Employees are responsible for performing their jobs in a safe manner.

The observance of safe and clean work practices, coupled with ongoing compliance of all established safety standards and codes, will reduce accidents and make our Company a better place to work.

Safety Meetings

W. L. Hickey has safety meetings every two weeks. 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 Superintendent will review a portion of the company's safe work practices contained in this booklet, or other safety related information essential to accomplish the goals of the program. W. L. Hickey 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.

Hazard Identification & Abatement

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

Safety Audits

The best method to establish a safer workplace is to study past accidents and worker compensation complaints. By focusing on past injuries, W. L. Hickey 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 any potential hazards, so other employees and guests are advised. You may also be given written communications regarding unsafe conditions or concealed dangers. Review this communication carefully and adjust your workplace behavior to avoid any danger or hazards. If you are unclear or unsure of the significance of this written communication, contact your supervisor and review your planned actions before starting to work. It is better to wait and check, then to go ahead and possibly cause an injury to yourself and others.

Managers must provide written notice to employees of any serious concealed dangers of which they have actual knowledge. In addition to providing written notice of all serious concealed dangers to employees managers are required to report serious concealed dangers to either OSHA or an appropriate administrative agency within fifteen days, or immediately if such danger would cause imminent harm, unless the danger is abated.

Merely identifying the problem is not sufficient. The danger must be reported to the appropriate supervisor and the Responsible Safety Officer, who then will correct the problem. If the danger cannot be corrected, then all employees will be warned to take protective action so that the danger will not result in any injuries.

Workplace Inspections

In addition to the examination of records, work place safety inspections will occur periodically every two weeks, when conditions change, or when a new process or procedure is implemented. During these inspections, there will be a review of the injury and illness prevention policy and W. L. Hickey code of safe work practices.

Accident Investigation

A primary tool used by W. L. Hickey to identify the areas responsible for accidents is a thorough and properly completed accident investigation. The results of each investigation will be a written summary of the incident that will be submitted to and reviewed by management as well as W. L. Hickey's insurance risk management advisors, and, if the incident resulted in serious injury, to Company attorneys. If the incident resulted in serious injury,

the investigation will be directed by W.L. Hickey's attorneys to provide the most reliable evidence or description legally permissible. All investigations pursuant to the directions of legal counsel will be protected by all applicable privileges, if any. The attorney will provide more detail on this topic during the investigation.

A written report should be prepared from notes and diagrams made at the scene, or a portable Dictaphone will be used to record direct eyewitness statements as near to the actual time of observation as possible. All statements should include the time and date given, and the town or county where the statement was made. If the statement is intended to be used in court proceedings, a suitable jurist is required, otherwise, a simple statement that the description is sworn to be true under penalty of perjury with the date, place and time should be included. All pictures should be similarly identified. Let people know on tape that they are being recorded. Also, make sure that the names and addresses and day and evening phone numbers of all eye witnesses are noted or recorded.

If a formal police report or other official investigation is conducted by any government agency, get the name and badge number of the official, or a business card, and find out when a copy of the official report will be available to the public. If you are requested to make a statement, you have the right to have the Company lawyer attend your statement at no cost to you.

A satisfactory accident report will answer the following questions:

1. What happened? *The investigation report should begin by describing the accident, the injury sustained, the eyewitnesses, the date, time and location of the incident and the date and time of the report. Remember: who, what, when, where and how are the questions that the report must answer.*
2. Why did the accident occur? *The ultimate cause of the accident may not be known for several days after all the data are analyzed. However, if an obvious cause suggests itself, include your conclusions as a hypothesis at the time you give your information to the person in charge of the investigation.*
3. What should be done? *Once a report determines the cause of the accident, it should suggest a method for avoiding future accidents of a similar character. This is a decision by the Responsible Safety Officer and the supervisor on the project, as well as top management. Once a solution has*

been adopted, it is everyone's responsibility to implement it.

4. *What has been done? A follow up report will be issued after a reasonable amount of time to determine if the suggested solution was implemented, and if so, whether the likelihood of accident has been reduced.*

Records

W. L. Hickey maintains records of employee training, hazard identification and abatement, and accident investigation.

OSHA Records Required

Copies of required accident investigations and certification of employee safety training shall be maintained by the Responsible Safety Officer. A written report will be maintained on each accident, injury or on-the-job illness requiring medical treatment. A record of each such injury or illness is recorded on OSHA Log and Summary of Occupational Injuries Form 300, 300A and 301 according to its instructions. Supplemental records of each injury are maintained for each individual accident. Every year, a summary of all reported injuries or illnesses is posted no later than February 1, for one month, until March 1, on OSHA Form 300. These records are maintained for five years from the date of preparation.

General Statement on Safety

Each employee has an individual responsibility to prevent accidents. It is to the benefit of all employees and W. L. Hickey if you report any situation or condition that you believe may present a safety hazard. W. L. Hickey encourages you to report your concern either to your immediate supervisor or to a member of the Safety Committee. The supervisor or Safety Committee will take immediate action to investigate the matter.

Safety Equipment

Proper safety equipment is necessary for your protection. The Company provides the best protective equipment it is possible to obtain.

Use all safeguards, safety appliances, or devices furnished for your protection and comply with all regulations that may concern or affect your safety. Wear your gear properly -- all snaps and straps fastened, cuffs not cut or rolled.

Your supervisor will advise you as to what protective equipment is required for your job.

Certain jobs require standard safety apparel and appliances for the protection of the employee. Your supervisor is aware of the requirements and will furnish you with the necessary approved protective appliances. These items shall be worn and effectively maintained as a condition of your continued employment and part of our mutual obligation to comply with the Occupational Safety and Health Act.

Safety goggles, glasses and face shields shall correspond to the degree of hazard, (i.e., chemical splashes, welding flashes, impact hazard, dust, etc.) Do not alter or replace an approved appliance without permission from your supervisor.

Rubber gloves and rubber aprons shall be worn when working with acids, caustics or other corrosive materials.

Specified footwear must be worn.

No jewelry shall be worn around power equipment.

Hearing protection appliances (approved muffs or plugs) shall be worn by all employees working within any area identified as having excess noise levels. Your supervisor will instruct you in the proper use of the appliance.

Protective Clothing

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

Your supervisor will advise you as to what protective equipment is required for your job.

Smoking & Fire Safety

Fire is one of the worst enemies of any facility. Learn the location of the fire extinguishers. Learn how to use them.

You can help prevent fires by observing the smoking rules:

1. Smoking is not allowed on the site, except in designated areas.
2. Smoking is not permitted in rest rooms.

3. If you are not sure about where you may smoke, ask the supervisor.

Reporting

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

CHAPTER TWO - GENERAL CODE OF SAFE WORK PRACTICES

General Fire Safety

Our local fire department is well acquainted with our facility, its location and specific hazards.

All fire doors and shutters must be maintained in good operating condition. Fire doors and shutters should be unobstructed and protected against obstructions, including their counterweights. Fire door and shutter fusible links must be in place. All automatic sprinkler water control valves, if any, air and water pressures should be checked routinely. The maintenance of automatic sprinkler systems is assigned to the Responsible Safety Officer. Sprinkler heads should be protected by metal guards if they could possibly be exposed to damage. Proper clearance must be maintained below sprinkler heads.

Portable fire extinguishers are provided in adequate number and type and are located throughout the facility. Fire extinguishers are mounted in readily accessible locations. Fire extinguishers are recharged regularly and the date of last inspection noted on their tags. All employees are periodically instructed in the use of extinguishers and fire protection procedures. Notify the Responsible Safety Officer of any damage to fire protection equipment.

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 splash guards 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 secure and arranged so they do not present a hazard. All special hand tools used for placing and removing material must protect the operator's hands. All revolving drums, barrels and containers should be guarded by an enclosure that is interlocked with the drive mechanisms, so that revolution cannot occur unless the guard enclosure is in place. All arbors and mandrels must have firm and secure bearings and be free of play. 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.

Lockout-Blockout Procedures

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 disconnects 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.

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 type signs) must be posted. Cylinders, cylinder valves, couplings, regulators, hoses and apparatus must be kept free of oily or greasy substances. Care must be taken not to drop or strike cylinders.

Unless secured on special trucks, all regulators must be removed and valve-protection caps put in place before moving cylinders. All cylinders without fixed

hand wheels must have keys, handles, or non-adjustable wrenches on stem valves when in service. Liquefied gases must be stored and shipped valve-end up with valve covers in place. Before a regulator is removed, the valve must be closed and gas released from the regulator. All employees are instructed never to crack a fuel-gas cylinder valve near sources of ignition. Red is used to identify the acetylene (and other fuel-gas) hose, green for oxygen hose, and black for inert gas and air hose. All pressure-reducing regulators must be used only for the gas and pressures for which they are intended.

The open circuit (No Load) voltage of arc welding and cutting machines must be as low as possible and not in excess of the recommended limits. Under wet conditions, automatic controls for reducing no-load voltage must be used. Grounding of the machine frame and safety ground connections of portable machines must be checked periodically. Electrodes must be removed from the holders when not in use. All electric power to the welder must be shut off when no one is in attendance.

Suitable fire extinguishing equipment must be available for immediate use before starting to ignite the welding torch. The welder is strictly forbidden to coil or loop welding electrode cable around his/her body.

All wet welding machines must be thoroughly dried and tested before being used. All work and electrode lead cables must be frequently inspected for wear and damage, and replaced when needed. All connecting cable lengths must have adequate insulation. When the object to be welded cannot be moved and fire hazards cannot be removed, shields must be used to confine heat, sparks and slag.

Fire watchers will be assigned when welding or cutting is performed in locations where a serious fire might develop. All combustible floors must be kept wet, covered by damp sand, or protected by fire-resistant shields. When floors are wet down, personnel should be protected from possible electrical shock.

When welding is done on metal walls, precautions must be taken to protect combustibles on the other side. Before hot work is begun, used drums, barrels, tanks and other containers must be so thoroughly cleaned that no substances remain that could explode, ignite or produce toxic vapors. It is required that eye protection helmets, hand shields and goggles meet appropriate standards.

Employees exposed to the hazards created by welding, cutting or brazing operations must be protected with personal protective equipment and clothing. Check for adequate ventilation where welding or cutting is performed. When working in confined spaces, environmental monitoring tests should be taken and means provided for quick removal of welders in case of emergency.

Compressors & Compressed Air

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

Compressed Gas & Cylinders

Cylinders with a water weight capacity over 30 pounds must be equipped with means for connecting a valve protector device, or with a collar or recess to protect the valve. Cylinders must be legibly marked to identify clearly the gas contained. Compressed gas cylinders should be stored only in areas which are protected from external heat sources such as flame impingement, intense radiant heat, electric arcs or high temperature lines. Cylinders must not be located or stored in areas where they will be damaged by passing or falling objects, or subject to tampering by unauthorized persons.

Cylinders must be stored or transported in a manner to prevent them from creating a hazard by tipping, falling or rolling. All cylinders containing liquefied fuel gas must be stored or transported in a position so that the safety relief device is always in direct contact with the vapor space in the cylinder. Valve protectors must always be placed on cylinders when the cylinders are not in use or connected for use. All valves must be closed off before a cylinder is moved, when the cylinder is empty, and at the completion of each job.

Low pressure fuel-gas cylinders must be checked periodically for corrosion, general distortion, cracks, or any other defect that might indicate a weakness or render them unfit for service. The periodic check of low pressure fuel-gas cylinders includes a close inspection of the cylinder's bottom.

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.

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.

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, 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.

Hazardous Substances Communication

When hazardous substances are used in the workplace, a hazard communication program dealing with Material Safety Data Sheets (MSDS), labeling and employee training will be in operation. MSDS materials will be readily available for each hazardous substance used. A training program plus regular question and answer sessions on dealing with hazardous materials will be given to keep employees informed.

The program will include an explanation of what an MSDS is and how to use and obtain one; MSDS contents for each hazardous substance or class of substances; explanation of the "Right to Know"; identification of where employees can see the employer's written hazard communication program and where hazardous substances are present in their work area; the health hazards of substances in the work area, how to detect their presence, and specific protective measures to be used; as well as informing them of hazards of non-routine tasks and unlabeled pipes.

Electrical

The workplace will be aware of the OSHA Electrical Safety Orders and will comply with the same. Employees will be required to report any hazard to life or property that is observed in connection with a job, electrical equipment or lines. Employees will be expected to make preliminary inspections or appropriate tests to determine conditions before starting work. When equipment or lines are to be serviced, maintained or adjusted, employees must be aware of open switches. Lockouts must be tagged whenever possible.

Equipment such as electrical tools or appliance must be grounded or of the double insulated type. Extension cords being used must have a grounding conductor. The workplace supervisor must be aware if multiple plug adapters 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:

1. Exposed wiring and cords with frayed or deteriorated insulation must be repaired or replaced.
2. Flexible cords and cables must be free of splices or taps.
3. Clamps or other securing means must be provided on flexible cords or cables at plugs, receptacles, tools, equipment. The cord jacket must be held securely in place.
4. All cord, cable and raceway connections must be intact and secure.
5. In wet or damp locations, electrical tools and equipment must be appropriate for the use or location, or otherwise protected.
6. 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.
7. 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.
8. 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.
9. All disconnecting switches and circuit breakers must be labeled to indicate their use or equipment served.
10. A means for disconnecting equipment must always be opened before fuses are replaced.
11. All interior wiring systems must include provisions for grounding metal parts or electrical raceways, equipment and enclosures.
12. All electrical raceways and enclosures must be fastened securely in place.
13. All energized parts of electrical circuits and equipment must be guarded against accidental contact by approved cabinets or enclosures.
14. Sufficient access and working space will be provided and maintained around all electrical equipment to permit ready and safe operations and maintenance.
15. All unused openings (including conduit knockouts) in electrical enclosures and fittings must be closed with appropriate covers, plugs or plates.

16. Electrical enclosures such as switches, receptacles, and junction boxes must be provided with tight-fitting covers or plates.
17. 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.)
18. Low voltage protection must be provided in the control device of motor driven machines or equipment which could cause injury from inadvertent starting.
19. A motor disconnecting switch or circuit breaker must be located within sight of the motor control device.
20. 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.
21. A controller for a motor in excess of two horsepower must be rated equal to but not in excess of the motor it services.
22. Employees who regularly work on or around energized electrical equipment or lines will be instructed in cardio-pulmonary resuscitation (CPR) methods.
23. Employees will be trained on how to work on energized lines or equipment over 600 volts.

Piping Systems

Substances that are transported through piping need to be identified by color or labeling. Signs must be posted identifying the substance being transported through the pipes as to whether it is hazardous and where turn-off valves, connections and outlets are located. All tags used for labeling will be of a durable material with distinguishable and clearly written print.

When non-potable water is piped through a facility, outlets or taps, notices will be posted to alert employees that it is unsafe and not to be used for drinking, washing or personal use. When pipelines are heated by electricity, steam or other external sources, warning signs or tags placed at unions, valves, or other serviceable parts will be part of the system.

Material Handling

In the handling of materials, employees must know the following:

1. There must be safe clearance for equipment through aisles and doorways.
2. Aisle ways must be designated, permanently marked, and kept clear to allow un-hindered passage.
3. Motorized vehicles and mechanized equipment will be inspected daily or prior to use.
4. Vehicles must be shut off and brakes must be set prior to loading or unloading.
5. Containers of combustibles or flammable, when stacked while being moved, must be separated by dunnage sufficient to provide stability.
6. If dock boards (bridge plates) are used when loading or unloading operations are taking place between vehicles and docks, precautions must be observed.
7. Trucks and trailers will be secured from movement during loading and unloading operations.
8. Dock plates and loading ramps will be constructed and maintained with sufficient strength to support imposed loading.
9. Hand trucks must be maintained in safe operating condition.
10. Chutes must be equipped with sideboards of sufficient height to prevent the handled materials from falling off.
11. At the delivery end of rollers or chutes, provisions must be made to brake the movement of the handled materials.
12. Pallets must be inspected before being loaded or moved.
13. 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.
14. Securing chains, ropes, chockers or slings must be adequate for the job to be performed.
15. When hoisting material or equipment, provisions must be made to assure no one will be passing under the suspended loads.
16. Material Safety Data Sheets will be available to employees handling hazardous substance.

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.

Safety Posters

W. L. Hickey is required to post certain employment related information. The required information is maintained outside the lunch room where employees can find the following required posters:

1. Various state and Federal orders regulating the Wages, Hours and Working Conditions in certain industries.
2. Pay Day Notice
3. Anti-Discrimination Poster
4. Equal Employment Opportunity is the Law (EEOC form)
5. OSHA Safety and Health Protection on the Job
6. Notice of Workers Compensation Carrier
7. Notice to Employees: Unemployment Insurance and Disability Insurance
8. Notice: Employee Polygraph Protection Act (form WH 1462)
9. Access to Medical and Exposure Records
10. 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 W. L. Hickey's code of Safe Work Practices and a Fire Prevention and Evacuation Plan will be posted.

Material Data Safety Sheets for W. L. Hickey's premises are available outside the lunch room. When employees are required to work on the premises of any other employer, such as a service call or installation situation, the job site will maintain a collection of Material Data Safety Sheets that describe any hazards unique to that site. Check with the other employer's job site coordinator or supervisor for the exact location of the MSDS information.

In addition to these required safety postings, emergency numbers are maintained outside the lunch room.

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.

Licenses & Permits

In addition to other postings required by law, W. L. Hickey 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 outside the lunch room.

Personal Protective Equipment Clothing

1. Where there is a danger of flying particles or corrosive materials, employees must wear protective goggles and/or face shields provided (or approved) by W. L. Hickey Sons, 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. Employees are required to wear protective gloves, aprons, shields and other means provided in areas where they may be subject to cuts, corrosive liquids and/or harmful chemicals.
5. Hard hats must be worn in areas subject to falling objects, and at all times while at construction sites.
6. Appropriate footwear including steel toed shoes must be worn in an area where there is any risk of foot injuries from hot, corrosive, poisonous substances, falling objects, crushing or penetrating action.
7. When necessary employees must use the approved respirators which are provided for regular and emergency use.
8. All safety equipment must be maintained in sanitary condition and ready for use. Report any defective equipment immediately.
9. An eye wash facility is located on site in the Sunnyvale headquarters and single use kits are

available on specific jobsite locations (when needed). If any irritant gets into an employee's eyes, call for medical assistance immediately and flush the eye out with clean water.

10. A shower is provided for emergencies. Ask your supervisor for more details on use of this facility.
11. Food may not be eaten in work areas, or in places where there is any danger of exposure to toxic materials or other health hazards. Ask your supervisor to identify safe eating places.
12. In cases where the noise level exceeds certain levels, ear protection is required.
13. In cases of cleaning toxic or hazardous materials, protective clothing provided must be worn.

Hard-hats

In W. L. Hickey, hard-hats are required (at all times, in designated areas, when appropriate). Hard-hats are common in our industry. There was a time, about one hundred years ago, when no one wore a hard-hat. But, over time, the value of hard-hats to save lives was firmly proven, so that the entire industry now accepts this safety device as a natural article of clothing, like a football player wearing a helmet during a game.

Sometimes a person fails to wear a hard-hat, 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 hard-hat.

When you wear a hard-hat, wear it right. Keep it squarely on your head with the inside band properly adjusted. See you supervisor if your having trouble adjusting the hard-hat.

Work Environment, General

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.

Work Area, General

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 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.

Driving

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

Vehicle Maintenance

Work safely when repairing vehicles. Where tires are mounted and/or inflated on drop center wheels, a safe practice procedure must be posted and enforced. Where tires are mounted and/or inflated on wheels with split rims and/or retainer rings, a safe practice procedure must be posted and enforced. Each tire inflation hose must have a clip-on chuck with at least

24 inches of hose between the chuck and an in-line hand valve and gauge. The tire inflation control valve should automatically shut off the air flow when the valve is released. A tire restraining device such as a cage, rack or other effective means must be used while inflating tires mounted on split rims, or rims using retainer rings.

Employees are strictly forbidden from taking a position directly over or in front of a tire while it's being inflated. Proper lifting techniques must be used by employees to avoid over-exertion when lifting packages.

Cleanliness

All work sites must be clean and orderly. All work surfaces must be kept dry or appropriate means taken to assure that surfaces are slip-resistant. All spill materials or liquids should be cleaned up immediately and combustible scrap, debris and waste stored safely and removed from the work site promptly.

Any accumulations of combustible dust must be routinely removed from elevated surfaces including the overhead structure of buildings. Combustible dust should be cleaned up with a vacuum system to prevent the dust going into suspension. Metallic or conductive dust must be prevented from entering or accumulating on or around electrical enclosures or equipment.

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.

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.

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.

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 screw drivers.

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 screw driver 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.

Mechanical Lockout-Tagout

Point of operation devices shall protect the operator by:

1. Preventing and/or stopping normal stroking of the press if the operator's hands are inadvertently placed in the point of operation; or
2. 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
3. Preventing the operator from inadvertently reaching into the point of operation at all times; or
4. 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
5. 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
6. 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.
7. A gate or movable barrier device shall protect the operator.
8. 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 downstroke of the press slide.
9. The device may not be used on machines using full revolution clutches.
10. The device may not be used as a tripping means to initiate slide motion.
11. 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.
12. 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.
 13. The safety distance from the sensing field to the point of operation shall be greater than the distance determined by the following formula:
 - * $Ds = 63 \text{ inches/second} \times Ts$ where:
 - * $Ds =$ minimum safety distance (inches);
 - * inches/second = hand speed constant; and
 - * $Ts =$ stopping time of the press measured at approximately 90° position of crankshaft rotation (seconds).
 14. Guards shall be used to protect all areas of entry to the point of operation not protected by the presence sensing device.
 15. The pull-out device shall protect the operator and shall include attachments for each of the operator's hands.
 16. Attachments shall be connected to and operated only by the press slide or upper die.
 17. 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.
 18. A separate pull-out device shall be provided for each operator if more than one operator is used on a press.
 19. 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.
 20. The sweep device must be activated by the slide or by motion of a foot pedal trip rod.
 21. 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.
 22. 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.
 23. 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.
 24. 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.
 25. The two hand control device shall protect the operator.
 26. 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.
 27. 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:
 - * $Ds = 63 \text{ inches/second} \times Ts$, where:
 - * $Ds =$ minimum safety distance (inches);
 - * 63 inches/second = hand speed constant; and
 - * $Ts =$ stopping time of the press measured at approximately 90° position of crankshaft rotation (seconds).

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.

CHAPTER THREE - CHEMICAL SAFETY

Introduction

The objective of this chapter is to provide guidance to all W. L. Hickey 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.

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 W. L. Hickey 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, W. L. Hickey 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 W. L. Hickey 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 W. L. Hickey 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 W. L. Hickey stock safety labels.
- * Provide generic training programs.
- * Assist supervisors in developing hazard-specific training programs.
- * Oversee the Hazard Communication Standard written policy and implementation plans.
- * Alert on-site contractors to hazardous materials in work areas.
- * Alert on-site contractors that they must provide to their employees information on hazardous materials they bring to the work site.

The number of hazardous chemicals and the number of reactions between them is so large that prior knowledge of all potential hazards cannot be assumed. Therefore, when the chemical properties of a material are not fully known, it should be assumed hazardous and used in as small quantities as possible to minimize exposure and thus reduce the magnitude of unexpected events.

The following general safety precautions should be observed when working with chemicals:

1. Keep the work area clean and orderly.
2. Use the necessary safety equipment.
3. Carefully label every container with the identity of its contents and appropriate hazard warnings.
4. Store incompatible chemicals in separate areas.
5. Substitute less toxic materials whenever possible.

6. Limit the volume of volatile or flammable material to the minimum needed for short operation periods.
7. Provide means of containing the material if equipment or containers should break or spill their contents.
8. Follow the requirements of this manual, if systems that can generate pressure or are operated under pressure are involved.
9. Provide a back-up method of shutting off power to a heat source if any hazard is involved.
10. Obtain and read the Material Safety Data Sheets.

Task Evaluation

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

Supervisor Responsibility

Supervisors are responsible for establishing safe procedures and for ensuring that the protective equipment needed to work with the chemicals is available. Supervisors must instruct their workers about possible hazards, safety precautions that must be observed, possible consequences of an accident, and procedures to follow if an accident does occur. The supervisor is required to enforce the proper use of protective equipment and the established safety practices.

It is the responsibility of employees and all who use W. L. Hickey 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.

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 as prepared by the Medical Services Department. The kit is obtained by contacting the Responsible Safety Officer.

Safety shields must be used for protection against possible explosions or splash hazards. Company equipment must be shielded on all sides so that there is no line-of-sight exposure of personnel. The sash on a chemical fume hood is a readily available partial shield. However, a portable shield must also be used, particularly with hoods that have vertical-rising sashes rather than horizontal-sliding sashes.

Labels

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

Chemical Storage

The separation of chemicals (solids or liquids) during storage is necessary to reduce the possibility of unwanted chemical reactions caused by accidental mixing. Explosives such as picric acid should be stored separately outdoors. Use either distance or barriers (e.g., trays) to isolate chemicals into the following groups:

- * Flammable liquids (e.g., acetone, benzene, ethers, alcohol's). 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).

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

Disposal of Chemicals

All W. L. Hickey 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:

1. 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).
2. Waste oils must be collected in 55-gallon drums. Disposal solids, and explosive materials must be stored in separate containers.
3. 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:

1. Maintain the smallest possible inventory of chemicals to meet your immediate needs.
2. Periodically review your stock of chemicals on hand.
3. Ensure that storage areas, or equipment containing large quantities of chemicals, are secure from accidental spills.
4. Rinse emptied bottles that contain acids or inflammable solvents before disposal.
5. Recycle unused laboratory chemicals wherever possible.

DO NOT:

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

CHAPTER FOUR - CONFINED SPACES

Definitions

A confined space is defined as any structure that must be entered and that has or may contain dangerous concentrations of hazardous gases or vapors or an oxygen deficient atmosphere.

Entry to these spaces must be rigorously controlled to prevent serious injury or death.

Hazardous Conditions

Hazardous conditions include, but are not limited, to the following:

1. An atmosphere containing less than 19.5% oxygen (normal air contains 20.9% oxygen). This is usually the result of oxygen displacement by inert gases such as nitrogen, argon, helium, or sulfur hexafluoride.
2. Flammable gases and vapors (e.g., methane, ethane, propane, gasoline, methyl-ethyl ketone, alcohol).
3. Toxic gases and vapors (e.g., hydrogen sulfide, nitrogen dioxide, 1,1,1 trichloroethane, perchloroethane, methylene chloride).

Hazard Prevention

The primary objective is to prevent oxygen deficiency or other hazardous condition. This must be accomplished by accepted engineering control measures, such as general and local ventilation and substitution of materials. Only when such controls are not possible should respiratory protection be used.

Written operating procedures governing the identification, testing, and entry into a confined space with a potential for oxygen deficiency must be established by the operating personnel and approved by the Responsible Safety Officer.

Monitoring devices, audible alarms, warning lights, and instructional signs should be installed where there is a potentially oxygen-deficient atmosphere. These installations must be approved by the Responsible Safety Officer.

Before entering a confined space, the steps below must be followed:

1. An entry permit must be issued to the worker by the responsible supervisor and reviewed by the Responsible Safety Officer.
2. Air quality must be tested to determine the level of oxygen and toxic or flammable air contaminants.
3. Air purging and ventilation must be provided whenever possible.
4. The confined space must be isolated from supply lines capable of creating hazardous conditions.
5. Lock-out procedures must be used to secure electrical systems, pressure systems, piping, machinery, or moving equipment.

If a person must enter a confined space containing hazardous gases, the procedures below must be followed:

1. Protective equipment must be worn, including air supply respirator plus harness and lifeline.
2. At least one person must be stationed outside the confined space, with suitable respirator.
3. Communication with personnel in the confined space must always be maintained.

CHAPTER FIVE - ELECTRICAL SAFETY

Policy

It is the policy of W. L. Hickey 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 W. L. Hickey.

Employee Responsibility

All W. L. Hickey 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 W. L. Hickey electrical safety requirements and procedures.

Individual employees are responsible for their own and their co-workers' safety. This means:

1. Become acquainted with all potential hazards in the area in which they work.
2. Learn and follow the appropriate standards, procedures, and hazard-control methods.
3. Never undertake a potentially hazardous operation without consulting with appropriate supervision.
4. Stop any operation you believe to be hazardous.
5. Notify a supervisor of any condition or behavior that poses a potential hazard.
6. Wear and use appropriate protective equipment.
7. 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:

1. Developing an attitude and awareness of safety in the people supervised and seeing that individual safety responsibilities are fully carried out.
2. Maintaining a safe work environment and taking corrective action on any potentially hazardous operation or condition.
3. Ensuring that the personnel he/she directs are knowledgeable and trained in the tasks they are asked to perform.
4. Ensuring that safe conditions prevail in the area and that everyone is properly informed of the area's safety regulations and procedures.
5. Ensuring that contract personnel are properly protected by means of instructions, signs, barriers, or other appropriate resources.
6. 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).
7. 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:

1. Is responsible for being aware of all potentially hazardous activities within the area of responsibility.

2. May assign responsibility or delegate authority for performance of any function, but -
3. Remains accountable to higher management for any oversight or error that leads to injury, illness, or damage to property.

Procedures

It is the policy of W. L. Hickey 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.

1. Practice proper housekeeping and cleanliness. Poor housekeeping is a major factor in many accidents. A cluttered area is likely to be both unsafe and inefficient. Every employee is responsible for keeping a clean area and every supervisor is responsible for ensuring that his or her areas of responsibility remain clean.
2. 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.
3. Resist "hurry-up" pressure. Program pressures should not cause you to bypass thoughtful consideration and planned procedures.
4. 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.
5. 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.
6. 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.
7. 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.

8. 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.
9. Test equipment safety. Tests should be made when the electrical equipment is de-energized, or, at most, energized with reduced hazard.
10. Know emergency procedures. All persons working in areas of high hazard (with high-voltage power supplies, capacitor banks, etc.) must be trained in emergency response procedures, including cardiopulmonary resuscitation (CPR) certification.

Working with Energized Equipment

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

Definitions:

The following definitions are used in this discussion of electrical safety.

1. 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.
2. 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.
3. Companion: A co-worker who is cognizant of potential danger and occasionally checks the other worker.
4. 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).
5. First Line Protection: The primary protective system and/or operational procedure provided to prevent physical contact with energized equipment.
 6. 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.
 7. 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.
 8. 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.
 9. Grounds, Massive: Large areas of metal, concrete, or wet ground that make electrical isolation difficult or impossible.
 10. 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.
 11. 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.
 12. 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.
 13. Safety Watch: An individual whose sole task is to observe the operator and to quickly de-

energize the equipment, using a crash button or circuit breaker control in case of an emergency, and to alert emergency personnel. This person should have basic CPR training.

Type of Hazards

The degree of hazard associated with electrical shock is a function of the duration, magnitude, and frequency of the current passed by the portion of the body incorporated in the circuit. The current that can flow through the human body with contacts at the extremities, such as between the hand or head and one or both feet, depends largely on the voltage. Body circuit resistance, even with liquid contacts (barring broken skin) will probably be not less than 500 ohms. The current flow at this resistance at 120 volts is 240 milliamperes.

Recognition of the hazards associated with various types of electrical equipment is of paramount importance in developing and applying safety guidelines for working on energized equipment. Three classes (in order of increasing severity) of electrical hazards have evolved.

Class A Hazard

Class A electrical hazard exists when all the following conditions prevail:

1. The primary AC potential does not exceed 130 volts rms.
2. The available primary AC current is limited to 30 amperes rms.
3. The stored energy available in a capacitor or inductor is less than 5 joules ($J=CV^2/2=LI^2/2$).
4. The DC or secondary AC potentials are less than 50 volts line-to-line and/or to ground or the DC or secondary AC power is 150 volt-amperes (V-A) or less.

Although the voltages and currents may be considered nominal, a "Class A" electrical hazard is potentially lethal. This class is particularly dangerous because of everyday familiarity with such sources, an assumed ability to cope with them, and their common occurrence in less guarded exposures.

Class B Hazard

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

Class C Hazard

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

Employee Attitude

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

Mode 1: Turn Off the Power

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

Mode 2: Latent Danger

All manipulative operations (such as making connections or alterations to or near normally energized components) are to be conducted with the equipment in the positively de-energized state. Measurements and observations of equipment functions may then be conducted with the equipment energized and with normal protective barriers removed. "Mode 2" is a moderate-to-severe hazard situation, depending on the operating voltages and energy capabilities of the equipment.

Mode 3: Hot Wiring

"Mode 3" exists when manipulative, measurement, and observational operations are to be conducted with the equipment fully energized and with the normal protective barriers removed.

"Mode 3" is a severe hazard situation that should be permitted only when fully justified and should be conducted under the closest supervision and control. One knowledgeable person should be involved in addition to the worker(s). Written permission may be required.

Work on Class B or Class C energized circuitry must only be done when it is absolutely necessary.

Safety Glasses

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

Personal Protective Devices

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

Elevated Locations

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

Chain of Command

The supervisory chain must be identified for normal operation and development, servicing, or testing of hazardous equipment.

1. 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.
2. 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.
3. All covering, clothing, and jewelry that might cause hazardous involvement must be removed.
4. Adequate and workable lock-out/tag-out procedures must be employed.
5. 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.
6. Supervisors and workers must be encouraged to make the conservative choice when they are in doubt about a situation regarding safety.
7. 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.
8. 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.
9. 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.

10. All equipment should have convenient, comfortable, and dry access.
11. 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.
12. 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.)
13. Periodic tests of interlocks to ensure operability must be performed and documented at least yearly.

Protective Systems

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

Periodic tests must be established to verify that these protective systems are operative.

Safety Practices

Additional safety practices are described below.

1. 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.
2. Emergency Lighting: There must be an emergency lighting system that activates when normal power fails in Class C conditions.
3. 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.
4. 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.

5. Lighting: Adequate lighting must be provided for easy visual inspection.
6. Overload Protection: Overload protection and well marked disconnects must be provided. Local "off" controls must be provided on remote-controlled equipment.
7. All disconnects and breakers should be clearly labeled as to which loads they control.
8. 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.
9. 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 rated as necessary for the environment and the application of the components.
10. Safety Grounding : Automatic discharge devices must be used on equipment with stored energy of 5 joules or more. Suitable and visible manual grounding devices must also be provided to short-to-ground all dangerous equipment while work is being performed.

Safety Practices

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.

1. 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.
2. 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.

3. 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.
4. 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.

1. 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.
2. Overload Protection. Overload protection must be provided on the input and should be provided on the output.

CHAPTER SIX - GASES

Introduction

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

Hazards

All gases must be used in a manner that will not endanger personnel or property in routine shop use or

experimental operations. Hazards associated with handling and use of flammable and/or high-pressure gases include the following:

1. Injuries caused by flying objects accelerated by an explosion or pressure release;
2. Almost certain death if a flammable mixture is inhaled and then ignited;
3. Asphyxiation;
4. Secondary accidents such as falls or electrical shocks;
5. Fire caused by ignition of flammable gases;

Relief Valves Required

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

Operational Safety Procedures

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

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.

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.

Cylinders

1. 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.
2. 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 W. L. Hickey must carry a legible label or stencil identifying the contents.
3. Do not repaint cylinders unless authorized by the supplier or manufacturer of the cylinder.
4. Compressed-gas containers must not contain gases capable of combining chemically, nor should the gas service be changed without approval by Responsible Safety Officer.
5. 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
6. 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.
7. 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.
8. Gases must not be mixed at W. L. Hickey sites in commercial DOT cylinders and must not be transferred from one DOT cylinder to another. Gases mixed at W. L. Hickey must never be put into a W. L. Hickey- or vendor-owned compressed gas cylinder.
9. 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.

10. It is illegal to transport a leaking cylinder (charged or partially charged) by common or contract carrier.

Compressed Gases

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

1. Type of cylinder and pressure rating
2. Serial number
3. 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.

W. L. Hickey 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.

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 (W. L. Hickey- 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 W. L. Hickey, such as in fixed tube banks, must be pressure tested to 5/3 (1.67) of their DOT service pressure every 6 years.

Cylinder Handling

Compressed gases should be handled only by experienced and properly instructed personnel. When in doubt about the proper handling of a compressed gas cylinder or its contents, consult 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.

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 pigtailed should not be left disconnected for more than a few minutes. Certain insects are attracted to pure gases and will quickly clog these lines.

Never use compressed gas to dust off clothing; this may cause serious injury or create a fire hazard.

About 30 psi gauge pressure (0.2 MPa) must be left in "empty" cylinders to prevent air from entering the cylinder and contaminating it; air contamination in a hydrogen cylinder is extremely dangerous.

Before a regulator is removed from a cylinder, close the cylinder valve and release all pressure from the regulator.

Before returning an empty cylinder, close the valve and replace the cylinder-valve protective cap and outlet cap or plug, if used.

Cylinder Storage

Cylinders not actively in use inside of buildings must be stored outside in areas approved by 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.

Supervisor Responsibilities

Supervisors must make periodic surveys of regulators in their areas. Damaged, unreliable, or otherwise defective regulators must be replaced immediately. All surplus regulators must be inspected, cleaned, adjusted, and repaired, as required.

Immediately after its removal from a flammable, toxic, and/or radioactive system, the entire regulator must be safely vented and purged. If in doubt about the hazard call the Responsible Safety Officer. Use only regulators of the approved type and design for the specific gas-and-cylinder combination to be employed. Ensure that threads and nipples (e.g. round, flat, conical) on regulators correspond to those on the cylinder-valve outlet (never force connections). Regulators with green-face gauges must be used only with oxygen.

Regulators designed for use on gas lines must not be used on gas cylinders; single-stage regulators are for use only up to 150 psig (1.0 MPa) and must be used only for in-line installation.

Two-stage regulators for inert gases are equipped with two relief valves that protect the regulator diaphragms and gauges from excessive over-pressure. Relief valves on regulators for use with flammable, toxic, and/or radioactive gases must be vented to a safe location. The second stage of a two-stage regulator will normally be adjusted so that the low-pressure output cannot exceed 67% of the highest reading on the low-pressure output gauge; the low pressure output relief valve will be set to open at (or under) the highest reading on the low-pressure

output gauge. Users are cautioned that additional pressure-relief valves may be required to protect downstream equipment.

Single-stage cylinder regulators (except acetylene regulators) are equipped with a single relief device that is set to open at (or under) the highest reading on the output gauge. These regulators will be adjusted to limit the output pressure to 67% of the highest reading of the output gauge.

If piping and associated apparatus connected to the regulator discharge are rated at a pressure lower than the lowest possible setting of the low-pressure output relief valve on the regulator and, therefore, a leak in the regulator valve seat could cause damage to the connected apparatus, a separate relief valve must be installed in the downstream equipment to protect it from damage caused by over-pressurization.

Diaphragm Failure

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

Regulators, Vacuum Service

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

Compressed Air

Compressed air for general shop or laboratory use must be restricted to 30-psig (207-kPa) maximum pressure by restricting nozzles. Compressed air at pressures up to 100-psig (700-kPa) may be used to operate pneumatic tools, certain control instruments, and research equipment with properly designed over-pressure relief devices. Use of air-pressurized research equipment must be approved by the Responsible Safety Officer.

Building compressed air (house air) may be used to dry parts and to help accomplish many other jobs in the shop or laboratory, but always ensure that no one is in line with the air stream and always wear goggles or a face shield.

Compressed air must not be used for breathing unless it has been especially installed for this purpose and such use has been approved by 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 nitro-gendewars 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 SEVEN - MECHANICAL GUARDING

Introduction & Standards

Mechanical guarding must encompass both the power transmission parts of all mechanical equipment and the points of operation on production machines.

1. 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.
2. Mechanical guards must be designed or otherwise procured to meet the following specifications:
3. The guard must provide positive protection equal to that specified in ANSI B15.1.

4. The guard must be considered a permanent part of the machine or equipment, capable of being easily or quickly removed or replaced.
5. The guard must not interfere with efficient operation or maintenance of the machine or give discomfort to the operator.
6. The guard must not weaken the machine structure.
7. The guard must be designed for a specific job and a specific machine.
8. The guard must be durable, resistant to fire and corrosion, and easily repaired.
9. The guard must not present hazards, such as rough edges, splinters, pinch points, shear points, or sharp corners.
10. 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
11. 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 No 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 EIGHT - MATERIALS HANDLING

Introduction

W. L. Hickey requires that safety planning and practices for commonplace tasks be as thorough as possible 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 external sources.

Lifting & Moving

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

Rigging

Planning for safe rigging and lifting must begin at the design stage, and lifting procedures must be developed for assembly and installation. The lifting

procedure should be developed and discussed with the rigging crew fore person.

Responsibility for all rigging jobs is shared between the rigging crew and the customer. The customer is responsible for defining and requesting the move, for providing technical information on relevant characteristics of the apparatus, including special lifting fixtures when required, for providing suggestions on rigging and moving, and for assigning someone to represent them both in planning and while the job is being carried out. The riggers are responsible for final rigging and for carrying out whatever moves have been designated. Before any movement takes place, however, each representative must approve the rigging and other procedures associated with the intended move. Each must respect the responsibility and authority of the other to prevent or terminate any action he or she judges to be unsafe or otherwise improper.

The supervisor must make certain that personnel know how to move objects safely by hand or with mechanical devices in the operations normal to the area and must permit only those employees who are formally qualified by training and certification to operate a fork truck, crane, or hoist. The supervisor must enforce the use of safe lifting techniques and maintain lifting equipment in good mechanical condition.

Employees are required to observe all established safety regulations relating to safe lifting techniques.

The Responsible Safety Officer provides training programs followed by certification for employees who have demonstrated the ability to operate fork trucks of up to 4-ton capacity and for incidental crane operations that require no special rigging.

Manual Lifting Rules

Manual lifting and handling of material must be done by methods that ensure the safety of both the employee and the material. It is W. L. Hickey 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:

1. Inspect the load to be lifted for sharp edges, splinters, and wet or greasy spots.
2. 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.

3. 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.
4. Consider the distance the load is to be carried. Recognize the fact your gripping power may weaken over long distances.
5. 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.
6. 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.
7. 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:

1. 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.
2. 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.
3. Carry the load close to your body (not on extended arms). To turn or change your position, shift your feet - don't twist your back.

The steps for setting an object on the ground are the same as above, but in reverse.

Mechanical Lifting

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

Inspections

Each mechanical lifting or moving device must be inspected periodically. Each lifting device must also be inspected before lifting a load near its rated capacity. Defective equipment must be repaired

before it is used. The rated load capacity of lifting equipment must not be exceeded.

Material moving equipment must be driven forward going up a ramp and driven backward going down a ramp.

Traffic must not be allowed to pass under a raised load.

The floor-loading limit must be checked before mobile lifting equipment enters an area. Passengers must not be carried on lifting equipment unless it is specifically equipped to carry passengers.

Load Path Safety

Loads moved with any material handling equipment must not pass over any personnel. The load path must be selected and controlled to eliminate the possibility of injury to employees should the material handling equipment fail.

Equipment worked on while supported by material handling equipment must have a redundant supporting system capable of supporting all loads that could be imposed by failure of the mechanical handling equipment. A suspended load must never be left unattended but must be lowered to the working surface and the material handling equipment secured before leaving the load unattended.

Truck Loading

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

Clean Work Areas

All areas controlled by W. L. Hickey 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:

1. Keep stairs, corridors, and aisles clear. Traffic lanes and loading areas must be kept clear and marked appropriately.
2. Store materials in work rooms or designated storage areas only. Do not use hallways, fan lofts, or boiler and equipment rooms as storage areas.
3. Do not allow exits, passageways, or access to equipment to become obstructed by either stored materials or materials and equipment that is being used.

4. Arrange stored materials safely to prevent tipping, falling, collapsing, rolling, or spreading - that is, any undesired and unsafe motion.
5. 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.
6. 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.
7. 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.
8. Segregate and store incompatible materials in separate locations.
9. Remove items that will not be required for extended periods from work areas and put them in warehouse storage. Call for assistance.
10. 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.
11. 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.

Forklift Operators

The Responsible Safety Officer must be notified whenever it is desired to acquire a crane from excess sources.

OSHA Standards for Forklifts

1. Forklift users must familiarize themselves with and comply with OSHA Standard 29 CFR 1910.178 and ANSI B56.1.
2. 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.
3. 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.
4. The user must see that all nameplates and caution and instruction markings are in place and legible.
5. The user must consider that changes in load dimension may affect truck capacities.

Forklift Maintenance

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

Forklift Extension

Maximum efficiency, reliability, and safety require that the use of fork extensions be guided by principles of proper application, design, fabrication, use, inspection, and maintenance. The user must notify the Responsible Safety Officer before purchasing extensions or having them fabricated.

Fork extensions are only appropriate for occasional use. When longer forks are needed on a regular basis, the truck should be equipped with standard forks of a longer length.

Routine on-the-job inspections of the fork extension must be made by the 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 W. L. Hickey. 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.

CHAPTER NINE - PROTECTIVE EQUIPMENT

Introduction

W. L. Hickey 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.

Protective Shoes

W. L. Hickey 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.

Protective Gloves

W. L. Hickey provides proper hand protection to employees exposed to known hand hazards. The supervisor must obtain the suitable hand protection and ensure that it is used. The individual department must maintain a supply of special or infrequently used hand protection.

Assistance in selecting the proper hand protection may be obtained by consulting the Responsible Safety Officer.

Head Protection

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

Eye Protection

W. L. Hickey provides appropriate eye protection devices for employees assigned to tasks in which an eye-injury hazard exists. The supervisor of the operation is responsible for determining the need for

suitable eye-protection devices and for ensuring that the employees use them.

The Responsible Safety Officer and appropriate Medical Services agency will assist the supervisor in defining eye-hazard operations and in selecting appropriate eye protection. An optometrist is available to issue, repair, adjust, and fit personal safety glasses and also for consultation regarding occupational eye protection. The standard sign:

**“CAUTION - EYE HAZARD AREA.
DO NOT ENTER
WITHOUT EYE PROTECTION.”**

must be posted in every area where eye protection is mandatory. All employees who work in such an area must wear the eye protection issued to them. Every visitor to the area must also be provided with suitable eye protection.

Respiratory Protection

Any operation that generates harmful airborne levels of dusts, fumes, sprays, mists, fogs, smokes, vapors, or gases or that may involve oxygen-deficient atmospheres requires the use of effective safety controls. This must be accomplished, as much as feasible, by accepted engineering control measures (for example, enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials). When effective engineering controls are not feasible, or while they are being instituted, appropriate respiratory protection must be used in accordance with W. L. Hickey requirements as prescribed by OSHA in ANSI 288.2-1980, Standard Practices for Respiratory Protection.

Responsibilities

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

Employees are responsible for:

1. Wearing the respirator in accordance with the instructions and training received.
2. Maintaining and storing the respirator in good condition.
3. Returning the respirator at the end of the required use for overhaul, cleaning, and disinfecting.

Supervisors are responsible for:

1. Identifying those employees who may need to use respiratory protection (Responsible Safety Officer will provide assistance upon request in this determination).
2. Ensuring that their employees have been properly trained and fitted.
3. Ensuring that their employees use the respirators as required.

The Responsible Safety Officer is responsible for:

1. Providing respiratory equipment.
2. Maintaining the equipment in good condition.
3. Fitting employees with proper respirators and providing training for their use.
4. Evaluating employee exposures and work conditions, including inspection of respirator use.

The Medical Services Department is responsible for:

1. Granting medical approval for each respirator user.

CHAPTER TEN - PRESSURE SAFETY

Definitions

The following definitions apply in this chapter:

Low Pressure: Gas Pressure less than 1 MPa gauge (150 psig) or liquid pressure less than 10 MPa (1500 psig).

Intermediate Pressure: Gas pressure from 1 to 20 MPa gauge (150 to 3000 psig) and liquid pressure from 10 to 35 MPa gauge (1500 to 5000 psig).

High Pressure: Gas pressure greater than 20 MPa gauge (3000 psig) and liquid pressure greater than 35 MPa gauge (5000 psig).

Pressure Equipment: Any equipment, e.g., vessels, manifolds, piping, or other components, that operates above or below (in the case of vacuum equipment) atmospheric pressure.

Pressure System: Any mechanical system comprising pressure equipment.

Pressure Vessel: A relatively high-volume pressure component (such as a spherical or cylindrical container) with a cross section larger than the associated piping.

Ductile Vessel: A pressure vessel fabricated from materials that yield extensively before failure when over stressed at any temperature within the vessel's operating range (generally, materials that exhibit greater than 5% plastic strain to rupture).

Brittle Vessel: A pressure vessel fabricated from materials that do not yield extensively before failure when over stressed at any temperature within the vessel's operating range (generally, materials that exhibit less than 5% plastic strain to rupture).

Research Pressure Equipment: Pressure equipment used for research, development, or for some other unique activity (such as special test equipment for shop use).

Plant-Facility Pressure Equipment: Pressure vessels and pressurized utility equipment that is part of W. L. Hickey 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.

Standard Operating Procedures

Any W. L. Hickey 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.

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, W. L. Hickey -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.

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.**"

OSHA Standards

State Safety Orders establish minimum standards for the design, construction, installation, inspection, operation, and repair of all (1) power boilers, including nuclear, (2) all low-pressure boilers and high-temperature-water boilers, and (3) any other fired pressure vessels in California not specifically exempted from these Orders.

State Safety Orders are not applicable to (1) boilers and fired pressure vessels under the jurisdiction of, and inspected by, the United States Government, (2) boilers and fired pressure vessels used in household service, and (3) boilers used exclusively to operate highway vehicles, including automobiles.

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 W. L. Hickey must be conducted by a Plant Maintenance Technician, a Physical Plant Mechanic, or an Assembly Shop

Machinist and must be observed (or conducted) and certified by the Responsible Safety Officer (or designee) or an outside independent Pressure Inspector.

Pressure-test and pressure-inspection records must be maintained for the life of the vessel by the organization that certifies the test or inspection.

Pressure Testing

Pressure vessels must be tested in accordance with the rules in this Section, using an inert fluid.

Pressure vessels for low-hazard inert systems for operation with nonflammable, non toxic, and non-radioactive fluids must be hydro-statically 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 non-magnetic vessels) the fluorescent-penetrant test.

During tests of pressure vessels in which the yield strengths of their construction materials is approached, strain-gauge measurements must be made at high-stress locations. Diameter measurements accurate to within plus or minus 0.025 mm (0.001 in.) must also be taken both before and after testing to determine whether detectable plastic yielding has occurred during pressurization.

When the strength of the vessel is questionable (old or unknown design), strain-gauge measurements must be made during testing, and diameter measurements must be taken before and after testing. The MAWP for ASME Code pressure vessels made of the acceptable ductile materials listed in the code, must not exceed 0.4 times the test pressure and must comply with a Proof Test to establish MAWP.

Pressure Testing Procedures

Inert-substance (low-hazard) pressure systems that will operate with non-hazardous liquids, inert gases, or compressed air must be tested hydro-statically (preferred) at least 1.5 times the MAWP or pneumatically to at least 1.25 times the MAWP using an inert fluid.

Reactive-substance (high-hazard) pressure systems that will operate with oxygen or with flammable, toxic, and/or radioactive fluids must be tested to at least 2.0 times the MAWP using an inert liquid (preferred) or gas.

Standards for Low Pressure Vessels

Pressure vessels and systems must be leak tested at their MAWP after successful pressure testing.

Leak Testing Required

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

A system or vessel must not be repaired while it is pressurized unless this is specifically authorized.

Leak Repairs

Any modification to a pressure vessel or system, other than repair or replacement (with an exact duplicate) of existing components, must be approved by the Responsible Safety Officer and recorded in a revision to the applicable engineering drawing, to the SN, and to the OSP (if applicable). The initial pressure test must be repeated before any further use of the modified vessel or system.

If an ASME-Code vessel is modified, the Code stamping must be obliterated, and the Responsible Safety Officer must be 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.

Inspections & 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 re-test must be certified and a label must be fixed on the vessel or system as described earlier.

Inspections & Testing

If it is impractical to pressure test a vessel or system at the Mechanical Shop or some other approved location, pressure test it in place, in accordance with the provisions of this Section.

The supervisor or user must ensure that in-place re-testing of pressure equipment for which he or she is responsible is performed. Although other individuals may be designated to observe and direct testing or re-testing, responsibility for safe conduct of the test and safe functioning of tested pressure equipment cannot be delegated.

The user and the Responsible Safety Officer must prepare the required test procedure, direct the test personnel, and witness in-place pressure testing of vessels and systems for which he or she is responsible.

Pressure Testing on Site

A written test procedure must be prepared for every high-hazard pressure test conducted in the field. When testing will be conducted in place, the test procedure must be included in (or appended to) the SN or OSP (if applicable).

Procedures for in-place testing of high-hazard vessels and systems must be approved.

The Building Manager or Area Supervisor must be advised of pressure tests planned to occur in his or her facility, and Responsible Safety Officer must be notified if toxic and/or radioactive material is involved.

All pressure tests must be conducted by a person designated by the Responsible Safety Officer or conducted by a Plant Maintenance Technician, a Physical Plant Mechanic, or a Machinist in the Assembly Shop and must be observed (or conducted) and certified by a member of the Responsible Safety Officer (or designee) or a Pressure Inspector.

Pressure Testing with Liquids

Pressure testing with a gas is more dangerous than testing with a liquid. Therefore, tests must be conducted with liquids, whenever practical.

Barricade the equipment being tested, shield the controls and operators, and evacuate all unauthorized personnel from the test area.

Signs reading "Danger - high-pressure Test in Progress - Keep Out" must be posted at all approaches to the test area.

For in-place testing with liquids, all air must be removed from both the testing system and the equipment to be tested. Compressed air will expand violently in case of vessel failure. Spongy action of pumping equipment usually indicates the presence of trapped air.

Pressure Testing with Gas

For correct standards, refer to the following:

ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 1, American Society of Mechanical Engineers, New York (latest version).

ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 2, American Society of Mechanical Engineers, New York (latest version).

ASME Boiler and Pressure Vessel Code, Section X, "Fiberglass-Reinforced Plastic Pressure Vessels," American Society of Mechanical Engineers, New York (latest version).

ARI Standards, air-conditioning and Refrigeration Institute, Arlington, VA (latest version).

Code of Federal Regulations 49, Transportation, Parts 100-199, General Services Administration (latest version).

Unfired Pressure Vessel Safety Orders, State of California Administration Code, Title 8, Industrial Relations, Part 1, Department of Industrial Relations, Chapter 4, Division of Industrial Relations, Subchapter 1 (latest version).

Boiler and Fired Pressure Vessel Safety Orders, State of California Administration Code, Title 8, Industrial Relations, Part 1, Department of Industrial Relations, Chapter 4, Division of Industrial Relations, Subchapter 2 (latest version).

OSHA Order 6430.1, General Design Criteria (latest version).

American Petroleum Institute, Standard 620 (latest version).

ASME Boiler and Pressure Vessel Code, Section I, Power Boilers, American Society of Mechanical Engineers, New York (latest version).

ASME Boiler and Pressure Vessel Code, Section IV, Heating Boilers, American Society of Mechanical Engineers, New York (latest version).

American National Standard Code, ANSI-B31.1, Power Piping (latest version).

American National Standard Code, ANSI-B31.3, Chemical Plant and Refinery Piping (latest version).

CHAPTER ELEVEN - LADDERS & SCAFFOLDS

Ladders

Ladders must be in good condition, made of suitable material, of proper length, and of the correct type for the use intended. Damaged ladders must never be used; they should be repaired or destroyed. Ladders used near electrical equipment must be made of a nonconducting material. Stored ladders must be easily accessible for inspection and service, kept out of the weather and away from excessive heat, and well supported when stored horizontally.

A portable ladder must not be used in a horizontal position as a platform or runway or by more than one person at a time. A portable ladder must not be placed in front of doors that open toward the ladder or on boxes, barrels, or other unstable bases. Ladders must not be used as guys, braces, or skids. The height of a stepladder should be sufficient to reach the work station without using the top or next to the top steps. Bracing on the back legs of stepladders must not be used for climbing.

The proper angle (75-1/2 degrees) for a portable straight ladder can be obtained by placing the base of the ladder a distance from the vertical wall equal to one quarter of the vertical distance from base to top of ladder's resting point. Ladders must be ascended or descended facing the ladder with both hands free to grasp the ladder. Tools must be carried in a tool belt or raised with a hand line attached to the top of the ladder. Extension ladders should be tied in place to prevent side slip.

Scaffolds

All scaffolds, whether fabricated on site, purchased, or rented must conform with the specifications found in ANSI A10.8, Safety Requirements for Scaffolding. Rolling scaffolds must maintain a 3:1 height to base ratio (use smaller dimension of base).

The footing or anchorage for a scaffold must be sound, rigid, and capable of carrying the maximum intended load without settling or displacement. Unstable objects such as barrels, boxes, loose brick, or concrete blocks must not be used to support scaffolds or planks. No scaffold may be erected, moved, dismantled, or altered unless supervised by competent persons. Scaffolds and their components must be capable of supporting at least four times the maximum intended load without failure.

Guard rails and toe boards must be installed on all open sides and ends of scaffolds and platforms more than 10 ft above the ground or floor. Scaffolds 4 feet to 10 feet in height having a minimum horizontal dimension in either direction of less than 45 inches must have standard installed on all open sides and ends of the platform.

Wire, synthetic, or fiber rope used for suspended scaffolds must be capable of supporting at least 6 times the rated load. No riveting, welding, burning, or open flame work may be performed on any staging suspended by means of fiber or synthetic rope. Treated fiber or approved synthetic ropes must be used for or near any work involving the use of corrosive substances. All scaffolds, boson'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.

CHAPTER TWELVE - TOOLS

Company Provided Tools

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

Grounding

Tools that are not double-insulated must be effectively grounded and tested. Testing must be accomplished before initial issue, after repairs, and after any incident that could cause damage, such as dropping or exposure to a wet environment.

Grounded tools must always be used with an effectively grounded circuit. Any extension cord used with a grounded tool must be a three-wire, grounded type.

Electric-powered hand tools used on construction sites, on temporary wired circuits, or in wet environments will be used in conjunction with an approved ground fault circuit interrupter (GFCI).

The responsibility for implementing and maintaining this program rests with the individual supervisors involved.

Tool testing equipment will be maintained by the Responsible Safety Officer.

Documentation of tool testing will be maintained by the group owning powered hand tools. Tools maintained in a tool crib and tested prior to issue are exempted from this requirement.

Repairs of defective tools will only be made by qualified electrical personnel.

Shop Rules

Any W. L. Hickey 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:

1. 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.
2. The person in charge will take whatever action is deemed necessary to prevent a personal injury or damage to equipment.
3. Equipment guards and protective devices must be used and must not be compromised.
4. Approved eye protection (visitor's glasses) must be worn by anyone entering and/or passing through shop areas.
5. Approved industrial safety eye protection must be worn by anyone working in a posted shop area.
6. Shoes or boots covering the whole foot must be worn in shop areas.
7. Persons using machine tools must not wear clothing, jewelry, or long hair in such a way as to represent a safety hazard.

CHAPTER THIRTEEN - TRAFFIC & TRANSPORTATION

Official Vehicle Use

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

Responsibility

Each Superintendent 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.

Safety Belts

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

Accidents

Any accident involving company vehicles (including private, rented or leased vehicles used on official company business) must be reported to the driver's supervisor. If the driver is unable to make a report, another employee who knows the details of the accident must make the report.

It is W. L. Hickey Sons'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 W. L. Hickey Sons, 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 W. L. Hickey Sons 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 and accident are carried in the vehicle or may be obtained from Administration. The Responsible Safety Officer will receive copies of all accident reports and will prepare any required OSHA reports.

CHAPTER FOURTEEN - HAZARD WARNINGS

Introduction

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

Contents & Configuration

Signs must conform to the colors, symbols, lettering size and proportions as specified by W. L. Hickey Sons, except that radiation signs must conform to the requirements stated in 10 CFR 20.

Every warning sign must include the following components:

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

CHAPTER FIFTEEN - TRENCHING & EXCAVATION SAFETY

Introduction

W. L. Hickey Sons will review and evaluate this standard practice instruction:

- On an annual basis
- When regulatory changes occur that prompt revision of this document
- When facility operational changes occur that require a revision of this document
- When there is an accident or close-call that relates to this topic

General Requirements

W. L. Hickey Sons will establish procedures for “trenching and excavation” undertaken by its employees, through the use of this document. Preventing future work-place injuries in our company is the principle purpose of this document. This document will provide a basis for ensuring that all procedures implemented, revised or modified meet our requirements for safety. This document will help identify hazards in our work-place and enable us to determine the best course of action to take to reduce or eliminate known hazards.

Surface Encumbrances & Underground Installations Safety Guidelines

All surface encumbrances that are located so as to create a hazard to employees will be removed or supported, as necessary, to safeguard employees. The estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, will be determined prior to opening an excavation. The following procedures are designed to provide employees of this company with a system for protection and safe conditions while working in a trenching or excavation environment. These guidelines are designed for use by employees at all levels within the work force.

Establish the locations of all underground and overhead utilities and services before beginning trenching or excavation operations.

Contact utility and service companies to include municipal owned and advise them prior to the start of all actual excavation. No exceptions.

When excavation operations approach the estimated location of underground installations, the exact location of the installations will be determined by safe and acceptable means (modern techniques and customary types of equipment). Where this determination is unclear, the owning utility will be contacted for assistance.

While any excavation is open, underground installations will be protected, supported or removed as necessary to safeguard employees.

Protection from Hazards Associated with Water Accumulation

Employees will not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline systems.

Inspect all excavations after any rainfall or other hazard producing occurrence to determine if any change to the soils capacity to resist the force has occurred.

Water should not be allowed to accumulate within the excavation. If such has occurred it will be removed utilizing proper pumping procedures.

Water will be controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations will be monitored by a competent person to ensure proper operation.

If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches or dikes, suitable means will be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will be inspected by a competent person.

Access & Egress from Excavations

Structural ramps. Structural ramps that are used solely by employees as a means of access or egress from excavations will be designed by a competent person. Structural ramps used for access or egress of

equipment will be designed by a competent person qualified in structural design, and will be constructed in accordance with the design.

Means of egress from trench excavations (less than 20 ft. deep). A stairway, ladder, ramp or other safe means of egress will be located in trench excavations that are 4 feet (1.22 m) or more in depth so as to require no more than 25 feet (7.62 m) of lateral travel for employees.

Means of egress from trench excavations (20 ft. or greater in depth). Ladders will be equipped with ladder platforms at 20-foot intervals.

Trench Safety

Trenches more than five (5) feet deep require shoring or will be laid back to its angle of repose (stabilized slope).

In hazardous soil conditions (loosely compacted or rocky) trenches under five (5) feet deep need protection.

There shall be at any excavation site a competently trained person, who is capable of identifying existing and predictable hazards and who shall have the authority to take prompt corrective action to eliminate them on the site. This individual shall be able to identify soil classifications and protective systems (shoring, bracing and piling) to be used in accordance with OSHA Trenching Standards found in 29 CFR 1926.652.

Trenches more than five (5) feet deep require shoring or will be laid back to a stable slope. In hazardous soil, trenches under five (5) feet will also be protected.

Portable trench boxes or sliding trench boxes used in place of shoring and sloping shall be designed, constructed and maintained to provide protection at least equal to the required sheeting and shoring. Shields shall be designed by a registered professional engineer and will meet the standards found in 29 CFR 1926.652.

Shields shall be installed so as to restrict lateral or other hazardous movement. Trench boxes and shields shall extend to the bottom of the trench and no less than eighteen (18) inches above the vertical top of the trench or excavation face. Exceptions are found in 29 CFR 1926.652. Excavation to a level not greater than 2 feet (.61 m) below the bottom of a shield shall be permitted, but only if the shield is

designed to resist the forces calculated for the full depth of the trench and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield. No employee shall be allowed within the shield, or trench box during the installation, removal or relocation. If at anytime trench boxes are stacked, means shall be provided to prevent separation.

Stability of Adjacent Structures

Where the stability of adjoining buildings, walls or other structures is endangered by excavation operations, support systems such as shoring, bracing or underpinning will be provided to ensure the stability of such structures for the protection of employees.

Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees will not be permitted except when:

1. A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure; or
2. The excavation is in stable rock; or
3. A registered professional engineer has approved the determination, that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity; or
4. A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.

Sidewalks, pavements and appurtenant structures will not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

Protection of Employees from Loose Rock or Soil

Adequate protection will be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection will consist of scaling to remove loose material; installation of protective barricades at intervals as necessary on the face to stop and contain falling material; or other means that provide equivalent protection.

Employees will be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection will be provided by placing and keeping such materials or equipment at least 2 feet (.61 m) from the edge of

excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

Fall Protection

Where employees or equipment are required or permitted to cross over excavations, walkways or bridges with standard guardrails will be provided.

Adequate barrier physical protection will be provided at all remotely located excavations. All wells, pits, shafts, etc., will be barricaded or covered. Upon completion of exploration and other similar operations, temporary wells, pits, shafts, etc., will be back-filled.

Protection of Employees in Excavations

Each employee in an excavation will be protected from cave-ins by an adequately designed protective system except when:

1. Excavations are made entirely in stable rock; or
2. Excavations are less than 5 feet (1.52 m) in depth and examination of the ground by a competent person provides no indication of a potential cave-in.

Protective systems will have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

Applicable Definitions

- * Accepted Engineering Practices - means those requirements which are compatible with standards of practice required by a registered professional engineer.
- * Aluminum Hydraulic Shoring - means a pre-engineered shoring system comprised of aluminum hydraulic cylinders (cross-braces) used in conjunction with vertical rails (uprights) or horizontal rails (wales). Such system is designed specifically to support the side-walls of an excavation and prevent cave-ins.
- * bell-bottom Pier Hole - means a type of shaft or footing excavation, the bottom of which is made larger than the cross section above to form a bell shape.
- * Benching (Benching System) - means a method of protecting employees from cave-ins by excavating the sides of an excavation to form

- one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.
- * cave-in - means the separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or other wise injure and immobilize a person.
 - * Competent Person - means one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.
 - * Cross Braces - mean the horizontal members of a shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either uprights or Wales.
 - * Excavation - means any man-made cut, cavity, trench or depression in an earth surface, formed by earth removal.
 - * Faces or Sides - means the vertical or inclined earth surfaces formed as a result of excavation work.
 - * Failure - means the breakage, displacement or permanent deformation of a structural member or connection so as to reduce its structural integrity and its supportive capabilities.
 - * Hazardous Atmosphere - means an atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness or injury.
 - * Kickout - means the accidental release or failure of a cross brace.
 - * Protective System - means a method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems and other systems that provide the necessary protection.
 - * Ramp - means an inclined walking or working surface that is used to gain access to one point from another, and is constructed from earth or from structural materials such as steel or wood.
 - * Registered Professional Engineer - means a person who is registered as a professional engineer in the state where the work is to be performed. However, a professional engineer, registered in any state is deemed to be a “registered professional engineer” within the meaning of this standard when approving designs for “manufactured protective systems” or “tabulated date” to be used in interstate commerce.
 - * Sheeting - means the members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.
 - * Shield (Shield System) - means a structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either pre-manufactured or job-built in accordance with 1926.652. Shields used in trenches are usually referred to as “trench boxes” or “trench shields”.
 - * Shoring (Shoring System) - means a structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.
 - * Sides. See “Faces”.
 - * Sloping (Sloping System) - means a method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure and application of surcharge loads.
 - * Stable Rock - means natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed. Unstable rock is considered to be stable when the rock material on the side or sides of the excavation is

secured against caving-in or movement by rock bolts or by another protective systems that has been designed by a registered professional engineer.

- * Structural Ramp - means a ramp built of steel or wood, usually used for vehicle access. Ramps made of soil or rock are not considered structural ramps.
- * Support System - means a structure such as underpinning, bracing or shoring, which provides support to an adjacent structure, underground installation or the sides of an excavation.
- * Tabulated Date - means tables and charts approved by a registered professional engineer and used to design and construct a protective system.
- * Trench (Trench Excavation) - means a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6 m) or less (measured at the bottom of the excavation), the excavation is also considered to be a trench.
- * Trench Box. See “Shield”.
- * Trench Shield. See “Shield”.
- * Uprights - means the vertical members of a trench shoring system placed in contact with the earth and usually positioned so that individual members do not contact each other. Uprights placed so that individual members are closely spaced, in contact with or interconnected to each other, are often called “sheeting”.
- * Wales - means horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members of the shoring system or earth.