GENERAL INDUSTRY

Safety Manual

TABLE OF CONTENTS

Page No.

GENERAL INDUSTRY SAFETY MANUAL
INJURY/ILLNESS PREVENTION
MANUAL GUIDELINES

DISCLAIMER:

Information provided in this written material should not be considered as all encompassing, or suitable for all situations, conditions or environments. Each company is responsible for implementing their own safety/injury/illness prevention program and should consult with their legal, medical or other advisors as to the suitability of using this information. Application of this information does not guarantee you will be successful in your safety efforts, or that the information will meet Federal OSHA standards or requirements. At the time this information was provided, it was believed to be from reliable sources and current with applicable local, state or federal safety standards, however, the producers of the program assume no liability arising from the use of, or reliance on the information provided. Always seek the advice of your legal, medical or other advisors as necessary before using this information in your Company's safety efforts.

There is more information in this manual than may be required. You may also want to add information we may not have included.

For the general industry, you should have the following minimum written plans:

- INJURY/ILLNESS PREVENTION PLAN
- HAZARD COMMUNICATION WRITTEN PLAN
- LOCKOUT/TAGOUT PLAN
- CONFINED SPACE ENTRY, PERMIT-ENTRY (if you have confined spaces)
- RESPIRATORY PROTECTION PROGRAM (if you use respirators)
- PERSONAL PROTECTIVE EQUIPMENT HAZARD ASSESSMENT
- SPECIFIC POLICIES AND PROCEDURES FOR MAINTENANCE
- HAZARDOUS WASTE/CHEMICALS

You must be able to show, through documentation, that your company enforces safety. This is one reason why we included safety counseling in this manual. Unless you can show that you do enforce safety, you do not have an effective safety program. Basically, there are several elements of an effective safety program, which must be proven through documentation, should your company be engaged in a legal dispute:

- Written safety policies and procedures.
- Employees must be trained in these policies and procedures. (training documentation).
- Safety policies and procedures must be enforced. How do you prove your policies/procedures are enforced? Documentation of disciplinary action taken on those

individuals who violate company safety policies/procedures. This can come in the form of "safety counseling". You simply cannot say that no employee has ever violated a safety rule, policy or procedure. That won't fly.

This manual addresses many of mandated requirements; however, you must edit the manual/plan to make the written plans "site specific", which means specifically for your organization; your equipment, your facilities and your employees. A "canned manual" is worthless unless it is edited and changed to fit your operations. Some of the information may be outdated or incorrect for your company and operations, so it's your responsibility to add, delete and improve on these guidelines. ANY pre-written manual, such as this one, is good only as GUIDE. Don't just put your name on it and call it your written plan. It is not your written plan or plans until you have made it fit your company/operations. Take your time and learn the requirements and make sure you have proper documentation to support your program. If you don't have documentation, you don't have a plan.

* * * * *

I. INJURY/ILLNESS PREVENTION PLAN

Safety Policy

"One of the principles of sound business management is the control of all factors which have a bearing on "incidents of loss". Whenever there is a personal injury or damage to property, from whatever cause, it is a direct reflection on our ability to perform our work in a correct and conscientious manner.

To help insure your continued good health and that of visitors to our offices/facilities, we are adopting and sponsoring a program of action dedicated to the reduction or elimination of causes for loss. In accepting this responsibility, management requests unqualified cooperation from every employee.

Our basic safety policy for all employees is simply stated:

WE HAVE NO JOB OR TASK TO PERFORM THAT WOULD ENDANGER THE HEALTH OR SAFETY OF ANY EMPLOYEE AND EACH EMPLOYEE HAS THE RESPONSIBILITY TO WORK AND ACT SAFELY AT ALL TIMES, IN THE FACILITY OR ON ASSIGNED DUTIES AWAY FROM THE OFFICE. IF ANY TASK IS UNHEALTHY OR UNSAFE TO PERFORM, NO ONE SHALL PERFORM THAT TASK. IF IT CAN'T BE DONE SAFELY, WE DON'T WANT ANY EMPLOYEE TO DO IT.

We recognize our responsibility in safety matters and shall endeavor to do our part in maintaining a safe and healthy place to work. The employer has the legal and moral obligation to provide a safe and healthful work environment, consequently each and every employee, as a condition of employment, has the obligation to work in a safe and healthful and productive manner. Safety is a team effort, requiring the diligence of all levels of management, supervision and employees.

_____ _____

(Date) *(President)*

APPOINTMENT OF SAFETY COORDINATOR

The following named person is hereby appointed as Safety Coordinator:

_____

The following named person is hereby designated as Acting Safety Coordinator, in the absence of the appointed Safety Coordinator:

_____

The duties of the Safety Coordinator are to consult with management and other employees, on all aspects of safety and health, and to properly maintain records, training documentation and hazard identification/correction as deemed necessary by management. Specific duties are to be outlined by management in an appropriate job description or other method prescribed by management. The Safety Coordinator's job is to COORDINATE safety efforts, however, the RESPONSIBILITY for safety remains upon management and supervision, with individual safety the responsibility of each employee.

General Safety Duties of Employees

Each employee should be the person most concerned for his/her own safety.

In addition, each employee has a responsibility to assure safety and health on the job, for the general public and other employees. By accepting employment, safety responsibility is a condition of continued employment:

- Knowing his/her job and always applying safe work practices.
- Recognizing the hazards of the job and taking precautions to assure the safety of the employee and others.
- Informing your department head or the Safety Coordinator of hazards and recommending how to eliminate them or improve performance.
- Actively participating and cooperating in the overall safety program.
- Maintaining cleanliness and good personal health habits.
- Each employee has the responsibility to communicate with management, openly and without fear of reprisal, any aspect of safety and health, specifically to make recommendations for safety and health improvement in the facilities, equipment and procedures. Each employee has the responsibility to report to management any safety or health hazard, so it may be corrected to prevent injury or illness.
- Each employee has the responsibility to work and act safely at all times, on all jobs, every day.

Basic Safety Requirements

- Personal Hygiene: Be fit for the job, through good healthy habits, proper meals, sufficient rest, and cleanliness.
- Know Your Job and Responsibilities: You learn the proper way by asking, not by trial and error. Communicate suggestions to management, on better and safer methods of improving job safety and health. Always be conscious of the safety of others, as well as your own. If you see a hazard, correct it if possible, even if it's not in your department. For

those hazards you cannot immediately correct, notify your supervisor so the hazard can be corrected.

- Clothing: Wear proper, acceptable clothing for the job. If you're not sure of what clothing is acceptable, ask your supervisor. Rings and jewelry should not be worn on, around or near moving machinery. Long hair must be kept tied back or confined under a cap or hat to prevent long hair from entanglements with machinery or equipment.

- Protective Clothing or Equipment

  Although routine tasks performed by employees may not require personal protective equipment, there may be times on the job, in the facilities or off site, where personal protective clothing/equipment is necessary for special hazards. When this personal protection is provided, each employee has an obligation to use this personal protective clothing or equipment, as prescribed by management.

- Housekeeping

  A place for everything and everything in its place. Keep equipment, tools, materials and work areas clean and orderly. Particular attention must be paid to electrical and cables/wires and other tripping hazards. If debris, leaks or other potential hazards are identified, it's up to each individual who notices such hazards to correct them, or if this is not possible, to notify supervision or management so the hazard may be corrected. All hazardous materials must be properly stored, according to their requirements.

- Machine Guarding

  Any machine that has exposed hazardous parts must be properly guarded. Should any machine or equipment have guards removed, or require guarding, that equipment will not be used until it has been properly guarded. Employees are not to use equipment or machinery that is not adequately guarded. Should equipment or machinery be locked or tagged out, with words such as:

  "Danger Do Not Start Machine", this indicates that the machine is being repaired, serviced or otherwise out of service and must not be started or tampered with while the lock or tag is in place. Only the person installing the lock or tag is authorized to remove the lock or tag.

- Movement

  Walk - never run. Use handrails on stairs. Be cautious when approaching swinging doors, corners or congested areas. Particular attention should be devoted to the prevention of slips and falls, particularly when carrying materials, equipment or tools. Most slips and falls are the result of not watching where a person is walking or inattention to footing.

- Safe Lifting

  Each employee has been, or will be trained in the safe lifting method and each employee must exercise these techniques and methods when lifting anything. If at any time, an employee believes an object is too heavy or awkward to be lifted by one person, then get help or move the object by mechanical lifting means. Each employee should maintain adequate fitness to keep the back healthy, thereby reducing the exposure to back injuries.

- Horseplay/Practical Jokes

  Practical jokes, horseplay and similar activity are strictly prohibited. Each employee has the responsibility to his/her behavior in a professional manner at all times.

- Fire and Emergency Preparedness

  Know what to do, what action to take and where to go in the event of an emergency. In the event of a fire, life safety is of paramount importance. If you have been trained and can safely extinguish a fire, use portable fire extinguishers or hoses, but only if there is no danger to your life. In the event of a fire, always call the fire department, even if the fire can be extinguished. It's best to have the fire department notified, in case the fire gets out of control. In the event of an earthquake, tornado or similar emergency, the best advice is to DUCK, COVER AND HOLD.

  Duck under a desk or sturdy workbench, cover to protect your head, eyes and other body parts from falling equipment or broken glass. Never run out of the building, since power lines are located in the proximity of our facilities. Flying glass from windows could be another hazard. Follow emergency procedures and use common sense to protect yourself and property. (The company must provide written emergency procedures and must verify inspection of all fire extinguishers on a monthly basis, with annual inspections required by a fire service company). Document these inspections/services.

- Accident/Injuries/Illnesses

  Report all work-related accidents, injuries or illnesses to management when they occur. First aid facilities are available and when required, competent medical assistance will be provided. Worker compensation insurance will cover all medical costs for injuries that are work related. Report all accidents, injuries and illnesses when they occur, even if you don't think medical treatment is required.

SAFETY AND HEALTH PROGRAM MANAGEMENT GUIDELINES

The Occupational Safety and Health Administration (OSHA) have concluded that effective management of worker safety and health protection is a decisive factor in reducing the extent and the severity of work-related injuries and illnesses. Effective management addresses all work-related hazards, including those potential hazards which could result from a change in

worksite conditions or practices. It addresses hazards whether or not they are regulated by government standards.

The language in these guidelines is general so that it may be broadly applied in general industry, Hospitality and Restaurant activities regardless of the size, nature, or complexity of operations. The guidelines consist of program elements which represent a distillation of applied safety and health management practices that are used by employers who are successful in protecting the safety and health of their employees. These program elements are advocated by many safety and health professionals and consultants. They were strongly endorsed by individuals, corporations, professional associations, and labor representatives who responded to the OSHA request for comments and information regarding these guidelines.

Enforcement of Safety Rules

Management has an obligation and responsibility to all employees to enforce safety rules. The vast majority of work related injuries are caused by the unsafe acts of employees, such as carelessness, negligence, violation of safety rules, taking short cuts or not following proper procedures.

When an investigation reveals the cause of an incident was a result of the unsafe acts of an employee(s), that employee(s) will be given a written counseling as to what behavior contributed to the cause of the incident and what action must be taken by the employee to eliminate this behavior.

A time frame in which to correct the unsafe behavior will be given the employee. This counseling should be viewed as TRAINING. Understanding the cause of the incident is essential and then what the employee should do to correct the unsafe behavior should follow. Without this information, the employee would not know why the incident occurred and would have no reason to change his/her behavior.

A safety counseling is not disciplinary action; however, continued demonstration of unsafe behavior could result in disciplinary action, up to and including termination.

The Value of a Written Counseling

In the context of SAFETY, a written counseling for violation of safety rules, unsafe acts or unsafe behavior is of unparalleled value. To ease the temperament of the person receiving a written counseling for safety violations, the best thing to do is call the written counseling a "SAFETY COUNSELING" or “SAFETY TRAINING”.

No one wants to get a disciplinary written counseling in their file, however, if you rename it: SAFETY COUNSELING, it becomes a bit more palatable to the employee, as well as being viewed as an individual recurrent training by any auditing agency. Safety counseling is designed to explain to the employee what type of behavior or unsafe act may have contributed to an accident or injury, in which the employee may have been involved.

II. SAFETY/TRAINING COUNSELING

Safety counseling is not considered disciplinary action, it's designed to promote safety awareness and improve prevention of injuries and illnesses. It's designed primarily to explain to the employee, how his/her unsafe behavior or unsafe act contributed to an accident, injury or illness. Continued demonstration of unsafe acts or unsafe behavior may lead to disciplinary action.

What was the unsafe act or unsafe behavior that contributed to the accident/injury/illness?

What corrective action should the employee take to correct the behavior?

Time Allowed for the employee to correct the behavior?

Employee comments regarding the counseling or incident:

_____ _____

(Print Employee's Name) *(Employee's Signature)*

Date of Counseling: _____

Safety Training

Management will provide safety training, as necessary. Employees are responsible for obtaining proper training as may be necessary to adequately educate themselves in the safe work practices required to prevent all accidents, injuries and illnesses. Generally, safety training includes, but is not limited to the following:

General Hazard to Which Exposed

- Employee Safety Orientation
- Safe Lifting/Back Injury Prevention
- Earthquake Safety
- Fire Extinguisher Operations and Safety
- Chemical Safety

Specific Hazards to Which Exposed

- Hazard Communications/Right to Know
- Ladder Safety
- Eye Protection
- Personal Protective Equipment.
- Office Safety.
- Specific Equipment/Machinery Operations.
- Video Display Terminals/Computers.
- Control of Hazardous Energy Sources/Lockout-Tagout.
- Bonding and Grounding of Flammable Liquids.

Note: Each company must determine what training is necessary, based upon equipment, hazard exposure and other criteria, to be sure training is provided for each specific hazard or potential hazard.

Where the employee is exposed to specific hazards, additional training will be provided, such as operating forklifts, respiratory protection, chemicals or other hazards.

Employees will not be permitted to operate machinery, equipment or expose themselves to hazards without proper training. If an employee is not sure of a hazard, or has any questions regarding the safety and health of any job assigned, that employee must not perform the job until such time as adequate training is provided.

If you haven't been trained or authorized, don't operate the equipment or machinery. If you are assigned to jobs or tasks with which you are unfamiliar, or haven't been properly trained, do not accept the job or task until you're satisfied that you have been properly trained and understand the potential hazards of the job or task.

Documentation of Safety Efforts

Subject: _____

Instructor: _____

Signature: _____

Lesson Plan Title & Training Aids Used:

_____

_____

_____

Persons Attending the Training:

Name	Department	Date	Training Subject

MANDATED POSTING REQUIREMENTS

These are postings of a variety of required POSTERS. Most states provide these POSTERS free of charge, as does OSHA. If you don't want the hassle of writing to a variety of governmental agencies, these posters are available for all State jurisdiction and requirements. See the name and phone number of the company that can provide these, if you want to purchase these laminated posters.

This listing here is designed for CALIFORNIA, but you can obtain the required POSTERS from any state upon request.

(This information is not required to be part of your manual, but it can be retained).

General Office Package

All State, Federal and OSHA postings you need to be in compliance are available on just two laminated posters! The State and Federal All-on-One Labor Law Poster includes all the postings you need to comply with the law. The All-on-One OSHA Poster meets all of OSHA's demanding "mandatory to post" and "mandatory to communicate" requirements.

Labor Law

State plus Federal All-on-One

- California Pregnancy / Disability Leave (Revised 995)
- CA EDD Unemployment & Disability Notice DE1857 a&d (Revised 895) and DE1858 (Revised 1296)
- CA Workers Compensation (Revised 895)
- CA EDD Withholding Allowance Certificate for the IRS DE35 (Revised 193/became mandatory posting 195)
- Emergency Phone Numbers
- Pay Day Notice
- Time Off for Voting Notice
- Harassment & Discrimination Act (Revised 196)
- CA Minimum Wage Notice IWC Order No. MW98 (Revised 1196)
- Equal Employment Opportunity is The Law (ADA)
- Family and Medical Leave Act of 1993
- Employee Polygraph Protection Act
- Federal Minimum Wage Notice (Revised 1096)

Health Care Package

(This also applies to hotels, motels, schools, and other institutions)

If any of the special situations described below apply to your workplace, OSHA regulations require that you display the appropriate posters.

Labor Law State plus Federal All-on-One

- California Pregnancy / Disability Leave (Revised 995)
- CA EDD Unemployment & Disability Notice DE1857 a&d (Revised 895) and DE1858 (Revised 1296)
- CA Workers Compensation (Revised 895)
- CA EDD Withholding Allowance Certificate for the IRS DE35 (Revised 193/became mandatory posting 195)
- Emergency Phone Numbers
- Pay Day Notice
- Time Off for Voting Notice
- Harassment & Discrimination Act (Revised 196)
- CA Minimum Wage Notice IWC Order No. MW98 (Revised 1196)
- Equal Employment Opportunity is The Law (ADA) Family and Medical Leave Act of 1993
- Employee Polygraph Protection Act
- Federal Minimum Wage Notice (Revised 1096)

OSHA "Safety in the Workplace"

Postings included:

- Job Safety & Health Protection
- Medical & Exposure Records
- Safety Awareness and Safety Meetings
- ABC's of CPR
- Choking Rescue with Diagrams
- Hazard Communications Checklist
- Emergency Numbers
- Quick Reference Hazard Materials
- SB198 Injury & Illness Prevention Program
- Freedom from Violence
- Injury Fraud Notice
- No Smoking Law

Are your employees exposed to blood or other bodily fluids? You Need the OSHA Bloodborne Poster. Meets 29 CFR 1910.1030 requirements. (First aid/CPR trained persons)

Postings included:

- Quick Guide to Definitions
- Personal Protective Equipment (PPE) Cuts Risks
- Protect Yourself when Handling Sharps
- Hepatitis B Vaccination
- Holding the Line on Contamination
- Reporting Exposure Incidents
- Emergency Numbers
- Important Information for Employees and Supervisors

- New Health and Safety Codes
- New Required Personal Protective Equipment (PPE) Charts

Industrial Package

Simply select Labor Law and OSHA "Safety in the Workplace" Poster.

If your employees are affected by exposure to hazardous chemicals or there is a forklift in use, OSHA regulations require that you also display the appropriate Specialty Posters as well.

Do your employees operate forklifts or industrial trucks? Add an OSHA Forklift Poster

Postings included:

- Revised 1997 Operating Rules, New Language Added to Paragraph 17
- Elevating Employees with Lift Trucks
- Operator Platforms
- Back Guards
- Rated Capacity
- Brakes and Warning Devices
- Internal Combustion Engines
- Maintenance of Industrial Trucks
- Quick Reference of OSHA Lift Truck Guidelines
- Quick Reference of OSHA Basic Operating Rules
- Emergency Numbers

Combines English and Spanish on one poster.

Do your employees handle or are exposed to hazardous chemicals? (Most organizations)

Add an OSHA Hazard Identification Poster

Complies with

- General Industry Safety Order #5494 and the National Fire Protection Agency mandatory Identification requirements
- Provides the necessary reference tool for identifying hazardous chemicals in the workplace
- Hazard ratings include: Health, Flammability, Reactivity, and Special Notice
- Protects the work environment by communicating safe use rules as well as, warning of potential hazards that may exist.

When the Law changes, cover with Peel 'N Post.

The Federal Minimum Wage was increased on September 1, 1997, and the law requires that you post the updated information. Our new laminated Peel 'N Post Update Overlays give you an easy, low cost way to comply with the law without having to purchase an entirely new poster. The peel off self adhesive back affixes directly to your existing poster, and neatly covers up the outdated information. We offer Peel 'N Post overlays for most brands of posters.

For Applicant Interview Room:

The Federal All-on-One poster is required for your lobby, reception area or interview room, where job applicants can readily see it.

Postings included:

- Employee Polygraph Protection Act
- Job Safety and Health Protection
- Revised Federal Minimum Wage Notice
- Federal Family and Medical Leave Act of 1993
- Equal Employment Opportunity is the Law (ADA, Title VII of the Civil Rights Act)
- Emergency Numbers.

* * * * * * *

III. HOW TO COMPLY WITH THE NEW GHS HAZCOM PROGRAM

INTRODUCTION

There is a lot of information about the new Hazard Communications program that's changing the way organizations comply with the new rules. This program is an explanation of how to comply, without changing your entire HAZCOM program.

The Globally Harmonized System (GHS) is an international approach to hazard communication, providing agreed criteria for classification of chemical hazards, and a standardized approach to label elements and safety data sheets. It is based on major existing systems around the world, including OSHA's Hazard Communication Standard and the chemical classification and labeling systems of other US agencies.

The result of this negotiation process is the United Nations' document entitled "Globally Harmonized System of Classification and Labeling of Chemicals," commonly referred to as The Purple Book.

OSHA has modified the Hazard Communication Standard (HCS) to adopt the GHS to improve safety and health of workers through more effective communications on chemical hazards. The GHS provides a standardized approach, including detailed criteria for determining what hazardous effects a chemical poses, as well as standardized label elements assigned by hazard class and category. This will enhance both employer and worker comprehension of the hazards, which will help to ensure appropriate handling and safe use of workplace chemicals. In addition, the safety data sheet requirements establish an order of information that is standardized. The harmonized format of the safety data sheets will enable employers, workers, health professionals, and emergency responders to access the information more efficiently and effectively, thus increasing their utility.

Adoption of the GHS in the US and around the world will also help to improve information received from other countries—since the US is both a major importer and exporter of chemicals, American workers often see labels and safety data sheets from other countries. The diverse and sometimes conflicting national and international requirements can create confusion among those who seek to use hazard information effectively. During the phase-in period, employers would be required to be in compliance with either the existing HCS or the revised HCS, or both. OSHA recognizes that hazard communication programs will go through a period of time where labels and SDSs under both standards will be present in the workplace. This will be considered acceptable, and employers are not required to maintain two sets of labels and SDSs for compliance purposes.

CHANGES TO HAZCOM

OSHA is requiring that employees are trained on the new label elements, such as pictograms and signal words and the new SDS format by December 2013. While many countries are in various stages of implementing the GHS, OSHA believes that it is possible that American

workplaces may begin to receive labels and SDSs that are consistent with the GHS shortly after publication. Thus, making it important to ensure that when employees begin to see the new labels and SDSs in their workplaces, they will be familiar with them, understand how to use them, and access the information effectively.

The three major areas of change are in hazard classification, labels, and safety data sheets.

- Hazard classification: The definitions of hazard have been changed to provide specific criteria for classification of health and physical hazards, as well as classification of mixtures. These specific criteria will help to ensure that evaluations of hazardous effects are consistent across manufacturers, and that labels and safety data sheets are more accurate as a result.

- Labels: Chemical manufacturers and importers will be required to provide a label that includes a harmonized signal word, pictogram, and hazard statement for each hazard class and category. Precautionary statements must also be provided.

- Safety Data Sheets: Will now have a specified 16-section format.

The revised Hazard Communication Standard (HCS) is a modification to the existing standard. The parts of the standard that did not relate to the GHS remained largely unchanged. There have been some modifications to terminology in order to align the revised HCS with language used in the GHS. For example, the term "hazard determination" has been changed to "hazard classification" and "material safety data sheet" was changed to "safety data sheet."

HAZARD CLASSIFICATION

Under both the current Hazard Communication Standard (HCS) and the revised HCS, an evaluation of chemical hazards must be performed considering the available scientific evidence concerning such hazards. The revised HCS has specific criteria for each health and physical hazard, along with detailed instructions for hazard evaluation and determinations as to whether mixtures or substances are covered. It also establishes both hazard classes and hazard categories—for most of the effects; the classes are divided into categories that reflect the relative severity of the effect. The current HCS does not include categories for most of the health hazards covered, so this new approach provides additional information that can be related to the appropriate response to address the hazard.

LABELS

Under the current Hazard Communication Standard (HCS), the label preparer must provide the identity of the chemical, and the appropriate hazard warnings. This may be done in a variety of ways, and the method to convey the information is left to the preparer. Under the revised HCS, once the hazard classification is completed, the standard specifies what information is to be provided for each hazard class and category. Labels will require the following elements:

- Pictogram: a symbol plus other graphic elements, such as a border, background pattern, or color that is intended to convey specific information about the hazards of a chemical. Each pictogram consists of a different symbol on a white background within a red square frame set on a point (i.e. a red diamond). There are nine pictograms under the GHS. However, only eight pictograms are required under the HCS.

- Signal words: a single word used to indicate the relative level of severity of hazard and alert the reader to a potential hazard on the label. The signal words used are "danger" and "warning." "Danger" is used for the more severe hazards, while "warning" is used for less severe hazards.

- Hazard Statement: a statement assigned to a hazard class and category that describes the nature of the hazard(s) of a chemical, including, where appropriate, the degree of hazard.

- Precautionary Statement: a phrase that describes recommended measures to be taken to minimize or prevent adverse effects resulting from exposure to a hazardous chemical or improper storage or handling of a hazardous chemical.

There are nine pictograms under the GHS to convey the health, physical and environmental hazards. The final Hazard Communication Standard (HCS) requires eight of these pictograms, the exception being the environmental pictogram, as environmental hazards are not within OSHA's jurisdiction. A quick look at the hazard pictograms and their corresponding hazards

Health Hazard (flame)

Carcinogen
Mutagenicity
Reproductive Toxicity
Respiratory Sensitizer
Target Organ Toxicity
Aspiration Toxicity
Flammables
Pyrophorics
Self-Heating
Emits Flammable Gas
Self-Reactives
Organic Peroxides
Irritant (skin & eye)
Skin Sensitizer
Acute Toxicity (harmful)
Narcotic Effects
Respiratory Tract Irritant
Hazardous to Ozone Layer

Corrosion (Exploding Bomb)

• Gases under Pressure
• Skin Corrosion/ burns
• Eye Damage
• Corrosive to Metals
• Explosives

• Self-Reactives
• Organic Peroxides

Environment (Flame over Circle)
(Non Mandatory)

Skull and Crossbones

• Oxidizers
• Aquatic Toxicity
• Acute Toxicity (fatal or toxic)

MORE ON PICTOGRAMS

Under the revised Hazard Communication Standard (HCS), pictograms must have red borders. OSHA believes that the use of the red frame will increase recognition and comprehensibility. Therefore, the red frame is required regardless of whether the shipment is domestic or international.

The revised Hazard Communication Standard (HCS) requires that all red borders printed on the label have a symbol printed inside it.

Employers may choose to label workplace containers either with the same label that would be on shipped containers for the chemical under the revised rule, or with label alternatives that meet the requirements for the standard. Alternative labeling systems such as the National Fire Protection Association (NFPA) 704 Hazard Rating and the Hazardous Material Information System (HMIS) are permitted for workplace containers. However, the information supplied on these labels must be consistent with the revised HCS, such as no conflicting hazard warnings or pictograms.

NEW SAFETY DATA SHEETS

The information required on the safety data sheet (SDS) will remain essentially the same as that in the current standard. The current Hazard Communication Standard (HCS) indicates what information has to be included on an SDS but does not specify a format for presentation or order of information. The revised HCS requires that the information on the SDS is presented using consistent headings in a specified sequence.

The SDS format is the same as the ANSI standard format which is widely used in the U.S. and is already familiar to many employees.

The format of the 16-section SDS should include the following sections:

Section 1. Identification
Section 2. Hazard(s) identification

Section 3. Composition/information on ingredients
Section 4. First-Aid measures
Section 5. Fire-fighting measures
Section 6. Accidental release measures
Section 7. Handling and storage
Section 8. Exposure controls/personal protection
Section 9. Physical and chemical properties
Section 10. Stability and reactivity
Section 11. Toxicological information
Section 12. Ecological information
Section 13. Disposal considerations
Section 14. Transport information
Section 15. Regulatory information
Section 16. Other information, including date of preparation or last revision
Sections 12-15 may be included in the SDS, but are not required by OSHA.

OSHA anticipates that, in addition to safety and health benefits, the revised HCS will result in four types of productivity benefits: (1) for chemical manufacturers, because they will need to produce fewer SDSs in future years; (2) for employers, in providing training to new employees as required by the existing OSHA HCS through the improved consistency of the labels and SDSs. (3) for firms engaging in, or considering engaging in, international trade.

SUMMARY

Basically, if you have a current Hazard Communication Program, including a written program, inventory control and training, the major changes that will affect most companies will be the Safety Data Sheet, Labels and Pictograms. The changes from MSDS to SDS will make it much easier to standardize the Safety Data Sheets as the required information will be in the same place on each SDS. Label changes are easy to do and almost every label vendor now has these new labels available. Pictograms will take just a while longer to learn and implement, but this will simplify the information for almost everyone using chemicals and hazardous materials.

Training is always an important part of any new program. Organizations with a current HAZCOM program can make these adjustments quickly and include these new basics in training. Overall, GHS is nothing to fear, it's a simplified system and in the long run, will result in greater efficiency, productivity and of course, great safety and health for anyone working with chemicals and hazardous materials.

GLOBAL HARMONIZING SYSTEM (GHS) - SAFETY DATA SHEET

What Information is provided on a Safety Data Sheet (SDS)?

- Company Information
- Hazardous Ingredients

- Physical Data
- Fire and Explosion Hazard Data
- Health Hazard Data
- Reactivity (Instability) Data
- Spill or Leak Procedures
- Special Protection Information
- Special Precautions

OSHA specifies the information to be included on an SDS, but does not prescribe the precise format for an SDS. A non-mandatory SDS form that meets the Hazard Communication Standard requirements has been issued and can be used as is or expanded as needed. The SDS must be in English and must include at least the following information:

Section I. Chemical Identity

- The chemical and common name(s) must be provided for single chemical substances.
- An identity on the SDS must be cross-referenced to the identity found on the label.

Section II. Hazardous Ingredients

- For a hazardous chemical mixture that has been tested as a whole to determine its hazards, the chemical and common names of the ingredients that are associated with the hazards, and the common name of the mixture must be listed.
- If the chemical is a mixture that has not been tested as a whole the chemical and common names of all ingredients determined to be health hazards and comprising 1 percent or greater of the composition must be listed.
- Chemical and common names of carcinogens must be listed if they are present in the mixture at levels of 0.1 percent or greater.
- All components of a mixture that have been determined to present a physical hazard must be listed.
- Chemical and common names of all ingredients determined to be health hazards and comprising less than 1 percent (0.1 percent for carcinogens) of the mixture must also be listed if they can still exceed an established Permissible Exposure Limit (PEL) or Threshold Limit Value (TLV) or present a health risk to exposed employees in these concentrations.

Section III. Physical and Chemical Characteristics

- The physical and chemical characteristics of the hazardous substance must be listed. These include items such as boiling and freezing points, density, vapor pressure, specific gravity, solubility, volatility, and the product's general

appearance and odor. These characteristics provide important information for designing safe and healthful work practices.

Section IV. Fire and Explosion Hazard Data

- The compound's potential for fire an explosion must be described. Also, the fire hazards of the chemical and the conditions under which it could ignite or explode must be identified. Recommended extinguishing agents and fire-fighting methods must be described.

Section V. Reactivity (Instability) Data

- This section presents information about other chemicals and substances with which it reacts. Information on any hazardous decomposition products, such as carbon monoxide, must be included.

Section VI. Health Hazards

- The acute and chronic health hazards of the chemical, together with signs and symptoms of exposure, must be listed. In addition, any medical conditions that are aggravated by exposure to the compound, must be included. The specific types of chemical health hazards defined in the standard include carcinogens, corrosives, toxins, irritants, sensitizers, mutagens, teratogens, and effects on target organs (i.e., liver, kidney, nervous system, blood, lungs, mucous membranes, reproductive system, skin, eyes, etc.).
- The route of entry section describes the primary pathway by which the chemical enters the body. There are three principal routes of entry: inhalation, skin, and ingestion.
- This section of the SDS supplies the OSHA PEL, the ACGIH TLV, and other exposure levels used or recommended by the chemical manufacturer.
- If the compound is listed as a carcinogen (cancer-causing agent) by OSHA, the National Toxicology Program (NTP), or the International Agency for Research on Cancer (IARC), this information must be indicated on the SDS.

Section VII. Precautions for Safe Handling and Use

- The standard requires the preparer to describe the precautions for safe handling and use. These include recommended industrial hygiene practices, precautions to be taken during repair and maintenance of equipment, and procedures for cleaning up spills and leaks. Some manufacturers also use this section to include useful information not specifically required by the standard, such as EPA waste disposal methods and state and local requirements.

Section VIII. Control Measures

- The standard requires the preparer of the SDS to list any generally applicable control measures. These include engineering controls, safe handling procedures, and personal protective equipment. Information is often included on the use of goggles, gloves, body suits, respirators, and face shields.

* * * * * *

IV. WALKING-WORKING SURFACES (SLIPS, TRIPS, AND FALLS)

Slips, trips, and falls constitute the majority of general industry accidents. They cause 15% of all accidental deaths, and are second only to motor vehicles as a cause of fatalities. The OSHA standards for walking and working surfaces apply to all permanent places of employment, except where domestic, mining, or agricultural work only is performed.

General Requirements

Housekeeping

Some of the most frequently overlooked general requirements involve housekeeping:

- All places of employment, passageways, storerooms, and service rooms shall be kept clean and orderly and in a sanitary condition.
- The floor of every workroom shall be maintained in a clean and, so far as possible, a dry condition. Where wet processes are used, drainage shall be maintained and gratings, mats, or raised platforms shall be provided.
- Every floor, working place and passageway shall be kept free from protruding nails, splinters, holes, or loose boards.

Aisles and Passageways

- Aisles and passageways shall be kept clear and in good repair with no obstruction across or in aisles that could create a hazard.
- Permanent aisles and passageways shall be appropriately marked.
- Where mechanical handling equipment is used, aisles shall be sufficiently wide.
- Improper aisle widths coupled with poor housekeeping and vehicle traffic can cause injury to employees, damage the equipment and material, and can limit egress in emergencies.

Covers and Guardrails

Covers and/or guardrails shall be provided to protect personnel from the hazards of open pits, tanks, vats, ditches, and the like.

Floor Loading Protection

Load rating limits shall be marked on plates and conspicuously posted. It shall be unlawful to place, or cause, or permit to be placed, on any floor or roof of a building or other structure, a load greater than that for which such floor or roof is approved.

Guarding Floor and Wall Openings and Holes

Floor openings and holes, wall openings and holes, and the open sides of platforms may create hazards. People may fall through the openings or over the sides to the level below. Objects, such as tools or parts, may fall through the holes and strike people or damage machinery on lower levels.

OSHA standards for guarding openings and holes use the following definitions:

Floor hole: An opening measuring less than 12 inches but more than 1 inch in its least dimension, in any floor, platform, pavement or yard, through which materials but not persons may fall.

Floor opening: An opening measuring 12 inches or more in its least dimension, in any floor, platform, pavement, or yard, through which persons may fall.

Platform: A working space for persons, elevated above the surrounding floor or ground.

Wall hole: An opening less than 30 inches but more than 1 inch high, of unrestricted width, in any wall or partition.

Wall opening: An opening at least 30 inches high and 18 inches wide, in any wall or partition, through which persons may fall.

Protection for Floor Openings

Standard railings shall be provided on all exposed sides of a stairway opening, except at the stairway entrance. For infrequently used stairways, where traffic across the opening prevents the use of a fixed standard railing, the guard shall consist of a hinged floor opening cover of standard strength and construction along with removable standard railings on all exposed sides, except at the stairway entrance.

A "standard railing" consists of top rail, mid rail, and posts, and shall have a vertical height of 42 inches nominal from the upper surface of top rail to floor, platform, runway, or ramp level. Nominal height of mid rail is 21 inches.

A "standard toe board" is 4 inches nominal in vertical height, with not more than 1/4-inch clearance above floor level.

Floor openings may be covered rather than guarded with rails. When the floor opening cover is removed, a temporary guardrail shall be in place, or an attendant shall be stationed at the opening to warn personnel.

Every floor hole into which persons can accidentally walk shall be guarded by either:

- A standard railing with toe-board, or
- A floor hole cover of standard strength and construction

While the cover is not in place, the floor hole shall be constantly attended by someone or shall be protected by a removable standard railing.

Protection of Open-Sided Floors, Platforms, and Runways

One of the most frequently overlooked requirements in walking-working surfaces is the requirement that every open-sided floor or platform 4 feet or more above adjacent floor or ground level shall be guarded by a standard railing on all open sides, except where there is an entrance to a ramp, stairway, or fixed ladder. The railing shall be provided with a toe-board wherever, beneath the open sides:

- persons can pass,
- there is moving machinery, or
- there is equipment with which falling materials could create a hazard

Every runway shall be guarded by a standard railing, or the equivalent, on all sides 4 feet or more above floor or ground level. Wherever tools, machine parts, or materials are likely to be used on the runway, a toe-board shall also be provided on each exposed side.

Regardless of height, open-sided floors, walkways, platforms, or runways above or adjacent to dangerous equipment, pickling or galvanizing tanks, degreasing units, and similar hazards shall be guarded with a standard railing and toe-board.

Stairway Railings and Guards

Every flight of stairs with four or more risers shall have standard stair railings or standard handrails as specified below. Stair width is measured clear of all obstructions except handrails.

- On stairways less than 44 inches wide having both sides enclosed, at least one handrail shall be affixed, preferably on the right side descending.

- On stairways less than 44 inches wide with one open side, at least one stair rail shall be affixed on the open side.

- On stairways less than 44 inches wide having both sides open, two stair rails shall be provided, one for each side.

- On stairways more than 44 inches wide, but less than 88 inches, one handrail shall be provided on each enclosed side and one stair rail on each open side.

- On stairways 88 inches or more in width, one handrail shall be provided on each enclosed side, one stair rail on each open side, and one intermediate stair rail placed approximately in the middle of the stairs.

A "standard stair railing" (stair rail) shall be of construction similar to a standard railing, but the vertical height shall be not more than 34 inches nor less than 30 inches from the upper surface

of the top rail to the surface of the tread in line with the face of the riser at the forward edge of the tread.

A "standard handrail" consists of a lengthwise member mounted directly on a wall or partition by means of brackets attached to the lower side of the handrail in order to keep a smooth, unobstructed surface along the top and both sides of the handrail. They shall hold the rail 3 inches from the wall and be no more than 8 feet apart.

The height of handrails shall be no more than 34 inches or less than 30 inches from the upper surface of the handrail to the surface of the tread in line with the face of the riser or to the surface of the ramp.

Winding stairs shall have a handrail that is offset to prevent people from walking on any portion of the treads where the width is less than 6 inches.

Fixed Industrial Stairs

This section contains specifications for the safe design and construction of fixed general industrial stairs. This includes interior and exterior stairs around machinery, tanks, and other equipment, and stairs leading to or from floors, platforms or pits. This section does not apply to stairs used for fire exit purposes, to construction operations, to private residences, or to articulated stairs, such as may be installed on floating roof tanks, the angle of which changes with the rise and fall of the base support.

Where are fixed stairs required?

Fixed Industrial Stairs shall be provided for access to and from places of work where operations necessitate regular travel between levels. OSHA requirements include:

- Fixed industrial stairs shall be strong enough to carry five times the normal anticipated live load.
- At the very minimum, any fixed stairway shall be able to carry safely a moving concentrated load of 1000 pounds.
- All fixed stairways shall have a minimum width of 22 inches.
- Fixed stairs shall be installed at angles to the horizontal of between 30^{o} and 50^{o}.
- Vertical clearance above any stair tread to an overhead obstruction shall be at least 7 feet measured from the leading edge of the tread.

When inspecting the condition of stairways in your place of work, here are some items to watch out for.

Handrails and Stair Rails

Lack of:

- placement
- smoothness of surface
- strength
- clearance between rail and wall or other object

Treads:

- strength
- slip resistance
- dimensions
- Evenness of surface
- Visibility of leading edge
- Improper/inadequate design, construction or location of staircases.
- Wet, slippery, or damaged walking or grasping surfaces.
- Improper illumination - there is no general OSHA standard for illumination levels. The Illuminating Engineering Society publications should be consulted for recommendations.
- Poor housekeeping.

The length of a staircase is important. Long flights of steps without landings should be avoided whenever possible.

The OSHA standards do not specify any exact number or placement of landings. The National Safety Council recommends landings at every tenth or twelfth tread.

Intermediate landings and platforms on stairways shall be no less than the stair width and a minimum of 30 inches in length measured in the direction of travel.

Portable Ladders

The chief hazard when using a ladder is falling. A poorly designed, maintained, or improperly used ladder may collapse under the load placed upon it and cause the employee to fall.

A ladder is an appliance consisting of two side rails joined at regular intervals by crosspieces on which a person may step to ascend or descend.

The various types of portable ladders include:

- Stepladder - A self-supporting portable ladder, non-adjustable in length, having flat steps and hinged back.

- Single Ladder - A non self-supporting portable ladder, nonadjustable in length, consisting of but one section. Its size is designed by overall length of the side rail.

- Extension Ladder - A non self-supporting portable ladder adjustable in length.

OSHA's requirements for portable ladders include:

- Portable stepladders longer than 20 feet shall not be used.
- Stepladders shall be equipped with a metal spreader or locking device of sufficient size and strength to securely hold the front and back sections in open position.
- Single ladders longer than 30 feet shall not be used.
- Extension ladders longer than 60 feet shall not be used.
- Ladders shall be maintained in good condition at all times.
- Ladders shall be inspected frequently and those which have developed defects shall be withdrawn from service for repair or destruction and tagged or marked as "Dangerous, Do Not Use."
- Proper use of ladders is essential in preventing accidents. Even a good ladder can be a serious safety hazard when used by workers in a dangerous way.

OSHA standards require the following safety precautions for ladder use:

- Ladders shall be placed with a secure footing, or they shall be lashed, or held in position
- Ladders used to gain access to a roof or other area shall extend at least 3 feet above the point of support.
- The foot of a ladder shall, where possible, be used at such a pitch that the horizontal distance from the top support to the foot of the ladder is one-quarter of the working length of the ladder (the length along the ladder between the foot and the support). See figure above.
- The worker shall always face the ladder when climbing up or down.
- Short ladders shall not be spliced together to make long ladders.
- Ladders shall never be used in the horizontal position as scaffolds or work platforms.
- The top of a regular stepladder shall not be used as a step.
- Use both hands when climbing or descending ladders.
- Metal ladders shall never be used near electrical equipment.

Fixed Ladders

A fixed ladder is a ladder permanently attached to a structure, building or equipment.

A point to remember is that fixed ladders, with a length of more than 20 feet to a maximum unbroken length of 30 feet shall be equipped with cages or a ladder safety device.

A "cage" is a guard that is fastened to the side rails of the fixed ladder or to the structure to encircle the climbing space of the ladder for the safety of the person who must climb the ladder.

Cages shall extend a minimum of 42 inches above the top of a landing, unless other acceptable protection is provided.

Cages shall extend down the ladder to a point not less than 7 feet or more than 8 feet above the base of the ladder.

A ladder safety device is any device, other than a cage or well, designed to eliminate or reduce the possibility of accidental falls and may incorporate such features as life belts, friction brakes, and sliding attachments.

Another feature of fixed ladders is the landing platform which provides a means of interrupting a free fall and serves as a resting place during long climbs.

When fixed ladders are used to ascend to heights exceeding 20 feet (except on chimneys), landing platforms shall be provided for each 30 feet of height or fraction thereof, when cages are used, except that, where no cage, well, or ladder safety device is provided, landing platforms shall be provided for each 20 feet of height or fraction thereof.

Ladder safety devices may be used on tower, water tank, and chimney ladders over 20 feet in unbroken length in lieu of cage protection. No landing platform is required in these cases.

The preferred pitch of fixed ladders shall be considered to come in the range of 75 degrees and 90 degrees with the horizontal. Fixed ladders shall be considered to be substandard if they are installed within the pitch range of 60 and 75 degrees with the horizontal. Substandard fixed ladders are permitted only where it is found necessary to meet conditions of installation. This substandard pitch range shall be considered as a critical range to be avoided, if possible.

Ladders having a pitch in excess of 90 degrees with the horizontal are prohibited.

As with all ladders, fixed ladders shall be maintained in a safe condition and inspected regularly.

Other Working Surfaces

An important requirement, which can prevent many serious accidents is contained in this section: portable dock-boards (bridge plates) shall be secured in position, either by being anchored or equipped with devices which will prevent their slipping. Movement of the dockboard during material handling operations has resulted in forklifts overturning, or falling off the dock, often with serious injury or death to the driver and damage to equipment and material.

A major contribution to accident experience comes from material handling. Handholds shall be provided on portable dock-boards to permit safe handling when the dockboard must be repositioned or relocated.

* * * * * *

V. ELECTRICAL

Electricity has become an essential of modern life, both at home and on the job. Some employees work with electricity directly, as is the case with engineers, electricians, or people who do wiring, such as overhead lines, cable harnesses, or circuit assemblies. Others, such as office workers and salespeople, work with it indirectly. As a source of power, electricity is accepted without much thought to the hazards encountered. Perhaps because it has become such a familiar part of our surroundings, it often is not treated with the respect it deserves.

OSHA's electrical standards address the government's concern that electricity has long been recognized as a serious workplace hazard, exposing employees to such dangers as electric shock, electrocution, fires and explosions. The objective of the standards is to minimize such potential hazards by specifying design characteristics of safety in use of electrical equipment and systems.

OSHA's electrical standards were carefully developed to cover only those parts of any electrical system that an employee would normally use or contact. The exposed and/or operating elements of an electrical installation - lighting equipment, motors, machines, appliances, switches, controls, enclosures, etc. - must be so constructed and installed as to minimize electrical dangers to people in any workplace.

The OSHA electrical standards were based on the National Fire Protection Association's standard NFPA 70E, Electrical Safety Requirements for Employee Workplaces, and the NFPA 70 Committee derived Part I of their document from the 1978 edition of the National Electrical Code (NEC). The standards extracted from the NEC were those considered to most directly apply to employee safety and least likely to change with each new edition of the NEC. OSHA's electrical standards are performance oriented; therefore they contain few direct references to the NEC. However, the NEC contains specific information as to how the required performance can be obtained.

Examination, Installation and Use of Equipment

Electrical equipment shall be free from recognized hazards that are likely to cause death or serious physical harm to employees. (1) Safety of equipment shall be determined using the following considerations:

- Suitability for installation and use in conformity with the provisions of this subpart.
- Suitability of equipment for an identified purpose may be evidenced by listing or labeling for that identified purpose.
- Mechanical strength and durability, including, for parts designed to enclose and protect other equipment, the adequacy of the protection thus provided.
- Electrical insulation.
- Heating effects under conditions of use.
- Arcing effects.

- Classification by type, size, voltage, current capacity, and specific use.
- Other factors which contribute to the practical safeguarding of employees using or likely to come in contact with the equipment.
- Note that this requirement is, in effect, an electrical "general duty clause" similar to Section 5(a)(1) of the OSH Act: "each employer shall furnish . . . a place of employment which is free from recognized hazards that are causing or are likely to cause death or serious harm to his employees."

Installation and Use

Listed or labeled equipment shall be used or installed in accordance with any instructions included in the listing or labeling.

Identification of Disconnecting Means and Circuits

Each disconnecting means required by this subpart for motors and appliances shall be legibly marked to indicate its purpose, unless located and arranged so the purpose is evident. Each service, feeder, and branch circuit, at its disconnecting means or over current device, shall be legibly marked to indicate its purpose, unless located and arranged so the purpose is evident. These markings shall be of sufficient durability to withstand the environment involved.

A disconnecting means is a switch that is used to disconnect the conductors of a circuit from the source of electric current. Disconnect switches are important because they enable a circuit to be opened, stopping the flow of electricity, and thus can effectively protect workers and equipment.

Each disconnect switch or over-current device required for a service, feeder, or branch circuit must be clearly labeled to indicate the circuit's function, and the label or marking should be located at the point where the circuit originates. For example, on a panel that controls several motors or on a motor control center, each disconnect must be clearly marked to indicate the motor to which each circuit is connected. The Number 2 circuit breaker in the panel box supplies current only to disconnect Number 2, which in turn controls the current to motor Number 2. This current to motor Number 2 can be shut off by the Number 2 circuit breaker or the Number 2 disconnect.

If the purpose of the circuit is obvious, no identification of the disconnect is required.

All labels and markings must be durable enough to withstand weather, chemicals, heat, corrosion, or any other environment to which they may be exposed.

Each Disconnect and Circuit Requires Identification.

Working Space About Electric Equipment

Note that this particular section is concerned with the safety of a person qualified to work on the equipment (presumably an electrician). Obviously, the hazard must be treated in a different way if the person will remove guards and enclosures and actually work on the live parts. Sufficient access and working space shall be provided and maintained about all electric equipment to permit ready and safe operation and maintenance of such equipment.

Clear Spaces

Working space required by this subpart may not be used for storage. When normally enclosed live parts are exposed for inspection or servicing, the working space, if in a passageway or general open space shall be suitably guarded.

Guarding of Live Parts

It should be noted that the purpose of this requirement is to protect any person who may be in the vicinity of electrical equipment against accidental contact. These people are presumably not electricians working on the equipment, and are not qualified or trained to be in close proximity to live parts.

Except as required or permitted elsewhere in this subpart, live parts of electric equipment operating at 50 volts or more shall be guarded against accidental contact by approved cabinets or other forms of approved enclosures, or by any of the following means:

- By location in a room, vault, or similar enclosure that is accessible only to qualified persons.
- By suitable permanent, substantial partitions or screens so arranged that only qualified persons will have access to the space within reach of the live parts. Any openings in such partitions or screens shall be so sized and located that persons are not likely to come into accidental contact with the live parts or to bring conducting objects into contact with them. It is good practice to use covers, screens or partitions which can only be removed by use of tools, so that unqualified persons are less likely to violate them.
- By location on a suitable balcony, gallery, or platform.
- By elevation of 8 feet or more above the floor or other working surface. Note that, although equipment elevated at least 8 feet is considered to be guarded, this may not be adequate if material being handled is likely to make contact with live parts.

In locations where electric equipment would be exposed to physical damage enclosures or guards, shall be so arranged and of such strength as to prevent such damage.

Entrances to rooms and other guarded locations containing exposed live parts shall be marked with conspicuous warning signs forbidding unqualified persons to enter.

You should be constantly aware of hazards in your workplace. New work or changes may create a new hazard, or poor maintenance may allow reappearance of old ones.

Identification of Conductors

A conductor used as a grounded conductor shall be identifiable and distinguishable from all other conductors. A conductor used as an equipment grounding conductor shall be identifiable and distinguishable from all other conductors.

The grounded conductor is an energized circuit conductor that is connected to earth through the system ground. It is commonly referred to as the neutral. The equipment grounding conductor is not an energized conductor under normal conditions. The equipment grounding conductor acts as a safeguard against insulation failure or faults in the other circuit conductors. The equipment grounding conductor is energized only if there is a leak or fault in the normal current path, and it directs this current back to the source. Directing the fault current back to the source enables protective devices, such as circuit breakers or fuses, to operate thus preventing fires and reducing the hazard of electrical shocks.

The grounded and equipment grounding conductors of an electrical circuit must be marked or color coded in a way that allows employees to identify them and tell them apart from each other and from the other conductors in the circuit.

Polarity of Connections

No grounded conductor may be attached to any terminal or lead so as to reverse designated polarity.

A grounding terminal or grounding-type device on a receptacle, cord connector, or attachment plug may not be used for purposes other than grounding.

The above two subparagraphs dealing with polarity of connections and use of grounding terminals and devices address one potentially dangerous aspect of alternating current: many pieces of equipment will operate properly even though the supply wires are not connected in the order designated by design or the manufacturer. Improper connection of these conductors is most prevalent on the smaller branch circuit typically associated with standard 120 volt receptacle outlets, lighting fixtures and cord- and plug-connected equipment.

When plugs, receptacles, and connectors are used in an electrical branch circuit, correct polarity between the ungrounded (hot) conductor, the grounded (neutral) conductor, and the grounding conductor must be maintained.

Reversed polarity is a condition when the identified circuit conductor (the grounded conductor or neutral) is incorrectly connected to the ungrounded or "hot" terminal of a plug, receptacle, or other type of connector.

Grounding

This section contains grounding requirements for systems, circuits, and equipment. Grounding electrical circuits and electrical equipment is required to protect employees against electrical shock, safeguard against fire, and protect against damage to electrical equipment. There are two kinds of grounding: (1) electrical circuit or system grounding, and (2) electrical equipment grounding. Electrical system grounding is accomplished when one conductor of the circuit is intentionally connected to earth. This is done to protect the circuit should lightning strike or other high voltage contact occur. Grounding a system also stabilizes the voltage in the system so "expected voltage levels" are not exceeded under normal conditions.

The second kind of ground is equipment grounding. This is accomplished when all metal frames of equipment and enclosures containing electrical equipment or conductors are grounded by means of a permanent and continuous connection or bond. The equipment grounding conductor provides a path for dangerous fault current to return to the system ground at the supply source of the circuit should an insulation failure take place. If installed properly, the equipment grounding conductor is the current path that enables protective devices, such as circuit breakers and fuses, to operate when a fault occurs.

Flexible cords shall be used only in continuous lengths without splice or tap. Hard service flexible cords, No. 12 or larger, may be repaired if spliced so that the splice retains the insulation, outer sheath properties, and usage characteristics of the cord being spliced.

Flexible cords shall be connected to devices and fittings so that strain relief is provided which will prevent pull from being directly transmitted to joints or terminal screws.

* * * * * * *

VI. CONFINED SPACE HAZARDS

Introduction

The hazards encountered and associated with entering and working in confined spaces are capable of causing bodily injury, illness, and death to the worker. Accidents occur among workers because of failure to recognize that a confined space is a potential hazard. It should therefore be considered that the most unfavorable situation exists in every case and that the danger of explosion, poisoning, and asphyxiation will be present at the onset of entry.

Before forced ventilation is initiated, information such as restricted areas within the confined space, voids, the nature of the contaminants present, the size of the space, the type of work to be performed, and the number of people involved should be considered. The ventilation air should not create an additional hazard due to re-circulation of contaminants, improper arrangement of the inlet duct, or by the substitution of anything other than fresh (normal) air (approximately 20.9% oxygen, 78.1% nitrogen, and 1% argon with small amounts of various other gases). The terms air and oxygen are sometimes considered synonymous. However, this is a dangerous assumption, since the use of oxygen in place of fresh (normal) air for ventilation will expand the limits of flammability and increase the hazards of fire and explosion.

Hazardous conditions covered in this discussion include: Hazardous Atmospheres (flammable, toxic, irritant, and asphyxiating), and General Safety Hazards (mechanical, communications, entry and exit, and physical).

Types of Confined Spaces

Confined spaces can be categorized generally as those with open tops and with a depth that will restrict the natural movement of air, and enclosed spaces with very limited openings for entry. In either of these cases, the space may contain mechanical equipment with moving parts. Any combination of these parameters will change the nature of the hazards encountered. Degreasers, pits, and certain types of storage tanks may be classified as open topped confined spaces that usually contain no moving parts. However, gases that are heavier than air (butane, propane, and other hydrocarbons) remain in depressions and will flow to low points where they are difficult to remove. Open topped water tanks that appear harmless may develop toxic atmospheres such as hydrogen sulfide from the vaporization of contaminated water. Therefore, these gases (heavier than air) are a primary concern when entry into such a confined space is being planned. Other hazards may develop due to the work performed in the confined space or because of corrosive residues that accelerate the decomposition of scaffolding supports and electrical components.

Confined spaces such as sewers, casings, tanks, silos, vaults, and compartments of ships usually have limited access. The problems arising in these areas are similar to those that occur in open topped confined spaces. However, the limited access increases the risk of injury. Gases which are heavier than air such as carbon dioxide and propane, may lie in a tank or vault for hours or even days after the containers have been opened. Because some gases are

odorless, the hazard may be overlooked with fatal results. Gases that are lighter than air may also be trapped within an enclosed type confined space, especially those with access from the bottom or side.

Hazards specific to a confined space are dictated by: (1) the material stored or used in the confined space; as an example, damp activated carbon in a filtration tank will absorb oxygen, thus creating an oxygen deficient atmosphere; (2) the activity carried out, such as the fermentation of molasses that creates ethyl alcohol vapors and decreases the oxygen content of the atmosphere; or (3) the external environment, as in the case of sewer systems that may be affected by high tides, heavier than air gases, or flash floods.

The most hazardous kind of confined space is the type that combines limited access and mechanical devices. All the hazards of open top and limited access confined spaces may be present together with the additional hazard of moving parts. Digesters and boilers usually contain power-driven equipment which, unless properly isolated, may be inadvertently activated after entry. Such equipment may also contain physical hazards that further complicate the work environment and the entry and exit process.

Reasons for Entering Confined Spaces

Entering a confined space as part of the industrial activity may be done for various reasons. It is done usually to perform a necessary function, such as inspection, repair, maintenance (cleaning or painting), or similar operations which would be an infrequent or irregular function of the total industrial activity.

Entry may also be made during new construction. Potential hazards should be easier to recognize during construction since the confined space has not been used. The types of hazards involved will be limited by the specific work practices. When the area meets the criteria for a confined space, all ventilation and other requirements should be enforced.

One of the most difficult entries to control is that of unauthorized entry, especially when there are large numbers of workers and trades involved, such as welders, painters, electricians, and safety monitors.

A final and most important reason for entry would be emergency rescue. This, and all other reasons for entry, must be well planned before initial entry is made and the hazards must be thoroughly reviewed. The standby person and all rescue personnel should be aware of the structural design of the space, emergency exit procedures, and life support systems required.

Hazardous Atmospheres

Hazardous atmospheres encountered in confined spaces can be divided into four distinct categories: Flammable, Toxic, Irritant and/or Corrosive, and Asphyxiating.

Flammable Atmospheres

A flammable atmosphere generally arises from enriched oxygen atmospheres, vaporization of flammable liquids, byproducts of work, chemical reactions, concentrations of combustible dusts, and desorption of chemical from inner surfaces of the confined space.

An atmosphere becomes flammable when the ratio of oxygen to combustible material in the air is neither too rich nor too lean for combustion to occur. Combustible gases or vapors will accumulate when there is inadequate ventilation in areas such as a confined space. Flammable gases such as acetylene, butane, propane, hydrogen, methane, natural or manufactured gases or vapors from liquid hydrocarbons can be trapped in confined spaces, and since many gases are heavier than air, they will seek lower levels as in pits, sewers, and various types of storage tanks and vessels. In a closed top tank, it should also be noted that lighter than air gases may rise and develop a flammable concentration if trapped above the opening.

The byproducts of work procedures can generate flammable or explosive conditions within a confined space. Specific kinds of work such as spray painting can result in the release of explosive gases or vapors. Welding in a confined space is a major cause of explosions in areas that contain combustible gas.

Chemical reactions forming flammable atmospheres occur when surfaces are initially exposed to the atmosphere, or when chemicals combine to form flammable gases. This condition arises when dilute sulfuric acid reacts with iron to form hydrogen or when calcium carbide makes contact with water to form acetylene. Other examples of spontaneous chemical reactions that may produce explosions from small amounts of unstable compounds are acetylene-metal compounds, peroxides, and nitrates. In a dry state, these compounds have the potential to explode upon percussion or exposure to increased temperature. Another class of chemical reactions that form flammable atmospheres arises from deposits of pyrophoric substances (carbon, ferrous oxide, ferrous sulfate, iron, etc.) that can be found in tanks used by the chemical and petroleum industry. These tanks containing flammable deposits will spontaneously ignite upon exposure to air.

Combustible dust concentrations are usually found during the process of loading, unloading, and conveying grain products, nitrated fertilizers, finely ground chemical products, and any other combustible material. High charges of static electricity, which rapidly accumulate during periods of relatively low humidity (below 50%), can cause certain substances to accumulate electrostatic charges of sufficient energy to produce sparks and ignite a flammable atmosphere. These sparks may also cause explosions when the right air or oxygen to dust or gas mixture is present.

Toxic Atmospheres

The substances to be regarded as toxic in a confined space can cover the entire spectrum of gases, vapors, and finely-divided airborne dust in industry. The sources of toxic atmospheres encountered may arise from the following:

- The manufacturing process (for example, in producing polyvinyl chloride, hydrogen chloride is used as will as vinyl chloride monomer, which is carcinogenic).

- The product stored [removing decomposed organic material from a tank can liberate toxic substances, such as hydrogen sulfide (H2S).

- The operation performed in the confined space (for example, welding or brazing with metals capable of producing toxic fumes).

During loading, unloading, formulation, and production, mechanical and/or human error may also produce toxic gases which are not part of the planned operation.

Carbon monoxide (CO) is a hazardous gas that may build up in a confined space. This odorless, colorless gas that has approximately the same density as air is formed from incomplete combustion of organic materials such as wood, coal, gas, oil, and gasoline; it can be formed from microbial decomposition of organic matter in sewers, silos, and fermentation tanks. Carbon monoxide is an insidious toxic gas because of its poor warning properties. Early stages of CO intoxication are nausea and headache. Carbon monoxide may be fatal at 1000 ppm in air, and is considered dangerous at 200 ppm, because it forms carboxyhemoglobin in the blood which prevents the distribution of oxygen in the body.

Carbon monoxide is a relatively abundant colorless, odorless gas, therefore, any untested atmosphere must be suspect. It must also be noted that a safe reading on a combustible gas indicator does not ensure that CO is not present. Carbon monoxide must be tested for specifically. The formation of CO may result from chemical reactions or work activities, therefore fatalities due to CO poisoning are not confined to any particular industry. There have been fatal accidents in sewage treatment plants due to decomposition products and lack of ventilation in confined spaces. Another area where CO results as a product of decomposition is in the formation of silo gas in grain storage elevators. In another area, the paint industry, varnish is manufactured by introducing the various ingredients into a kettle, and heating them in an inert atmosphere, usually town gas, which is a mixture of carbon dioxide and nitrogen.

In welding operations, oxides of nitrogen and ozone are gases of major toxicological importance, and incomplete oxidation may occur and carbon monoxide can form as a byproduct.

Another poor work practice, which has led to fatalities, is the recirculation of diesel exhaust emissions. Increased CO levels can be prevented by strict control of the ventilation and the use of catalytic convertors.

Irritant (Corrosive) Atmospheres

Irritant or corrosive atmospheres can be divided into primary and secondary groups. The primary irritants exert no systemic toxic effects (effects on the entire body). Examples of primary irritants are chlorine, ozone, hydrochloric acid, hydrofluoric acid, sulfuric acid, nitrogen dioxide,

ammonia, and sulfur dioxide. A secondary irritant is one that may produce systemic toxic effects in addition to surface irritation. Examples of secondary irritants include benzene, carbon tetrachloride, ethyl chloride, trichloroethane, trichloroethylene, and chloropropene.

Irritant gases vary widely among all areas of industrial activity. They can be found in plastics plants, chemical plants, the petroleum industry, tanneries, refrigeration industries, paint manufacturing, and mining operations.

Prolonged exposure at irritant or corrosive concentrations in a confined space may produce little or no evidence of irritation. This may result in a general weakening of the defense reflexes from changes in sensitivity. The danger in this situation is that the worker is usually not aware of any increase in his/her exposure to toxic substances.

Asphyxiating Atmospheres

The normal atmosphere is composed approximately of 20.9% oxygen and 78.1% nitrogen, and 1% argon with small amounts of various other gases. Reduction of oxygen in a confined space may be the result of either consumption or displacement.

The consumption of oxygen takes place during combustion of flammable substances, as in welding, heating, cutting, and brazing. A more subtle consumption of oxygen occurs during bacterial action, as in the fermentation process. Oxygen may also be consumed during chemical reactions as in the formation of rust on the exposed surface of the confined space (iron oxide). The number of people working in a confined space and the amount of their physical activity will also influence the oxygen consumption rate.

A second factor in oxygen deficiency is displacement by another gas. Examples of gases that are used to displace air, and therefore reduce the oxygen level are helium, argon, and nitrogen. Carbon dioxide may also be used to displace air and can occur naturally in sewers, storage bins, wells, tunnels, wine vats, and grain elevators. Aside from the natural development of these gases, or their use in the chemical process, certain gases are also used as inerting agents to displace flammable substances and retard pyrophoric reactions. Gases such as nitrogen, argon, helium, and carbon dioxide, are frequently referred to as non-toxic inert gases but have claimed many lives. The use of nitrogen to inert a confined space has claimed more lives than carbon dioxide. The total displacement of oxygen by nitrogen will cause immediate collapse and death. Carbon dioxide and argon, with specific gravities greater than air, may lie in a tank or manhole for hours or days after opening. Since these gases are colorless and odorless, they pose an immediate hazard to health unless appropriate oxygen measurements and ventilation are adequately carried out.

Oxygen deprivation is one form of asphyxiation. While it is desirable to maintain the atmospheric oxygen level at 21% by volume, the body can tolerate deviation from this ideal. When the oxygen level falls to 17%, the first sign of hypoxia is deterioration to night vision which is not noticeable until a normal oxygen concentration is restored. Physiologic effects are increased breathing volume and accelerated heartbeat. Between 14-16% physiologic effects are increased

breathing volume, accelerated heartbeat, very poor muscular coordination, rapid fatigue, and intermittent respiration. Between 6-10% the effects are nausea, vomiting, inability to perform, and unconsciousness. Less than 6%, spasmatic breathing, convulsive movements, and death in minutes.

GENERAL SAFETY HAZARDS

Mechanical

If activation of electrical or mechanical equipment would cause injury, each piece of equipment should be manually isolated to prevent inadvertent activation before workers enter or while they work in a confined space. The interplay of hazards associated with a confined space, such as the potential of flammable vapors or gases being present, and the build-up of static charge due to mechanical cleaning, such as abrasive blasting, all influence the precautions which must be taken.

To prevent vapor leaks, flashbacks, and other hazards, workers should completely isolate the space. To completely isolate a confined space, the closing of valves is not sufficient. All pipes must be physically disconnected or isolation blanks bolted in place. Other special precautions must be taken in cases where flammable liquids or vapors may re-contaminate the confined space. The pipes blanked or disconnected should be inspected and tested for leakage to check the effectiveness of the procedure. Other areas of concern are steam valves, pressure lines, and chemical transfer pipes. A less apparent hazard is the space referred to as a void, such as double walled vessels, which must be given special consideration in blanking off and inerting.

Communication Problems

Communication between the worker inside and the standby person outside is of utmost importance. If the worker should suddenly feel distressed and not be able to summon help, an injury could become a fatality. Frequently, the body positions that are assumed in a confined space make it difficult for the standby person to detect an unconscious worker. When visual monitoring of the worker is not possible because of the design of the confined space or location of the entry hatch, a voice or alarm-activated explosion proof type of communication system will be necessary.

Suitable illumination of an approved type is required to provide sufficient visibility for work in accordance with the recommendations made in the Illuminating Engineering Society Lighting Handbook.

Entry and Exit

Entry and exit time is of major significance as a physical limitation and is directly related to the potential hazard of the confined space. The extent of precautions taken and the standby equipment needed to maintain a safe work area will be determined by the means of access and rescue. The following should be considered: type of confined space to be entered, access to the entrance, number and size of openings, barriers within the space, the occupancy load, and the

time requirement for exiting in event of fire or vapor incursion, and the time required to rescue injured workers.

Physical

The hazards described in this section include thermal effects (heat and cold), noise, vibration, radiation, and fatigue while working in a confined space.

Thermal Effects

Four factors influence the interchange of heat between people and their environment. They are: (1) air temperature, (2) air velocity, (3) moisture contained in the air, and (4) radiant heat. Because of the nature and design of most confined spaces, moisture content and radiant heat are difficult to control. As the body temperature rises progressively, workers will continue to function until the body temperature reaches approximately 102oF. When this body temperature is exceeded, the workers are less efficient, and are prone to heat exhaustion, heat cramps, or heat stroke. In a cold environment, certain physiologic mechanisms come into play, which tend to limit heat loss and increase heat production. The most severe strain in cold conditions is chilling of the extremities so that activity is restricted. Special precautions must be taken in cold environments to prevent frostbite, trench foot, and general hypothermia.

Protective insulated clothing for both hot and cold environments will add additional bulk to the worker and must be considered in allowing for movement in the confined space and exit time. Therefore, air temperature of the environment becomes an important consideration when evaluating working conditions in confined spaces.

Noise

Noise problems are usually intensified in confined spaces because the interior tends to cause sound to reverberate and thus expose the worker to higher sound levels than those found in an open environment. This intensified noise increases the risk of hearing damage to workers which could result in temporary or permanent loss of hearing. Noise in a confined space which may not be intense enough to cause hearing damage may still disrupt verbal communication with the emergency standby person on the exterior of the confined space. If the workers inside are not able to hear commands or danger signals due to excessive noise, the probability of severe accidents can increase.

Vibration

Whole body vibration may affect multiple body parts and organs depending upon the vibration characteristics. Segmental vibration, unlike whole body vibration, appears to be more localized in creating injury to the fingers and hands of workers using tools, such as pneumatic hammers, rotary grinders or other hand tools which cause vibration.

General/Physical

Some physical hazards cannot be eliminated because of the nature of the confined space or the work to be performed. These hazards include such items as scaffolding, surface residues, and structural hazards. The use of scaffolding in confined spaces has contributed to many accidents caused by workers or materials falling, improper use of guard rails, and lack of maintenance to insure worker safety. The choice of material used for scaffolding depends upon the type of work to be performed, the calculated weight to be supported, the surface on which the scaffolding is placed, and the substance previously stored in the confined space.

Surface residues in confined spaces can increase the already hazardous conditions of electrical shock, reaction of incompatible materials, liberation of toxic substances, and bodily injury due to slips and falls. Without protective clothing, additional hazards to health may arise due to surface residues.

Structural hazards within a confined space such as baffles in horizontal tanks, trays in vertical towers, bends in tunnels, overhead structural members, or scaffolding installed for maintenance constitute physical hazards, which are exacerbated by the physical surroundings. In dealing with structural hazards, workers must review and enforce safety precautions to assure safety.

Rescue procedures may require withdrawal of an injured or unconscious person. Careful planning must be given to the relationship between the internal structure, the exit opening, and the worker. If the worker is above the opening, the system must include a rescue arrangement operated from outside the confined space, if possible, by which the employee can be lowered and removed without injury.

Permit-Required Confined Spaces

Many workplaces contain spaces that are considered to be "confined" because their configurations hinder the activities of any employees who must enter into, work in, and exit from them. In many instances, employees who work in confined spaces also face increased risk of exposure to serious physical injury from hazards such as entrapment, engulfment, and hazardous atmospheric conditions. Confinement itself may pose entrapment hazards, and work in confined spaces may keep employees closer to hazards, such as an asphyxiating atmosphere, than they would be otherwise. For example, confinement, limited access, and restricted airflow can result in hazardous conditions that would not arise in an open workplace.

The term "permit-required confined space" (i.e., permit space) refers to those spaces that meet the definition of a "confined space" and pose health or safety hazards, thereby requiring a permit for entry.

A confined space has limited or restricted means of entry or exit, is large enough for an employee to enter and perform assigned work, and is not designed for continuous occupancy by the employee. These spaces may include, but are not limited to, underground vaults, tanks, storage bins, pits and diked areas, vessels, and silos.

A permit-required confined space is one that meets the definition of a confined space and has one or more of these characteristics: (1) contains or has the potential to contain a hazardous atmosphere, (2) contains a material that has the potential for engulfing an entrant, (3) has an internal configuration that might cause an entrant to be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross section, and/or (4) contains any other recognized serious safety or health hazards.

REQUIREMENTS OF THE STANDARD

General

In general, employers must evaluate the workplace to determine if spaces are permit-required confined spaces. If there are permit spaces in the workplace, the employer must inform exposed employees of the existence, location, and danger posed by the spaces. This can be accomplished by posting danger signs or by another equally effective means. The following language would satisfy the requirements for such a sign:

DANGER--PERMIT REQUIRED-CONFINED SPACE--
AUTHORIZED ENTRANTS ONLY

If employees are not to enter and work in permit spaces, employers must take effective measures to prevent their employees from entering the permit spaces.

If employees are to enter permit spaces, the employer must develop a written permit space program, which shall be made available to employees or their representatives. Under certain conditions, the employer may use alternate procedures for worker entry into a permit space. For example, if employers can demonstrate with monitoring and inspection data that the only hazard is an actual or potential hazardous atmosphere, which can be made safe for entry by the use of continuous forced air ventilation alone, they may be exempted from some requirements, such as permits and attendants. Even in such circumstances, however, the internal atmosphere of the space must be tested first for oxygen content, second for flammable gases and vapors, and third for potential toxic air contaminants before any employee enters.

Written Program

The employer who allows employee entry must develop and implement a written program for permit-required confined spaces.

Among other things, the OSHA standard requires the employer's program to:

- Identify and evaluate permit space hazards before allowing employee entry;
- Test conditions in the permit space before entry operations and monitor the space during entry;

- Perform in the following sequence, appropriate testing for atmospheric hazards: oxygen, combustible gases or vapors, and toxic gases or vapors;
- Implement necessary measures to prevent unauthorized entry;
- Establish and implement the means, procedures and practices --such as specifying acceptable entry conditions, isolating the permit space, providing barriers, verifying acceptable entry conditions, purging, making inert, flushing, or ventilation of the permit space—to eliminate or control hazards necessary for safe permit-space entry operations;
- Identify employee job duties;
- Provide, maintain, and require, at no cost to the employee, the use of personal protective equipment and any other equipment necessary for safe entry (e.g., testing, monitoring, ventilating, communications, and lighting equipment; barriers, shields, and ladders);
- Ensure that at least one attendant is stationed outside the permit space for the duration of entry operations;
- Coordinate entry operations when employees of more than one employer are to be working in the permit space;
- Implement appropriate procedures for summoning rescue and emergency services;
- Establish, in writing, and implement a system for the preparation, issuance, use, and cancellation of entry permits;
- Review established entry operations and annually revise the permit-space entry program; and
- When an attendant is required to monitor multiple spaces, implement the procedures to be followed during an emergency in one or more of the permit spaces being monitored.

If hazardous conditions are detected during entry, employees must immediately leave the space, and the employer must evaluate the space to determine the cause of the hazardous atmospheres.

When entry to permit spaces is prohibited, the employer must take effective measures to prevent unauthorized entry. Non-permit confined spaces must be reevaluated when there are changes in their use or configuration and, where appropriate, must be reclassified.

If testing and inspection data prove that a permit-required confined space no longer poses hazards, that space may be reclassified as a non-permit confined space. If entry is required to eliminate hazards and to obtain the data, the employer must follow procedures as set forth under sections (d) through (k) of the standard. A certificate documenting the data must be made available to employees entering the space. The certificate must include the date, location of the space, and the signature of the person making the certification.

Contractors also must be informed of permit spaces and permit space entry requirements, any identified hazards, the employer's experience with the space (i.e., the knowledge of hazardous conditions), and precautions or procedures to be followed when in or near permit spaces.

When employees of more than one employer are conducting entry operations, the affected employers must coordinate entry operations to ensure that affected employees are appropriately protected from permit space hazards. Contractors also must be given and other pertinent information regarding hazards and operations in permit spaces and be debriefed at the conclusion of entry operations.

Permit System

A permit, signed by the entry supervisor and verifying that pre-entry preparations have been completed and that the space is safe to enter, must be posted at entrances or otherwise made available to entrants before they enter a permit space.

The duration of entry permits must not exceed the time required to complete an assignment. Also, the entry supervisor must terminate entry and cancel permits when an assignment has been completed or when new conditions exist. New conditions must be noted on the canceled permit and used in revising the permit space program. The standard also requires the employer to keep all canceled entry permits for at least 1 year.

Entry Permits

Entry permits must include the following information:

- Test results;
- Tester's initials or signature;
- Name and signature of supervisor who authorizes entry;
- Name of permit space to be entered, authorized entrant(s), eligible attendants, and individual(s) authorized to be entry supervisor(s);
- Purpose of entry and known space hazards;
- Measures to be taken to isolate permit spaces and to eliminate or control space hazards, i.e., locking out or tagging of equipment and procedures for purging, making inert, ventilating and flushing permit spaces;
- Name and telephone numbers of rescue and emergency services;
- Date and authorized duration of entry;
- Acceptable entry conditions;
- Communication procedures and equipment to maintain contact during entry;
- Additional permits(s), such as for hot work, that have been issued to authorize work in the permit space;

- Special equipment and procedures, including personal protective equipment and alarm systems; and
- Any other information needed to ensure employee safety.

Training and Education

Before initial work assignment begins, the employer must provide proper training for all workers who are required to work in permit spaces. Upon completing this training, employers must ensure that employees have acquired the understanding, knowledge, and skills necessary for the safe performance of their duties. Additional training is required when (1) the job duties change, (2) there is a change in the permit-space program or the permit space operation presents a new hazard, and (3) when an employee's job performance shows deficiencies. Training also is required for rescue team members, including cardiopulmonary resuscitation (CPR) and first-aid training (see Emergencies). Employers must certify that training has been accomplished.

Upon completion of training, employees must receive a certificate of training that includes the employee's name, signature or initials of trainer(s), and dates of training. The certification must be made available for inspection by employees and their authorized representatives.

In addition, the employer also must ensure that employees are trained in their assigned duties.

Authorized Entrant's Duties:

- Know space hazards, including information on the mode of exposure (e.g., inhalation or dermal absorption), signs or symptoms, and consequences of the exposure;
- Use appropriate personal protective equipment properly (e.g., face and eye protection, and other forms of barrier protection such as gloves, aprons, and coveralls);
- As necessary, maintain communication (i.e., telephone, radio, visual observation) with attendants to enable the attendant to monitor the entrant's status as well as to alert the entrant to evacuate;
- Exit from permit space as soon as possible when ordered by an authorized person, when the entrant recognizes the warning signs or symptoms of exposure exist, when a prohibited condition exists, or when an automatic alarm is activated; and
- Alert the attendant when a prohibited condition exists or when warning signs or symptoms of exposure exist.

Attendant's Duties:

- Remain outside permit space during entry operations unless relieved by another authorized attendant;
- Perform no-entry rescues when specified by employer's rescue procedure;
- Know existing and potential hazards, including information on the mode of exposure, signs or symptoms, consequences of the exposure, and their physiological effects;

- Maintain communication with and keep an accurate account of those workers entering the permit-required space;
- Order evacuation of the permit space when a prohibited condition exists, when a worker shows signs of physiological effects of hazardous exposure, when an emergency outside the confined space exists, and when the attendant cannot effectively and safely perform required duties;
- Summon rescue and other services during an emergency;
- Ensure that unauthorized persons stay away from permit spaces or exit immediately if they have entered the permit space;
- Inform authorized entrant's and entry supervisor of entry by unauthorized persons; and;
- Perform no other duties that interfere with the attendant's primary duties.

Entry Supervisor's Duties

- Know space hazards including information on the mode of exposure, signs, or symptoms and consequences of exposure;
- Verify emergency plans and specified entry conditions such as permits, tests, procedures, and equipment before allowing entry;
- Terminate entry and cancel permits when entry operations are completed or if a new condition exists;
- Take appropriate measures to remove unauthorized entrants; and
- Ensure that entry operations remain consistent with the entry permit and that acceptable entry conditions are maintained.

Confined Space Emergencies

The standard requires the employer to ensure that rescue service personnel are provided with and trained in the proper use of personal protective and rescue equipment, including respirators; trained to perform assigned rescue duties; and have had authorized entrant's training. The standard also requires that all rescuers be trained in first aid and CPR and, at a minimum, one rescue team member be currently certified in first aid and in CPR. The employer also must ensure that practice rescue exercises are performed yearly, and that rescue services are provided access to permit spaces so that they can practice rescue operations. Rescuers also must be informed of the hazards of the permit space.

Also, when appropriate, authorized entrants who enter a permit space must wear a chest or full body harness with a retrieval line attached to the center of their backs near shoulder level, or above their heads. Wristlets may be used if the employer can demonstrate that the use of a chest or full body harness is infeasible or creates a greater hazard. Also, the employer must ensure that the other end of the retrieval line is attached to a mechanical device or to a fixed point outside the permit space. A mechanical device must be available to retrieve personnel from vertical type permit spaces more than 5 feet deep.

In addition, if an injured entrant is exposed to a substance for which a Material Safety Data Sheet (MSDS) or other similar written information is required to be kept at the worksite, that MSDS or other written information must be made available to the medical facility treating the exposed entrant.

* * * * * * *

VII. CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

This standard helps safeguard employees from hazardous energy while they are performing service or maintenance on machines and equipment. The standard identifies the practices and procedures necessary to shut down and lock out or tag out machines and equipment, requires that employees receive training in their role in the lockout/tagout program, and mandates that periodic inspections be conducted to maintain or enhance the energy control program.

In the early 1970's, OSHA adopted various lockout-related provisions of the then existing national consensus standards and Federal standards that were developed for specific types of equipment or industries. When the existing standards require lockout, the new rule supplements these existing standards(1) by requiring the development and utilization of written procedures, the training of employees, and periodic inspections of the use of the procedures. OSHA has determined that lockout is a more reliable means of de-energizing equipment than tagout and that it should always be the preferred method used by employees. The Agency believes that, except for limited situations, the use of lockout devices will provide a more secure and more effective means of protecting employees from the unexpected release of hazardous energy or start-up of machines and equipment.

This rule requires that, in general, before service or maintenance is performed on machinery or equipment, the machinery or equipment must be turned off and disconnected from the energy source, and the energy-isolating device must be either locked or tagged out. OSHA estimates that adherence to the requirements of this standard can eliminate nearly 2% of all workplace deaths in establishments affected by this rule and can have a significant impact on worker safety and health in the U.S.

Glossary

Affected Employee - An employee who performs the duties of his or her job in an area in which the energy control procedure is implemented and servicing or maintenance operations are performed. An affected employee does not perform servicing or maintenance on machines or equipment and, consequently, is not responsible for implementing the energy control procedure. An affected employee becomes an "authorized" employee whenever he or she performs servicing or maintenance functions on machines or equipment that must be locked or tagged.

Authorized Employee - An employee who performs servicing or maintenance on machines and equipment. Lockout or tagout is used by these employees for their own protection.

Capable of being locked out - An energy-isolating device is considered capable of being locked out if it meets one of the following requirements:

- It is designed with a hasp to which a lock can be attached;
- It is designed with any other integral part through which a lock can be affixed;
- It has a locking mechanism built into it; or

- It can be locked without dismantling, rebuilding, or replacing the energy isolating device or permanently altering its energy control capability.

Energized - Machines and equipment are energized when (1) they are connected to an energy source or (2) they contain residual or stored energy.

Energy-isolating device - Any mechanical device that physically prevents the transmission or release of energy. These include, but are not limited to, manually-operated electrical circuit breakers, disconnect switches, line valves, and blocks.

Energy source - Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy.

Energy control procedure - A written document that contains those items of information an authorized employee needs to know in order to safely control hazardous energy during servicing or maintenance of machines or equipment.

Energy control program - A program intended to prevent the unexpected energizing or the release of stored energy in machines or equipment on which servicing and maintenance is being performed by employees. The program consists of energy control procedure(s), an employee training program, and periodic inspections.

Lockout - The placement of a lockout device on an energy – isolating device, in accordance with an established procedure, ensuring that the energy - isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

Lockout device - Any device that uses positive means such as a lock, either key or combination type, to hold an energy - isolating device in a safe position, thereby preventing the energizing of machinery or equipment. When properly installed, a blank flange or bolted slip blind are considered equivalent to lockout devices.

Tagout - The placement of a tagout device on an energy-isolating device, in accordance with an established procedure, to indicate that the energy-isolating device and the equipment being controlled may not be operated until the tagout device is removed.

Tagout device - Any prominent warning device, such as a tag and a means of attachment that can be securely fastened to an energy-isolating device in accordance with an established procedure. The tag indicates that the machine or equipment to which it is attached is not to be operated until the tagout device is removed in accordance with the energy control procedure.

Scope & Application

The lockout/tagout standard applies to general industry employment and covers the servicing and maintenance of machines and equipment in which the unexpected start-up or the release of stored energy could cause injury to employees. (If employees are performing service or maintenance tasks that do not expose them to the unexpected release of hazardous energy, the standard does not apply.)

The standard establishes minimum performance requirements for the control of hazardous energy.

The standard does not apply in the following situations:

- While servicing or maintaining cord and plug connected electrical equipment. (The hazards must be controlled by unplugging the equipment from the energy source; the plug must be under the exclusive control of the employee performing the service and/or maintenance.)

- During hot tap operations that involve transmission and distribution systems for gas, steam, water, or petroleum products when they are performed on pressurized pipelines; when continuity of service is essential, and shutdown of the system is impractical; and employees are provided with an alternative type of protection that is equally effective.

Normal Production Operations

OSHA recognizes that machines and equipment present many hazardous situations during normal production operations - i.e., whenever machines and equipment are used to perform their usual production function. These production hazards are covered by rules in other General Industry Standards, such as the requirements in Subpart O of Part 1910 for general machine guarding and guarding power transmission apparatus (1910.212 and 1910.219). In certain circumstances, however, some hazards encountered during normal production operations may be covered by the lockout/tagout rule. The following paragraphs illustrate some of these instances.

Servicing and/or Maintenance Operations

If a servicing activity - such as lubricating, cleaning, or unjamming the production equipment - takes place during production, the employee performing the servicing may be subjected to hazards that are not encountered as part of the production operation itself. Workers engaged in these operations are covered by lockout/tagout when any of the following conditions occurs:

- The employee must either remove or bypass machine guards or other safety devices, resulting in exposure to hazards at the point of operation;

- The employee is required to place any part of his or her body in contact with the point of operation of the operational machine or piece of equipment; or

- The employee is required to place any part of his or her body into a danger zone associated with a machine operating cycle.

In the above situations, the equipment must be de-energized and locks or tags must be applied to the energy-isolation devices.

In addition, when normal servicing tasks - such as setting equipment up, and/or making significant adjustments to machines - do not occur during normal production operations, employees performing such tasks are required to lock out or tag out if they can be injured by unexpected energization of the equipment.

OSHA also recognizes that some servicing operations must be performed with the power on. Making many types of fine adjustments, such as centering the belt on conveyors, is one example. Certain aspects of troubleshooting, such as identifying the source of the problem as well as checking to ensure that it has been corrected, is another. OSHA requires the employer to provide effective protection for employees performing such operations. Although, in these cases, a power-on condition is essential either to accomplish the particular type of servicing or to verify that it was performed properly, lockout or tagout procedures are required when servicing or maintenance occurs with the power off.

Minor Servicing Tasks

Employees performing minor tool changes and adjustments and/or other minor service activities during normal production operations that are routine, repetitive, and integral to the use of the production equipment are not covered by the lockout/tagout standard, provided the work is performed using alternative measures that give effective protection.

Provisions of the Standard

The standard requires employers to establish procedures for isolating machines or equipment from the input of energy and affixing appropriate locks or tags to energy-isolating devices to prevent any unexpected energization, start-up, or release of stored energy that would injure workers. When tags are used on energy-isolating devices capable of being locked out, the employer must provide additional means to assure a level of protection equivalent to that of locks. The standard also requires the training of employees, and periodic inspections of the procedures to maintain or improve their effectiveness.

Energy Control Program

The lockout/tagout rule requires that the employer establish an energy control program that includes (1) documented energy control procedures, (2) an employee training program, and (3) periodic inspections of the procedures. The standard requires employers to establish a program to ensure that machines and equipment are isolated and inoperative before any employee performs service or maintenance where the unexpected energization, start up, or release of stored energy could occur and cause injury.

The purpose of the energy control program is to ensure that, whenever the possibility of unexpected machine or equipment start-up exists or when the unexpected release of stored energy could occur and cause injury, the equipment is isolated from its energy source(s) and rendered inoperative prior to servicing or maintenance.

Employers have the flexibility to develop a program and procedures that meet the needs of their particular workplace and the particular types of machines and equipment being maintained or serviced.

Energy Control Procedure

This standard requires that energy control procedures be developed, documented, and used to control potentially hazardous energy sources whenever workers perform activities covered by the standard.

The written procedures must identify the information that authorized(2) employees must know in order to control hazardous energy during service or maintenance. If this information is the same for various machines or equipment or if other means of logical grouping exists, then a single energy control procedure may be sufficient. If there are other conditions -such as multiple energy sources, different connecting means, or a particular sequence that must be followed to shut down the machine or equipment - then the employer must develop separate energy control procedures to protect employees.

The energy control procedure must outline the scope, purpose, authorization, rules and techniques that will be used to control hazardous energy sources as well as the means that will be used to enforce compliance. At a minimum, it includes, but is not limited to, the following elements:

- A statement on how the procedure will be used;
- the procedural steps needed to shut down, isolate, block, and secure machines or equipment;
- the steps designating the safe placement, removal, and transfer of lockout/tagout devices and who has the responsibility for them; and
- the specific requirements for testing machines or equipment to determine and verify the effectiveness of locks, tags, and other energy control measures.

The procedure must include the following steps: (1) preparing for shutdown, (2) shutting down the machine(s) or equipment, (3) isolating the machine or equipment from the energy source(s), (4) applying the lockout or tagout device(s) to the energy-isolating device(s), (5) safely releasing all potentially hazardous stored or residual energy, and (6) verifying the isolation of the machine(s) or equipment prior to the start of service or maintenance work.

In addition, before lockout or tagout devices are removed and energy is restored to the machines or equipment, certain steps must be taken to re-energize equipment after service is

completed, including: (1) assuring that machines or equipment components are operationally intact; (2) notifying affected employees that lockout or tagout devices are removed from each energy-isolating device by the employee who applied the device.

Energy-Isolating Devices

The employer's primary tool for providing protection under the standard is the energy-isolating device, which is the mechanism that prevents the transmission or release of energy and to which all locks or tags are attached. This device guards against accidental machine or equipment start-up or the unexpected re-energization of equipment during servicing or maintenance. There are two types of energy-isolating devices: those capable of being locked and those that are not. The standard differentiates between the existence of these two conditions and the employer and employee responsibilities in each case.

When the energy-isolating device cannot be locked out, the employer must use tagout. Of course, the employer may choose to modify or replace the device to make it capable of being locked. When using tagout, the employer must comply with all tagout-related provisions of the standard and, in addition to the normal training required for all employees, must train his or her employees in the following limitations of tags:

- Tags are essentially warning devices affixed to energy-isolating devices and do not provide the physical restraint of a lock.
- When a tag is attached to an isolating means, it is not to be removed except by the person who applied it, and it is never to be bypassed, ignored, or otherwise defeated.
- Tags must be legible and understandable by all employees.
- Tags and their means of attachment must be made of materials that will withstand the environmental conditions encountered in the work-place.
- Tags may evoke a false sense of security. They are only one part of an overall energy control program.
- Tags must be securely attached to the energy-isolating devices so that they cannot be detached accidentally during use.

If the energy-isolating device is lockable, the employer shall use locks unless he or she can prove that the use of tags would provide protection at least as effective as locks and would assure "full employee protection."

Full employee protection includes complying with all tagout related provisions plus implementing additional safety measures that can provide the level of safety equivalent to that obtained by using lockout. This might include removing and isolating a circuit element, blocking a controlling switch, opening an extra disconnecting device, or removing a valve handle to reduce the potential for any inadvertent energization.

Although OSHA acknowledges the existence of energy-isolating devices that cannot be locked out, the standard clearly states that whenever major replacement, repair, renovation or modification of machines or equipment is performed and whenever new machines or equipment are installed, the employer must ensure that the energy-isolating devices for such machines or equipment are lockable. Such modifications and/or new purchases are most effectively and efficiently made as part of the normal equipment replacement cycle. All newly purchased equipment must be lockable.

Requirements for Lockout/Tagout Devices

When attached to an energy-isolating device, both lockout and tagout devices are tools that the employer can use in accordance with the requirements of the standard to help protect employees from hazardous energy. The lockout device provides protection by holding the energy-isolating device in the safe position, thus preventing the machine or equipment from becoming energized. The tagout device does so by identifying the energy-isolating device as a source of potential danger; it indicates that the energy-isolating device and the equipment being controlled may not be operated until the tagout device is removed. Whichever devices are used, they must be singularly identified, must be the only devices used for controlling hazardous energy, and must meet the following requirements:

- Durable - Lockout and tagout devices must withstand the environment to which they are exposed for the maximum duration of the expected exposure. Tagout devices must be constructed and printed so that they do not deteriorate or become illegible, especially when used in corrosive (acid and alkali chemicals) or wet environments.

- Standardized - Both lockout and tagout devices must be standardized according to either color, shape, or size. Tagout devices must also be standardized according to print and format.

- Substantial - Lockout and tagout devices must be substantial enough to minimize early or accidental removal. Locks must be substantial to prevent removal except by excessive force of special tools such as bolt cutters or other metal cutting tools. Tag means of attachment must be non-reusable, attachable by hand, self-locking and non-releasable, with a minimum unlocking strength of no less than 50 pounds.

- The device for attaching the tag also must have the general design and basic characteristics equivalent to a one-piece nylon cable tie that will withstand all environments and conditions.

- Identifiable - Locks and tags must clearly identify the employee who applies them. Tags must also warn against hazardous conditions if the machine or equipment is energized and must include a legend such as the following: DO NOT START, DO NOT OPEN, DO NOT CLOSE, DO NOT ENERGIZE, DO NOT OPERATE.

Employee Training

The employer must provide effective initial training and retraining as necessary and must certify that such training has been given to all employees covered by the standard. The certification must contain each employee's name and dates of training.

For the purposes of the standard, there are three types of employees - authorized, affected, and other. The amount and kind of training that each employee receives is based upon (1) the relationship of that employee's job to the machine or equipment being locked or tagged out, and (2) the degree of knowledge relevant to hazardous energy that he or she must possess.

For example, the employer's training program for authorized employees (those who are charged with the responsibility for implementing the energy control procedures and performing the service and maintenance) must cover, at minimum, the following areas:

- details about the type and magnitude of the hazardous energy sources present in the workplace, and

- the methods and means necessary to isolate and control those energy sources (i.e., the elements of the energy control procedure(s).)

By contrast, affected employees (usually the machine operators or users) and all other employees need only be able to (1) recognize when the control procedure is being implemented, and (2) understand the purpose of the procedure and the importance of not attempting to start up or use the equipment that has been locked or tagged out.

Because an "affected" employee is not one who is performing the service of maintenance, that employee's responsibilities under the energy control program are simple: Whenever there is a lockout or tagout device in place on an energy-isolating device, the affected employee leaves it alone and does not attempt to operate the equipment.

Every training program must ensure that all employees understand the purpose, function and restrictions of the energy control program and that authorized employees possess the knowledge and skills necessary for the safe application, use, and removal of energy controls.

Training programs used for compliance with this standard, which is performance-oriented, should deal with the equipment, type(s) of energy, and hazard(s) specific to the workplace being covered.

Retraining must be provided, as required, whenever there is a change in job assignments, a change in machines, equipment or processes that present a new hazard, or a change in energy control procedures. Additional retraining must be conducted whenever a periodic inspection reveals, or whenever the employer has reason to believe, that there are deviations from or inadequacies in the employee's knowledge or use of the energy control procedure.

Periodic Inspections

Periodic inspections must be performed at least annually to assure that the energy control procedures (locks and tags) continue to be implemented properly and that the employees are familiar with their responsibilities under those procedures. In addition, the employer must certify that the periodic inspections have been performed. The certification must identify the machine or equipment on which the energy control procedure was used, the date of the inspection, the employees included in the inspection, and the name of the person performing the inspection. For lockout procedures, the periodic inspection must include a review, between the inspector and each authorized employee, of that employee's responsibilities under the energy control procedure being inspected. When a tagout procedure is inspected, a review on the limitation of tags, in addition to the above requirements, must also be included with each affected and authorized employee.

Application of Controls and Lockout/Tagout Devices

The established procedure of applying energy controls includes the specific elements and actions that must be implemented in sequence (3) These are briefly identified as follows:

(1) Prepare for shut down.

(2) Shut down the machine or equipment.

(3) Apply the lockout or tagout device.

(4) Render safe all stored or residual energy.

(5) Verify the isolation and de-energization of the machine or equipment.

Removal of Locks and Tags

Before lockout or tagout devices are removed and energy is restored to the machine or equipment, the authorized employee(s) must take the following actions or observe the following procedures:

- Inspect the work area to ensure that non-essential items have been removed and that machine or equipment components are intact and capable of operating properly;
- Check the area around the machine or equipment to ensure that all employees have been safely positioned or removed;
- Notify affected employees immediately after removing locks or tags and before starting equipment or machines; and
- Make sure that locks or tags are removed ONLY by those employees who attached them. (In the very few instances when this is not possible, the device may be removed

under the direction of the employer, provided that he or she strictly adheres to the specific procedures outlined in the standard.)

Additional Safety Requirements

Special circumstances exist when (1) machines need to be tested or repositioned during servicing, (2) outside (contractor) personnel are at the worksite, (3) servicing or maintenance is performed by a group (rather than one specific person), and (4) shifts or personnel changes occur.

- Testing or positioning of machines. OSHA allows the temporary removal of locks or tags and the re-energization of the machine or equipment ONLY when necessary under special conditions - for example, when power is needed for the testing or positioning of machines, equipment, or components. The re-energization must be conducted in accordance with the sequence of steps listed below:
    - Clear the machines or equipment of tools and materials.
    - Remove employees from the machines or equipment area.
    - Remove the lockout or tagout devices as specified in the standard.
    - Energize and proceed with testing or positioning.
    - De-energize all systems, isolate the machine or equipment from the energy source, and reapply lockout or tagout devices as specified.
- Outside personnel (contractors, etc.) The onsite employer and the outside employer must inform each other of their respective lockout or tagout procedures. Each employer must ensure that his or her personnel must understand and comply with all restrictions and/or prohibitions of the other employer's energy control program.
- Group lockout or tagout. During all group lockout/tagout operations where the release of hazardous energy is possible, each authorized employee performing service or maintenance shall be protected by his/her personal lockout or tagout device or comparable mechanism that affords equivalent protection.
- Shift or personnel changes. Specific procedures must ensure the continuity of lockout or tagout protection during shift or personnel changes.

* * * * * *

VIII. RESPIRATORS

Selection

Donning/Doffing/Seal Checks

Anyone wearing a respirator must be trained and authorized by the company in several different areas, such as how to put on and take off the respirator. We call that donning and doffing. The process is simple, but it does require some basic knowledge, which we'll now review. You are being asked to select the respirator that provides the most acceptable fit. A mirror must be provided to assist you in evaluating the fit and positioning of the respirator. Each respirator represents a different size and shape and if fitted and used properly, will provide adequate protection. Hold each face piece up to the face and eliminate those that do not give you an acceptable fit. Put the most comfortable mask on your face and wear it for at least five minutes. If you're not experienced wearing a respirator, put it on and take it off several times, to become familiar with the process. Be sure to adjust the straps each time the respirator is donned. While wearing the respirator, check the comfort of the mask, how it fits your face, nose and proper seal between the mask and your face and cheeks. Make sure your chin fits the respirator. Check the strap tension to make sure it's not too loose or too tight. Some respirators have a tendency to slip, so check the fit in the mirror and through testing of the fit. Move your mouth as if talking to make sure you don't break the seal or fit.

Before conducting the negative and positive pressure checks, seat the mask on your face and move your head from side to side and up and down to ensure a stable fit. Make sure there is room for eye protection and good vision. If you wear glasses, the glasses cannot extend through the seal of the mask. Conduct seal checks. If you have any facial hair or sideburns that would prevent a proper seal, you cannot wear or select the respirator. While selecting or wearing a respirator and you have any difficulty in breathing, you must stop and be provided a medical evaluation before being allowed to use respiratory protection. To conduct a positive pressure seal check, close off the exhalation valve and exhale gently into the face piece. The face fit is considered satisfactory if a slight positive pressure can be built up inside the face piece without any evidence of outward leakage of air at the seal. For most respirators, this method of leak testing requires the wearer to first remove the exhalation valve cover before closing off the valve and then carefully replacing it after the test.

The negative pressure test is conducted by closing off the inlet opening of the canister or cartridges by covering with the palm of the hands or by replacing the filter seals. Inhale gently so the face piece collapses slightly, and hold your breath for 10 seconds. The design of the inlet opening of some cartridges cannot be effectively covered with the palm of the hand. If this occurs the test can be performed by covering the inlet opening of the cartridge with a thin latex or nitrile glove. If the face piece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is considered satisfactory. If the respirator manufacturer recommends a different seal check, then their recommendations should be followed. To remove the respirator, you should loosen the straps and while pulling on the

straps, allow the mask to gently release from the face seal. Upon removing the mask, it should be cleaned, disinfected and stored according to the manufacturer's recommendations.

Different Types of Respirators

Let's now take a look at some of the different types of respirators, so you'll have a better understanding of proper selection, for the hazard to which you may be exposed. First, you need to know some basic terminology before you can properly select a respirator. Right now, don't worry about the different types of hazards, as these will be covered later. Concentrate on understanding the basic terms and meaning of these words and phrases. We're not giving you exact terminology of these words or phrases, just some basic information so you'll have an understanding of what they mean, in a general sense:

Permissible Exposure Limit, Threshold Limit Value, Oxygen Deficiency, IDLH, particulate, contaminant, APF, End of Service Life Indicator, SCBA, air purifying, and more.

Let's begin with Permissible Exposure Limit. PEL's are exposure limits for each different chemical. Established by OSHA, PEL's may be expressed as a time-weighted average or TWA or as a ceiling exposure limit. TLV or Threshold Limit Values are used by industrial hygienists to express the airborne concentration of a material to which nearly all workers can be exposed day after day, without adverse effects. Each chemical or airborne concentration has different TLV's. Oxygen Deficiency simply means there isn't enough oxygen in the air to support life. IDLH is Immediately Dangerous to Life and Health. All oxygen deficient atmospheres must be considered IDLH. There are exceptions to this rule, but there are many technicalities that must be met, so in general, oxygen deficient atmospheres are considered IDLH. If an atmosphere is IDLH, the employer must provide the following respirators: a full face piece, NIOSH certified SCBA with a minimum service life of 30 minutes or a full face piece pressure demand airline respirator with auxiliary self-contained air supply. If a respirator is to be used for escape from an IDLH atmosphere only, the respirator must be NIOSH certified for escape from the atmosphere in which it will be used.

Generally, these escape respirators are available for 5 or 10 minute uses. The word particulate means a particle of solid or liquid matter. Matter is divided into three states: Solids, liquids, and gases. Solids are either finely divided dust particles, such as from grinding operations or as still more finely divided metal fume particles, as generated when smoldering hot metals vaporize, the combine with oxygen in the air and condense as oxide.

Contaminant is something that contaminates. APF stands for Assigned Protection Factors. This is the minimum anticipated protection provided by a properly functioning respirator or class of respirators to a given percentage of properly fitted and trained users. Generally, respirators have APF's of 10 or greater than 10. APF's apply to half-mask and full face air-purifying respirators. An APF of 10 is for half masks and 50 for full face masks. Of course, if there is an IDLH situation, then an SCBA respirator must be selected. ESLI is End of Service Life Indicator. The ESLI will be provided by the respirator manufacturer, indicating the life of the respirator. After that ESLI has expired, the respirator can no longer be used. Where there is no

ESLI, your employer must develop change schedules for respirators. This means that based upon the chemicals or contaminants in the air, a respirator's filter or cartridge must be changed every two hours, four hours or whatever schedule is developed for that particular respirator. If the respirator does not have an ESLI or there is no change schedule established, then a supplied air respirator must be used. SCBA is the short term for Self Contained Breathing Apparatus. These respirators are used in oxygen deficient atmospheres and where filtering cartridges or face piece respirators would not provide sufficient protection. Oxygen cylinders provide the air needed for breathing.

It takes time and effort to fully understand the terminology and meaning of respirator related equipment, atmosphere concentrations and all the things you need to protect your health. OK, there's more, but the following information is necessary when you're selecting respirators.

Filtering Respirators

When selecting filtering respirators to protect from harmful contaminants, remember there are three series of filters. N, R, and P. These filters are tested against the most penetrating size of aerosol, hygiene factors, damage and breathing resistance. Keep in mind that certification of these respirators are obtained for the complete respirator assembly, not just the filters. To help you remember the difference between the N, R and P filters, think about oil. Oil in the air makes a big difference in the type of filter you select. The N designation on a filter means it is NOT resistant to oil. The R designation means the filter is RESISTANT to oil, but not oil proof. What does the P designation mean? Oil proof. N.R and P. Not resistant, Resistant and oil-proof.

Now these three series of filters will each have an efficiency rating. N95, R95, P95. The 95 number means it is 95 percent efficient. N99, R99, P99 means filters have been certified as having a minimum efficiency of 99 percent. N100, R100, P100 means these filters have a 99.7 percent efficiency rating. These efficiency ratings depend on how much filter leakage can be accepted. The higher the efficiency rating, the lower the filter leakage.

The N series filter is limited to use in atmospheres containing non-oil-based particulates cannot be used if oil particles are present, such as those generated when cutting oil covered steel. Generally these filters have a time-use restriction of eight hours.

Both the R and P series are intended for filtering any non-oil or oil containing particles. Eight-hour time usage is also generally eight hours.

The P series may be used in either a non-oil or oil-containing atmosphere and do not have by time restrictions other than those normally associated with particulate filters.
Again, a determination must be made as to which filter should be used and what efficiency rating to use for protection. In most cases, you'll be using the same types of respirators currently used; however the filtering elements may change to meet these new rules. The presence of oil particles will depend on which filter and efficiency is selected. If no oil particles are present in the work environment, use a filter from any series of N, R, P. If oil particles, such as lubricants or cutting fluids are present, use an R or P series filter. The N series can't be

selected if there are oil particles present. If oil particles are present, and the filter is to be used for more than one work shift, use only a P series filter.

When selecting respirators, look for the NIOSH certification number 84A. This means it has the new certification. There are no requirements for color coding on respirators or cartridges, except the P100 filter. The P100 respirators will be color coded magenta.

What does air purifying mean? Something that purifies the air, obviously. Let's take a look at air purifying as it applies to respirators. Air purifying respirators removes contaminants such as particulate, vapor and gas or a combination of both, but do not supply oxygen. An air-purifying respirator cannot be used in an oxygen deficient or IDLH atmosphere.

For protection against gases and vapors, the following must be used:

An atmosphere-supplying respirator or an air purifying respirator where the respirator is equipped with a NIOSH certified ESLI for the contaminant or a change schedule for cartridges that is based on objective information or data that ensures the cartridges are changed before the end of their service life.

For protection against particulates, an atmosphere-supplying respirator or an air-purifying respirator equipped with a NIOSH certified HEPA filter or an air-purifying respirator equipped with NIOSH certified filter for particulates. Powered filtering respirators are simply respirators that have small motors that increase air flow through the respirator.

Respirator Use

Let's now review respirator use. The purpose of a respirator is to prevent the inhalation of harmful airborne substances. A respirator is designed as an enclosure that covers the nose and mouth or the entire face or head. Respirators are of two general "fit" types. Tight fitting and full face piece. Tight fitting respirators, such as quarter masks which cover the mouth and nose and where the lower sealing surface rests between the chin and the mouth. The half mask, which fits over the nose and under the chin and the full face piece, which covers from the hairline to below the chine. There are also loose fitting hoods, helmets or full suits that cover the head completely. There are two major classifications of respirators and these are air purifying and atmosphere supplying respirators. Air purifying respirators are grouped into three general types:

Particulate Removing – Vapor & Gas Removing – and Combination

Elements that remove particulates are called filters, while vapor and gas removing elements are called either chemical cartridges or canisters. Filters and canisters/cartridges are the functional portion of air-purifying respirators and they can generally be removed and replaced once their effective life has expired. The exception would be disposable respirators, those, which cannot be cleaned and disinfected or resupplied with an unused filter after each use. Combination elements are those that protect for both particulates and vapors and gases.

There are many types of respiratory hazards that may result from an oxygen deficient atmosphere or from breathing air contaminated with toxic particles, vapors, gases, fumes or mists. The proper selection and use of a respirator depends upon an initial determination of the concentration of the hazard or hazards present in the workplace. Keep in mind that NIOSH certifications are minimum standards. This certification may not protect from exposures in every case, so each organization must assess the exposure and recommend the proper respirator for that particular hazard or hazards.

Limitations of Respirator Use

Not all workers can wear respirators. Individuals with impaired lung function, due to asthma or emphysema for example, may be physically unable to wear a respirator. Individuals who cannot get a good face piece fit, including those individuals whose beards or sideburns interfere with the face piece seal, will be unable to wear tight fitting respirators. An adequate fit is necessary for a respirator to be effective.

Naturally, in addition to these problems, respirators may restrict communications or vision. Fatigue and reduced work efficiency are also potential problems when wearing respirators. Keep in mind there are many considerations to be taken into account when selecting respirators. Heavy breathing due to overexertion on a particular job will increase the air used, so this could reduce the amount of supplied air available and you would not be able to stay in an atmosphere as long as you would normally. Some people will have reduced capabilities by simply wearing a respirator. Heat, humidity, extremely cold weather may affect the type of respirator selected. Proper seals on the face, fit of the respirator on different sizes of faces. All these things must be taken into consideration. A worker who must speak loudly to communicate may experience a seal leak. It's important for all respirator users to understand the signs and symptoms of improper seals or wearing of respirators. Quite often, the user, for a variety of reasons does not detect seal leaks. It could be that the user has been desensitized to the odor or quite possibly there is no odor, yet the user is exposed to these contaminants.

Should any respirator user feel faint, dizzy, have headaches, and become nauseous or have any abnormal health effect, that's the time to get out of the atmosphere and have your respirator tested for proper seal, fit and to make sure the filtering cartridge or filter is working properly. No need to take chances. To fully understand the health effects and symptoms of each chemical used, you should review and understand the Material Safety Data Sheet or MSDS that is maintained in your workplace. Each chemical is different, with different exposure reactions. Respirators are used to protect you from health hazards, but you should be aware of the symptoms for any unplanned exposures. All the potential hazards in the workplace and potential problems associated with respirator use must be taken into consideration when selecting respiratory protective equipment.

Particulate Respirators

REMEMBER that identification of the hazard is the first step in selecting respirators. This means identifying the respiratory hazards and the level of employee exposure. Next, you'll want

to confirm that the atmosphere is not IDLH and is not oxygen deficient and that the hazard is a particulate. Next, you need to know the HAZARD RATIO for the contaminant. Hazard ratio is the hazard concentration and the exposure limit for the contaminant. Generally technically qualified individuals who have the proper contaminant testing equipment determine the hazard ratio. If the hazard ratio is less than 10, you may use a half mask air-purifying respirator with a filter efficiency of 95 percent or higher. If the hazard ratio is less than 20, you may use a full face piece air-purifying respirator with a filter efficiency of 99 percent or higher. Keep in mind the oil in the air. This makes a difference in the filter classification. If the hazard ratio is determined to be 100 or greater, then you must use an atmosphere-supplying respirator. Manufacturers of respirator equipment will generally provide your company with a particulate and hazard ratio flow chart, to help in the selection of the proper respirator that will protect from the particulate hazard.

Routine and Emergency Uses of Respirators

Respirators for use in non-emergency situations are to be inspected before each use and during cleaning. For respirators designated for use in an emergency situation, should be inspected at least monthly and in accordance with the manufacturer's recommendations. Emergency respirators must be examined to ensure they are working properly before and after each use. A basic examination of the equipment conducted prior to each use will provide assurance to the wearer that the respirator, which is about to be used in an emergency, will work properly. This includes that cylinders on the SCBA are charged the air is available and flowing. Respirators used for escape only are to be inspected prior to being carried into the workplace. Mouth bit or other emergency escape respirators are carried into the workplace for use by one person in an emergency and must be inspected for proper condition prior to being carried into the workplace. Therefore, escape only respirators need only be inspected before being carried into the workplace. Inspection procedures must include the respirator is working properly, and all connections are tight and all the various components of the respirator are functioning properly and in good condition.

We've already mentioned IDLH, but let's take that one step further when talking about emergency situations. When there is an IDLH situation, a standby person must be in communications with people in the IDLH atmosphere. This standby person must be properly fitted with respiratory equipment and be adequately prepared to facilitate rescue attempts. Prior to entering an IDLH atmosphere for rescue, the standby rescue person should notify management to take the responsibility for the rescue and to make sure the rescue is carried out appropriately. The employer should be advised of the rescue to ensure the rescue is necessary and that an emergency response team has been advised of the emergency. No one should enter an IDLH atmosphere that has not been properly trained, or is not wearing appropriate respiratory protection.

Breathing Air Quality for Atmosphere Supplying Respirators

When using atmosphere-supplying respirators, the suppliers of breathing air must now provide a certificate of analysis to verify that the breathing air meets the requirements of type 1, grade D.

This certifies that the air supplied meets breathing air quality standards. It is advisable that this certification verification be documented in your company's files and if the vendor is changed, to obtain certification from the new vendor.

Filtering Face piece

Filtering face piece is new terminology for dust masks. A number of instances may arise where there are no contaminants or threats to a person's health; however, some people may feel more comfortable wearing a filtering face piece. If respirator use is strictly voluntary, you must develop certain parts of the respirator program to ensure the face pieces that are worn are kept clean and in a sanitary condition. Furthermore, the user must be medically capable to wear the respirator and trained in its limitations. This requires standard operating procedures, medical evaluations, training and maintenance. Filtering face pieces are to be single use, which means only one person may wear the filtering face piece and not be used by another person. The voluntary use of filtering face pieces is strictly for comfort and not protection. In some cases, the wearing of a filtering face piece in itself can be hazardous, if the person wearing the face piece has not been evaluated as being medically qualified to wear it. If filtering face pieces are mandatory, then a comprehensive written program and training are required, just as is the case with other types of respirators.

SCBA and Respirator Maintenance

Self-contained breathing apparatus, or SCBA and air supplied respirators are a bit more complicated and require additional training. This information is contained in another training program. Respirators must be maintained in a clean, sanitary condition. After each use, respirators must be cleaned, disinfected and properly stored. The information on how to clean and maintain respirators will be covered in other training programs.

Selection of respirators requires knowledge, thought, planning and understanding the hazards in the workplace. Just because a respirator is new and looks great - that doesn't mean it works for your particular hazards. It requires special effort and training to make sure you use the proper respirator for the potential exposure. If you follow the rules, company policies and procedures, you will be much more capable of protecting your health. Respirator selection is an important part of your job responsibilities, so don't take the job lightly. Be informed and put your knowledge and good judgment to work for you.

Fit Testing Respirators Under New NIOSH Standards

There are new rules for fit testing of respirators. This short program explains the new rules and procedures for proper fit testing of respiratory equipment. These new standards have established new filtering efficiency and performance criteria for all non-powered, air-purifying, particulate-filter respirators. The purpose of fit testing is to make sure the respirator you use will not leak, under normal use and working conditions. Almost any respirator you use will appear to fit, but individuals wearing a respirator may not always be able to detect a leak, therefore a good fit testing program is necessary.

The new standard allows respirator users to continue using and purchasing *air-purifying and particulate filter* respirators certified under the old standards. Before an employee may be required to use any respirator with a negative or positive pressure tight-fitting face piece, the employee must be fit tested with the same make, model, style and size of respirator that will be used. The employer shall ensure employees using a tight-fitting face piece respirator pass an appropriate qualitative fit test or quantitative fit test. Fit testing a respirator determines the quality of the respirator-to-face seal and is the only way to screen out poorly fitting face pieces. A fit test should not be confused with a "fit check or user seal check". The fit check or user seal checks are used only to verify that a respirator is seated properly before a fit test or before entering a work area with a previously fitted respirator. The two basic types of fit tests are quantitative and qualitative. You can remember the difference between the two by remembering the word QUANTITATIVE, or quantity. Quantity, in that something must be measured with an instrument.

Quantitative fit testing provides a numerical or scientific measurement of the respirator fit. It is the most accurate type of fit testing. Quantitative fit testing is performed by challenging the seal of a probed respirator, equipped with P100 HEPA filters, to a challenge aerosol that is easily detected by the fit test instrument or by measuring the pressure inside the face pieces during a controlled Negative Pressure fit test. The words "challenge aerosol" refers to approved materials, such as smoke or other aerosols that can be detected by a human being. A probed respirator is one that has a probe inside the respirator, for measuring pressure. The "challenge aerosol" material is something that is not harmful, but it can be easily detected with sensitive instruments. A fit testing instrument will monitor the aerosol concentration both inside and outside the face piece during this test or the instrument will calculate the pressure differences between the inside and outside, to determine if there is any leakage. Next, the instrument will either report these concentrations or calculate the wearer's fit factor.

A "fit factor" is the ratio of the concentration outside the face piece divided by the concentration inside the face piece or a measure of the leakage rate. While this "fit factor" represents the actual fit of the respirator in a TEST ENVIRONMENT, an assigned protection factor or APF is a limit set by an applicable regulatory agency. When the assigned protection factor and the fit factor are compared, the fit factor must exceed the APF by at least ten times in order for the fit to be adequate. Let's say that again. When the assigned protection factor and the fit factor are compared, the fit factor must exceed the APF by at least ten times in order for the fit to be adequate. This means you need to know and understand Assigned Protection Factors or APF's to make sure you have a proper for the potential hazard.

For example, a half mask respirator has an assigned protection factor of ten. Therefore, the wearer must achieve a fit factor ten times greater than the APF or 100. This safety factor may be set higher at the discretion of the respiratory program administrator.

A probed respirator is a respirator that has been modified by the manufacturer to provide a sampling port through which internal air can be monitored. This "probed" respirator can only be used for fit testing and CAN NEVER BE USED FOR RESPIRATORY PROTECTION. Another practical alternative is a fit test adapter. This adapter allows the conversion of a working

respirator to be fitted with a probe. An advantage to this procedure is the wearer can be fit tested in his or her own respirator.

Qualitative fit testing is not accurate and merely provides a pass/fail result without obtaining a numerical or scientific measurement. In this type of test, the respirator's face piece-to-face seal is challenged with a substance detectable by the human senses, such as smell or taste. The test subject is relied upon to provide an unbiased and honest response. Since the test subject is the person who will be detecting the smell or taste of the testing material, pre-screening is necessary to demonstrate an ability of the person being tested to detect the test agent. A qualitative fit test would be extremely unsatisfactory if the person being tested could not detect or smell the testing material.

Every human being is different. Some people have very sensitive senses, such as some people can detect a very minor odor, while another person would have to be saturated with an odor before they could smell it. That's why qualitative fit testing is not scientifically accurate, but it does have value in helping respirator wearers evaluate the respirator they will be wearing will protect their health from potential hazards. The qualitative test only verifies a protection factor of ten. If more protection is required, then a quantitative fit test must be performed.

During the qualitative fit test, if the person's senses detect the substance inside the face piece, the respirator being tested fails the test.

Commonly used aerosols and testing substances include irritant smoke and bitrex. These materials are designed for the safety of the person being tested and for the strength of the test material for proper detection. Although passing a qualitative fit test only verifies a protection factor of ten, this type of fit test can be used to comply with the new fit testing requirements for all tight fitting face piece respirators, up to a protection factor of ten.

Some disadvantages of qualitative fit test protocols are the subjectivity of the test as well as lack of information on the magnitude of the respirator leakage. Other limitations are the ability of the subject to detect the test agent and the type of response it elicits. The only recourse in overcoming these limitations is to perform a quantitative fit test, with scientific or numerical measurements. Regardless of which test is used, fit testing of tight-fitting atmosphere-supplying respirators and tight-fitting powered air-purifying respirators must be accomplished by fit testing in the NEGATIVE PRESSURE mode. Fit testing must be accomplished in the Negative Pressure mode.

General Requirements:

The first requirement in fit testing is to allow the wearer to pick the most acceptable respirator from a sufficient number of respirator models and sizes so the respirator is acceptable to and correctly fits the user. These sufficient numbers of models do not have to be from different manufacturers. Proper training must be provided relating to donning, doffing and adjustment of tension straps on the respirator. If a person is not familiar with these procedures, additional training in donning and doffing must be provided. The person should make sure the respirator

fits comfortably, including the position of the mask on the nose, room for eye protection, room for talking, position of the mask on the face and cheeks, chin placement, adequate strap tension, proper fit across the nose bridge, proper size to span the distance from the nose to the chin and tendency of the respirator to slip. A mirror must be provided to evaluate fit and respirator position.

During the fit test, the test subject will perform various exercises to determine the effectiveness of the fit and seal of the respirator. The tested person should perform as many different exercises that would closely relate to respirator use in a normal working environment. Depending on the type of test, these may or may not include:

Normal breathing - deep breathing - turning the head side to side - moving the head up and down – talking - grimacing - bending over or jogging in place - and normal breathing again. These exercises are performed in the above order for one minute, except for the grimace exercise, which is performed for only 15 seconds.

The objective to perform enough exercises to demonstrate that the seal of the respirator is satisfactory for normal, routine respirator use. Proper fit testing is an important element of any respirator program. No matter what else you do, if a respirator doesn't fit properly, it's useless. The standards require fit testing on all tight-fitting face pieces, including air-supplying and powered air-purifying respirators. Fits tests are required annually, and after a significant change in the type or model of respirators. Also, fit testing is required if there is a physical change in a person, such as weight gain or loss - facial scarring - cosmetic surgery - substantial dental work or other factors that could affect the wearing of the respirator.

There are other conditions of respirator use that can affect the fit. Nothing must interfere with the seal of a tight-fitting respirator, including facial hair and glasses. If beards are trimmed so they do not break the respirator, this is acceptable. However, the fit test shall not be conducted if there is any hair growth, beard, mustache or sideburns, which cross the respirator sealing surface. In the example shown here, would this person be allowed to fit test or wear a respirator under this condition? The answer is no. There is facial hair stubble that may interfere with an appropriate seal between the face and respirator. There must be a proper seal before anyone may be fit tested or wear a respirator.

Seal Checks

Each time a worker puts on a respirator, a user seal check is required. These seal checks are not substitutes for fit testing. Exactly how do you perform these seal checks?

A *Positive-Pressure Check* is performed by closing off the exhalation valve and exhales gently into the face piece. The face fit is considered satisfactory if a slight positive pressure can be built up inside the face piece without any evidence of outward leakage of air at the seal.

A *Negative-Pressure Check* is performed by covering the inlet opening of the canister or cartridges and inhale gently so the face piece collapses slightly… and you hold your breath for

10 seconds. If the face piece remains in the slightly collapsed condition. And no inward leakage of air is detected; the tightness of the respirator's seal to the face is considered satisfactory. The purpose of fit testing and seal checks is to make sure there is a proper fit and seal, without any leakage inside the respirator. Fit testing and seal checks are mandatory.

Documentation

The respirator plan requires extensive employee training in all aspects of respirator use, selection, fit testing, maintenance and of course, the respirator program must be written. Documentation of all training, testing, repairing and maintenance is required. One of the more important parts of the respirator program will be if employees can answer some of the following questions:

- Has your respirator been properly fit tested?
- Do you know the proper procedures for selecting respirators?
- Have you completed a medical questionnaire and a health professional evaluated your health to ensure you are able to wear a respirator.
- Do you know how to properly conduct a seal check?
- Have you been trained in the various aspects of respiratory protection?
- Do you know the capabilities and limitations of respirators?
- Do you know how to properly care for and maintain respiratory equipment?
- Can you recognize the signs and symptoms that may limit or prevent the effective use of respirators?

These questions will help evaluate the effectiveness of your company's respiratory protection program. Of course, appropriate surveillance shall be maintained of work area conditions and degree of exposure or stress. When there is a change in work area conditions or exposure, the employer shall reevaluate the continued effectiveness of the respirator. After employees leave a respirator use area, they should wash their hands and faces and respirator face pieces as necessary to prevent eye or skin irritation associated with respirator use. Naturally, if the wearer experiences any difficulty, leakage, changes in breathing resistance, the respirator must be cleaned and tested. If the respirator is defective it must be repaired or replaced. Proper maintenance, cleaning, storing and inspecting respirators is an important part of the respiratory protection program.

The use of respirators is simply one method of helping protect the health of people working in environments where their health could be affected, if this protection were not used. If respiratory protection is not used, or used improperly in these environments and conditions, then the worker's health could be impaired. It's up to the company to provide the training, equipment and maintenance. The most important element of the program is the wearer's responsibility in following the rules and regulations established by the company. The respirator wearer's attitude towards safety and complying with the standards will make the difference

between an effective program and a less than effective program. Protection of your health is the goal of the respirator program.

* * * * * *

IX. BLOODBORNE PATHOGENS

Note: May not be applicable to this industry, unless you have first aid/CPR trained employees, however, it is good information for all employee training.

This is *not* a written Bloodborne Pathogens plan. It's information to inform all employees about the potential of developing a serious illness, if they come in contact with blood or body fluids of a person who is ill with various diseases/viruses.

It is most applicable to anyone who is trained as a First Aid or CPR provider. If you have employees that are exposed to blood or body fluids, you must have a written Bloodborne Pathogens Plan.

Throughout the industrialized world, great strides have been made in promoting knowledge about Bloodborne Pathogens. Training programs, such as this one.... have been designed to educate people.....and to make them aware of the protective measures that should be used to avoid exposure to Bloodborne Pathogens. This updated program will provide information about Bloodborne Pathogens.....and diseases relating to Bloodborne Pathogens. We will discuss and demonstrate proper methods of infection control and exposure control that will help you to avoid the risk of contamination with potentially infectious materials.

There are governmental regulations and standards relating to bloodborne pathogens. The purpose of these standards is to eliminate or to minimize an employee's risk of an occupational exposure to hepatitis B virus, also referred to as HBV, Human Immunodeficiency Virus, also referred to as HIV and to other potentially infectious bloodborne pathogens. These standards do not automatically apply to employees if they are trained in first aid. However, they do apply to employees who are required by their employer to administer first aid. People who perform unanticipated A Good Samaritan acts are not covered, but certainly it is an advantage to anyone, to be aware of the precautionary measures that should be taken to avoid an exposure. Before we go further let=s define what is meant by an occupational exposure. A reasonably anticipated skin, eye, mucous membrane or skin puncture contact with blood or other potentially infections materials that may result from the performance of an employee's duties.

Bloodborne Diseases

Although the information is directed at occupational hazards in the workplace, the information in this program can be used by anyone, regardless of their job. Let's now examine bloodborne diseases and what are bloodborne pathogens. Actually, they are bacteria. viruses and other microorganisms carried in the blood stream. These microorganisms may cause disease and some pathogens can be deadly. Some of these pathogens that are of greatest risk include Hepatitis B virus or HBV, Hepatitis C virus or HCV and human immunodeficiency Virus or HIV. Hepatitis C infects up to 150,000 people each year in the United States alone. Hepatitis C attacks and inflames the liver. Between 8,000 to 10,000 die each year from HCV related chronic liver disease. People most at risk for HCV include people who have received blood

transfusions before 1990, intravenous drug users who share needles, household members and sexual partners of infected persons and of course, persons in the medical field who are exposed to infected blood. Many people who are infected may not experience any signs or symptoms at all. There are tests now available to assist in making the diagnosis of HCV. Although no preventative medication or treatment has been conclusive, an antiviral medication is now available that has been shown to be helpful for some people with HCV.

Hepatitis B or HBV attacks the liver and is the major infectious bloodborne occupational hazard to health care workers. HBV is considered to be extremely infectious. The exposure to extremely small amounts of HBV positive blood may transmit infection. Fortunately, there are vaccines available to prevent the development of HBV infection.

The Human Immunodeficiency Virus or HIV attacks the body=s immune system, weakening it so that it cannot fight and destroy other deadly diseases. HIV causes Acquired Immune Disorder Syndrome or AIDS. AIDS is a fatal disease, and while treatment for it is improving, there is no known cure. Some of the other less common bloodborne diseases include Hepatitis D, .Malaria, Syphilis, Viral Hemorrhagic Fever and Ebola.

Modes of Transmission

Let's now take a quick look at how these potentially deadly viruses can pass from one person to another. The HIV and HBV bloodborne pathogens may be transmitted from the infected individual to other individuals by blood or Other Potentially Infections Materials or OPIM such as:

FLUIDS, including semen, vaginal secretions, fluids around the brain and spinal cord, around the joints, abdomen, uterus, heart, saliva from dental procedures or saliva containing blood, breast milk and any body fluid visibly contaminated with blood. In situations where it is difficult or impossible to differentiate between body fluids, it must be assumed to be infectious Bloodborne pathogens can be transmitted by any detached body tissue or organ from a human, living or dead. It's extremely important for you to understand how exposure and transmission can most likely occur in your particular work or life setting. HBV and HIV are most commonly transmitted through sexual contact, sharing of hypodermic needles, from mothers to their children at or before birth, accidental puncture wounds, contact between broken or damaged skin and infected body fluids and contact between mucous membranes and infected body fluids.

Lifestyles

You may be at risk if you have had more than one sexual partner, you have unprotected sex, you or your partner have ever been diagnosed with another sexually transmitted disease,..... such as herpes, gonorrhea, syphilis, Chlamydia or genital warts. You or your partner have had unprotected sexual contact with an infected person. You or your sexual partner are an intravenous drug user.

Workplace Risks

Certainly, your employer must determine which jobs are at risk. The employer must advise those employees to the exposure risks and the measures to take to reduce such exposure. Occupational risks include professionals in the health care industry, first responders, such as fire, police, Emergency Medical Technicians who give first aid, medical attention or through other exposures. An occupational risk includes coming in contact with blood or body fluids at work. This could include morticians, custodial workers and human service care providers.

First Aid Providers

A common barrier to action in an emergency is fear of disease transmission between an ill or injured person and a first aid provider. As an example, the perceived risk of disease transmission during CPR has reduced the willingness of some lay persons to initiate mouth-to-mouth ventilation in unknown victims of cardiac arrest. Because of disease transmission concerns, first aid providers must learn the importance of Standard precautions or body substance isolation. They must know what steps to take for personal protection from bloodborne pathogens. These steps include how to use, remove and discard such equipment. First aid providers are obviously at an increased exposure risk and they should have the responsibility of meeting more comprehensive bloodborne pathogen standards.

Vaccines

There are no vaccines or cures for HCV or HIV. However, there is a vaccine for HBV. Vaccination is your best protection against HBV. The vaccine is given in a series of three doses. Most often these three doses are taken over a six month time period. The vaccine works most effectively when all three doses are taken. If you decide to get the HBV vaccination, you should check with your doctor and or your employer. The vaccine is safe and effective and is currently recommended for children as well as adults.

Standard Precautions

Standard Precautions is a method of infection control in which all human blood and certain human body fluids are treated as if they are known to be infectious for HIV, HBV, HCV and other bloodborne pathogens. Standard Precautions are to be observed in all situations where there is a potential for contact with blood or other potentially infectious material. Some body fluids may be difficult to differentiate between other types of body fluid. In this case, all body fluids are to be considered potentially infectious. A good rule of thumb to follow is: always place a barrier between you and any moist or wet substance originating from another person. Hepatitis B or HBV is extremely infectious and is more prevalent than the more publicized HIV or Hepatitis C or HCV. By utilizing Standard Precautions, you can help protect yourself, not only from HBV, .but all other bloodborne pathogens.

Personal Protection

We've already discussed the things you can do in your lifestyle outside of work and these behaviors can be an important part of your protection from bloodborne pathogens. In the workplace, it's important to be familiar with appropriate personal protection. Personal protective equipment or PPE is considered appropriate if it does not permit blood or other potentially infectious substances and contaminated materials to pass through or reach your work clothing, street clothing, undergarments, skin, eyes, mouth or other mucous membranes under normal conditions of use and for the duration of time the protective equipment is in use. Here are some basic rules to follow:

- Wash your hands immediately or as soon as possible after removal of gloves or other personal protective equipment.
- Always wear personal protective equipment in exposure situations.
- Remove PPE before leaving the work area.
- Keep your work area clean and sanitized. Decontaminate area routinely.
- Handle and dispose of any sharp items that may be contaminated with extreme caution by using mechanical means such as tongs, brush and dustpan or forceps.
- Never use bare or gloved hands.

Some of the examples of PPE are:

Gloves should be disposable, single use gloves made of latex or other fluid impervious materials. All cuts or sores on your hands should be covered with a bandage, as additional protection before applying your gloves.

Goggles or Protective Eyewear must be worn whenever there is a risk of splashing or vaporizing of contaminated fluids. Bloodborne pathogens can be transmitted through the thin membranes of the eyes, so it is extremely important to protect them.

Face Shields can be worn in addition to goggles or other protective eye wear to protect the nose and mouth.

Aprons or Jumpsuits prevent contaminated infectious material from reaching clothing and under garments, as well as exposed skin surfaces. The material should be appropriate for the level of exposure.

CPR Masks or other mouth to barrier device is strongly recommended.

CAPS and Booties cover the head and shoes completely. Be sure the booties are tied securely.

Any PPE or normal clothing items that become soiled with infectious material must be removed as soon as possible. Contaminated materials must be handled with caution and placed in an appropriately labeled bag or container until it is decontaminated or properly disposed.

Along with PPE is the advice that you should never drink, smoke, handle contact lenses or apply cosmetics or lip balm until you have left the area containing potentially infectious materials. Do not leave the area until you have thoroughly washed your hands.

Containers, Color-Coding and Labels

For decontamination and disposal methods, your employer will provide specifically labeled and color coded containers, such as:

Biohazard bags, sharps containers, and biohazard laundry bags Regulated waste containers are required to be color coded or labeled with the biohazard sign. These color codes and labels are intended to warn the person who handles the container. Biohazard symbols and labels must be fluorescent orange or orange-red with letters or symbols in a contrasting color. These symbols must be affixed to any container that is used to store or transport potentially infectious materials.

Exposure

One of the most common definitions of an occupational exposure is a specific eye, mouth, other mucous membrane, non-intact skin, or piercing mucous membranes or the skin barrier through such events as needle sticks, human bites, cuts and abrasions, contact with blood or other potentially infectious materials that results from the performance of an employee's duties. *In case of an Exposure*, remember these key words: *Stop-Wash-and Report.*

Stop whatever you are doing as soon as possible and WASH the exposed area immediately with soap and running water. Cleanse thoroughly by scrubbing vigorously and creating a good lather. Rinse mucous membranes, which is considered the eyes and mouth, with plenty of water. Try to save any contaminated object for testing purposes. REPORT the incident to your employer as promptly as possible. Seek medical help, treatment and counseling. If you have not already been vaccinated against HBV, this treatment can be administered even after you have been exposed.

Exposure Control

Each organization must have an exposure control plan. All new employees must be informed and trained in these policies and procedures. Workplace exposure control plans are implemented to eliminate or minimize the employee's exposure to bloodborne pathogens.

When cleaning a spill, you must remember to use Standard Precautions. Protect yourself and others from exposures. When cleaning, wear appropriate protective gloves and use an appropriate and approved solution. An inexpensive, approved solution is 10 percent bleach and water or 1/4 cup of bleach to one gallon of water which is freshly made. You should use disposable towels, and if necessary, a disposable brush and tray to clean the spill. Everything must be placed in a biohazard bag and disposed of, according to the workplace exposure control plan.

During work, you may come into contact with IV needles, Hypodermic needles, razors and other blades, scalpels, scissors, broken glass and other sharp objects. Use extreme caution when handling, storing. or using sharp objects. Needles should be disposed by carefully placing them into an appropriate, labeled, puncture proof containers designed for sharps. Never clean up broken sharp materials with your hands. Use a dustpan and brush or tongs. These materials must to go into sharps containers and not placed in biohazard bags.

Contaminated laundry must be placed into leak resistant labeled containers. If plastic biohazard bags are being used, they should be doubled as an extra precaution. Remember to wear the proper personal protection whenever handling soiled/contaminated laundry.

We certainly haven't covered all aspects of bloodborne pathogens, but speak with your employer and contact your local public health unit for more information on bloodborne pathogens. You can protect yourself and reduce your risk of exposure to a bloodborne pathogen by the use of PPE and practicing Standard Precautions, both at home and at work. Lifestyle behavior modification will also minimize the risk of exposure.

* * * * * * *

X. EMERGENCY PREPAREDNESS

This discussion details the basic steps to handle emergencies in the workplace. These emergencies include accidental releases of toxic gases, chemical spills, fires, explosions, and bodily harm and trauma caused by workplace violence. This discussion is intended to assist small businesses that do not have safety and health professionals. It is not intended as an all inclusive safety program but rather to provide guidelines for planning for emergencies.

Planning

The effectiveness of response during emergencies depends on the amount of planning and training performed. Management must show its support for plant safety programs and the importance of emergency planning. If management is not interested in employee protection and in minimizing property loss, little can be done to promote a safe workplace. It is therefore management's responsibility to see that a program is instituted and that it is frequently reviewed and updated. The input and support of all employees must be obtained to ensure an effective program. The emergency response plan should be developed locally and should be comprehensive enough to deal with all types of emergencies specific to that site. When emergency action plans are required by a particular OSHA standard, the plan must be in writing; except for firms with 10 or fewer employees, the plan may be communicated orally to employees. The plan must include, as a minimum, the following elements:

- Emergency escape procedures and emergency escape route assignments.
- Procedures to be followed by employees who remain to perform (or shut down) critical plant operations before the plant is evacuated.
- Procedures to account for all employees after emergency evacuation have been completed.
- Rescue and medical duties for those employees who are to perform them.
- The preferred means for reporting fires and other emergencies, and
- Names or regular job titles of persons or departments to be contacted for further information or explanation of duties under the plan.

The emergency action plan should address all potential emergencies that can be expected in the workplace. Therefore, it will be necessary to perform a hazard audit to determine toxic materials in the workplace, hazards, and potentially dangerous conditions. For information on chemicals, the manufacturer or supplier can be contacted to obtain Material Safety Data Sheets. These forms describe the hazards that a chemical may present, list precautions to take when handling, storing, or using the substance, and outline emergency and first-aid procedures.

The employer must list in detail the procedures to be taken by those employees who must remain behind to care for essential plant operations until their evacuation becomes absolutely necessary. This may include monitoring plant power supplies, water supplies, and other essential services that cannot be shut down for every emergency alarm, and use of fire extinguishers.

For emergency evacuation, the use of floor plans or workplace maps that clearly show the emergency escape routes and safe or refuge areas should be included in the plan. All employees must be told what actions they are to take in emergency situations that may occur in the workplace, such as a designated meeting location after evacuation.

This plan must be reviewed with employees initially when the plan is developed, whenever the employees' responsibilities under the plan change, and whenever the plan is changed. A copy should be kept where employees can refer to it at convenient times. In fact, to go a step further, the employer could provide the employees with a copy of the plan, particularly all new employees.

Chain of Command

A chain of command should be established to minimize confusion so that employees will have no doubt about who has authority for making decisions. Responsible individuals should be selected to coordinate the work of the emergency response team. In larger organizations, there may be a plant coordinator in charge of plant-wide operations, public relations, and ensuring that outside aid is called in. Because of the importance of these functions, adequate backup must be arranged so that trained personnel are always available.

The duties of the Emergency Response Team Coordinator should include the following:

- Assessing the situation and determining whether an emergency exists that requires activating the emergency procedures.
- Directing all efforts in the area including evacuating personnel.
- Ensuring that outside emergency services such as medical aid and local fire departments are called in when necessary, and
- Directing the shutdown of plant operations when necessary.

Communications

During a major emergency involving a fire or explosion it may be necessary to evacuate offices in addition to manufacturing areas. Also, normal services, such as electricity, water, and telephones, may be nonexistent. Under these conditions, it may be necessary to have an alternate area to which employees can report or that can act as a focal point for incoming and outgoing calls. Since time is an essential element for adequate response, the person designated as being in charge should make this the alternate headquarters so that he/she can be easily reached.

Emergency communications equipment such as amateur radio systems, public address systems, or portable radio units should be present for notifying employees of the emergency and for contacting local authorities, such as law enforcement officials, private sector charitable groups, and the fire department.

A method of communication also is needed to alert employees to the evacuation or to take other action as required in the plan. Alarms must be audible or seen by all people in the plant and have an auxiliary power supply in the event electricity is affected. The alarm must be distinctive and recognizable as a signal to evacuate the work area or perform actions designated under the emergency action plan. The employer must explain to each employee the means for reporting emergencies, such as manual pull box alarms, public address systems, or telephones. Emergency phone numbers should be posted on or near telephones, on employees' notice boards, or in other conspicuous locations. The warning plan should be in writing and management must be sure each employee knows what it means and what action is to be taken.

It may be necessary to notify other key personnel such as the plant manager or physician during off-duty hours. An updated written list of key personnel should be kept listed in order of priority.

Accounting for Personnel

Management will need to know when all personnel have been accounted for. This can be difficult during shift changes or if contractors are on site. A responsible person in the control center must be appointed to account for personnel and to inform police or Emergency Response Team members of those persons believed missing.

Emergency Response Teams

Emergency Response Teams are the first line of defense in emergencies. Before assigning personnel to these teams, the employer must assure that employees are physically capable of performing the duties that may be assigned to them. Depending on the size of the plant there may be one or several teams trained in the following areas:

- Use of various types of fire extinguishers.
- First aid, including cardiopulmonary resuscitation (CPR).
- Shutdown procedures.
- Evacuation procedures.
- Chemical spill control procedures.
- Use of self-contained breathing apparatus (SCBA).
- Search and emergency rescue procedures.
- Incipient and advanced stage firefighting.
- Trauma counseling.

The type and extent of the emergency will depend on the plant operations and the response will vary according to the type of process, the material handled, the number of employees, and the availability of outside resources. OSHA's Hazard Communication Standard (29 CFR part 1910.1200) is designed to ensure that the hazards of all chemicals produced or imported are evaluated and that information concerning their hazards is transmitted to employers and

employees. This is done by means of comprehensive hazard communication programs including container labeling and other forms of warnings, material safety data sheets, and employee training.

Emergency Response Teams should be trained in the types of possible emergencies and the emergency actions to be performed. They are to be informed about special hazards - such as storage and use of flammable materials, toxic chemicals, radioactive sources, and water-reactive substances-to which they may be exposed during fire and other emergencies. It is important to determine when not to intervene. For example, team members must be able to determine if the fire is too large for them to handle or whether search and emergency rescue procedures should be performed. If there is the possibility of members of the Emergency Response Team receiving fatal or incapacitating injuries, they should wait for professional firefighters or emergency response groups.

Training

Training is important to the effectiveness of an emergency plan. Before implementing an emergency action plan, a sufficient number of persons must be trained to assist in the safe and orderly evacuation of employees. Training for each type of disaster response is necessary so that employees know what actions are required.

In addition to the specialized training for Emergency Response Team members, all employees should be trained in the following:

- Evacuation plans,
- Alarm systems.
- Reporting procedures for personnel.
- Shutdown procedures.
- Types of potential emergencies.
- These training programs must be provided as follows:
- Initially when the plan is developed.
- For all new employees.
- When new equipment, materials, or processes are introduced.
- When procedures have been updated or revised.
- When exercises show that employee performance must be improved.
- At least annually.

The emergency control procedures should be written in concise terms and be made available to all personnel. A drill should be held for all personnel, at random intervals at least annually, and an evaluation of performance made immediately by management and employees. When possible, drills should include groups supplying outside services such as fire and police

departments. In buildings with several places of employment, the emergency plans should be coordinated with other companies and employees in the building. Finally, the emergency plan should be reviewed periodically and updated to maintain adequate response personnel and program efficiency.

Personal Protection

Effective personal protection is essential for any person who may be exposed to potentially hazardous substances. In emergency situations employees may be exposed to a wide variety of hazardous circumstances, including:

- Chemical splashes or contact with toxic materials.
- Falling objects and flying particles.
- Unknown atmospheres that may contain toxic gases, vapors or mists, or inadequate oxygen to sustain life.
- Fires and electrical hazards.
- Violence in the workplace.

It is extremely important that employees be adequately protected in these situations. Some of the safety equipment that may be used includes:

- Safety glasses, goggles, or face shields for eye protection.
- Hard hats and safety shoes for head and foot protection.
- Proper respirators for breathing protection.
- Whole body coverings chemical suits, gloves, hoods, and boots for body protection from chemicals.
- Body protection for abnormal environmental conditions such as extreme temperatures.

The equipment selected must meet the criteria contained in the OSHA standards or described by a nationally recognized standards producing organization. The choice of proper equipment is not a simple matter and consultation should be made with health and safety professionals before making any purchases. Manufacturers and distributors of health and safety products may be able to answer questions if they have enough information about the potential hazards involved.

Professional consultation will most likely be needed in providing adequate respiratory protection. Respiratory protection is necessary for toxic atmospheres of dust, mists, gases, or vapors and for oxygen-deficient atmospheres. There are four basic categories of respirators:

- Air-purifying devices (filters, gas masks, and chemical cartridges), which remove contaminants from the air but cannot be used in oxygen-deficient atmospheres.

- Air-supplied respirators (hose masks, air line respirators), which should not be used in atmospheres that are immediately dangerous to life or health.

- Positive-pressure self-contained breathing apparatus (SCBA), which are required for unknown atmospheres, oxygen-deficient atmospheres, or atmospheres immediately dangerous to life or health.

- Escape masks.

Before assigning or using respiratory equipment the following conditions must be met:

- A medical evaluation should be made to determine if the employees are physically able to use the respirator.

- Written procedures must be prepared covering safe use and proper care of the equipment, and employees must be trained in these procedures and in the use and maintenance of respirators.

- A fit test must be made to determine a proper match between the face piece of the respirator and the face of the wearer. This testing must be repeated periodically. Training must provide the employee an opportunity to handle the respirator, have it fitted properly, test its face piece-to-face seal, wear it in normal air for a familiarity period, and wear it in a test atmosphere.

- A regular maintenance program must be instituted including cleaning, inspecting, and testing of all respiratory equipment. Respirators used for emergency response must be inspected after each use and at least monthly to assure that they are in satisfactory working condition. A written record of inspection must be maintained.

- Distribution areas for equipment used in emergencies must be readily accessible to employees.

A positive-pressure self-contained breathing apparatus (SCBA) offers the best protection to employees involved in controlling emergency situations. It must have a minimum service life rating of at least 30 minutes. Conditions that require a positive-pressure SCBA include the following:

- Leaking cylinders or containers, smoke from chemical fires, or chemical spills that indicate high potential for exposure to toxic substances.

- Atmospheres with unknown contaminants or unknown contaminant concentrations, confined spaces that may contain toxic substances, or oxygen-deficient atmospheres.

Emergency situations may involve entering confined spaces to rescue employees who are overcome by toxic compounds or who lack oxygen. These permit-required confined spaces include tanks, vaults, pits, sewers, pipelines, and vessels. Entry into permit-required confined

spaces can expose the employee to a variety of hazards, including toxic gases, explosive atmospheres, oxygen deficiency, electrical hazards, and hazards created by mixers and impellers that have not been deactivated and locked out. Personnel must never enter a permit-required confined space unless the atmosphere has been tested for adequate oxygen, combustibility, and toxic substances. Conditions in a permit-required confined space must be considered immediately dangerous to life and health unless shown otherwise. If a permit-required confined space must be entered in an emergency, the
following precautions must be adhered to:

- All lines containing inert, toxic, flammable, or corrosive materials must be disconnected or blocked off before entry.
- All impellers, agitators, or other moving equipment inside the vessel must be locked out.
- Appropriate personal protective equipment must be worn by employees before entering the vessel. Mandatory use of harnesses must be stressed.
- Rescue procedures must be specifically designed for each entry. A trained stand-by person must be present. This person should be assigned a fully charged, positive-pressure, self-contained breathing apparatus with a full face piece. The stand-by person must maintain unobstructed lifelines and communications to all workers within the permit-required confined space and be prepared to summon rescue personnel if necessary. The stand-by person should not enter the confined space until adequate assistance is present. While awaiting rescue personnel, the stand-by person may make a rescue attempt utilizing lifelines from outside the permit-required confined space.

A more complete description of procedures to follow while working in confined spaces may be found in the OSHA standard for permit-required confined spaces, 29 CFR 1910.145 and the National Institute for Occupational Safety and Health (NIOSH) Publication Number 80-106, Criteria for a Recommended Standard...Working in Confined Spaces.

Medical Assistance

In a major emergency, time is critical factor in minimizing injuries. Most small businesses do not have a formal medical program, but they are required to have the following medical and first-aid services:

- In the absence of an infirmary, clinic, or hospital in close proximity to the workplace that can be used for treatment of all injured employees, the employer must ensure that a person or persons are adequately trained to render first aid. The first aid is to begin within 3 to 4 minutes of the incident if the injury is of a serious nature.

- Where the eyes or body of any employee may be exposed to injurious corrosive materials, eye washes or suitable equipment for quick drenching or flushing must be provided in the work area for immediate emergency use. Employees must be trained to use the equipment.

- The employer must ensure the ready availability of medical personnel for advice and consultation on matters of employees' health. This does not mean that health care must be provided, but rather that, if health problems develop in the workplace, medical help will be available to resolve them.

To fulfill the above requirements, the following actions should be considered:

- Survey the medical facilities near the place of business and make arrangements to handle routine and emergency cases. A written emergency medical procedure should then be prepared for handling accidents with minimum confusion.

- If the business is located far from medical facilities, at least one and preferably more employees on each shift must be adequately trained to render first aid. The American Red Cross, some insurance carriers, local safety councils, fire departments, and others may be contacted for this training.

- First-aid supplies should be provided for emergency use. This equipment should be ordered through consultation with a physician.

- Emergency phone numbers should be posted in conspicuous places near or on telephones.

- Sufficient ambulance service should be available to handle any emergency. This requires advance contact with ambulance services to ensure they become familiar with plant location, access routes, and hospital locations.

Security

During an emergency, it is often necessary to secure the area to prevent unauthorized access and to protect vital records and equipment. An off-limits area must be established by cordoning off the area with ropes and signs. It may be necessary to notify local law enforcement personnel or to employ private security personnel to secure the area and prevent the entry of unauthorized personnel.

Certain records also may need to be protected, such as essential accounting files, legal documents, and lists of employees' relatives to be notified in case of emergency. These records may be stored in duplicate outside the plant or in protected secure locations within the plant.

Training

Every employee needs to know details of the emergency action plan, including evacuation plans, alarm systems, reporting procedures for personnel, shutdown procedures, and types of potential emergencies. Drills should be held at random intervals, at least annually, and include, if possible, outside police and fire authorities.

Training must be conducted initially, when new employees are hired, and at least annually. Additional training is needed when new equipment, materials, or processes are introduced, when procedures have been updated or revised, or when exercises show that employee performance is inadequate.

Personal Protection

Employees exposed to accidental chemical splashes, falling objects, flying particles, unknown atmospheres with inadequate oxygen or toxic gases, fires, live electrical wiring, or similar emergencies need personal protective equipment, including:

- Safety glasses, goggles, or face shields for eye protection.
- Hard hats and safety shoes.
- Properly selected and fitted respirators.
- Whole body coverings, gloves, hoods, and boots.
- Body protection for abnormal environmental conditions such as extreme temperatures.

Medical Assistance

Employers not near an infirmary, clinic, or hospital should have someone on-site trained in first aid, have medical personnel readily available for advice and consultation, and develop written emergency medical procedures.

It is essential that first aid supplies are available to the trained medical personnel, that emergency phone numbers are placed in conspicuous places near or on telephones, and prearranged ambulance services for any emergency are available.

* * * * * * *

XI. HAND AND PORTABLE POWER TOOLS

Hazard Recognition

Tools are such a common part of our lives that it is difficult to remember that they may pose hazards. All tools are manufactured with safety in mind but, tragically, a serious accident often occurs before steps are taken to search out and avoid or eliminate tool-related hazards.

In the process of removing or avoiding the hazards, workers must learn to recognize the hazards associated with the different types of tools and the safety precautions necessary to prevent those hazards.

Hand Tools

Hand tools are non-powered. They include anything from axes to wrenches. The greatest hazards posed by hand tools result from misuse and improper maintenance.

Some examples:

- Using a screwdriver as a chisel may cause the tip of the screwdriver to break and fly, hitting the user or other employees.
- If a wooden handle on a tool such as a hammer or an axe is loose, splintered, or cracked, the head of the tool may fly off and strike the user or another worker.
- A wrench must not be used if its jaws are sprung, because it might slip.
- Impact tools such as chisels, wedges, or drift pins are unsafe if they have mushroomed heads. The heads might shatter on impact, sending sharp fragments flying.

The employer is responsible for the safe condition of tools and equipment used by employees but the employees have the responsibility for properly using and maintaining tools.

Employers should caution employees that saw blades, knives, or other tools be directed away from aisle areas and other employees working in close proximity. Knives and scissors must be sharp. Dull tools can be more hazardous than sharp ones.

Appropriate personal protective equipment, e.g., safety goggles, gloves, etc., should be worn due to hazards that may be encountered while using portable power tools and hand tools.

Safety requires that floors be kept as clean and dry as possible to prevent accidental slips with or around dangerous hand tools.

Around flammable substances, sparks produced by iron and steel hand tools can be a dangerous ignition source. Where this hazard exists, spark-resistant tools made from brass, plastic, aluminum, or wood will provide for safety.

Power Tool Precautions

Power tools can be hazardous when improperly used. There are several types of power tools, based on the power source they use: electric, pneumatic, liquid fuel, hydraulic, and powder-actuated.

Employees should be trained in the use of all tools - not just power tools. They should understand the potential hazards as well as the safety precautions to prevent those hazards from occurring.

The following general precautions should be observed by power tool users:

- Never carry a tool by the cord or hose.
- Never yank the cord or the hose to disconnect it from the receptacle.
- Keep cords and hoses away from heat, oil, and sharp edges.
- Disconnect tools when not in use, before servicing, and when changing accessories such as blades, bits and cutters.
- All observers should be kept at a safe distance away from the work area.
- Secure work with clamps or a vise, freeing both hands to operate the tool.
- Avoid accidental starting. The worker should not hold a finger on the switch button while carrying a plugged-in tool.
- Tools should be maintained with care. They should be kept sharp and clean for the best performance. Follow instructions in the user's manual for lubricating and changing accessories.
- Be sure to keep good footing and maintain good balance.
- The proper apparel should be worn. Loose clothing, ties, or jewelry can become caught in moving parts.
- All portable electric tools that are damaged shall be removed from use and tagged "Do Not Use."

Guards

Hazardous moving parts of a power tool need to be safeguarded. For example, belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, or other reciprocating, rotating, or moving parts of equipment must be guarded if such parts are exposed to contact by employees.

Guards, as necessary, should be provided to protect the operator and others from the following:

- point of operation
- in-running nip points
- rotating parts
- flying chips and sparks

Safety guards must never be removed when a tool is being used. For example, portable circular saws must be equipped with guards. An upper guard must cover the entire blade of the saw. A retractable lower guard must cover the teeth of the saw, except when it makes contact with the work material. The lower guard must automatically return to the covering position when the tool is withdrawn from the work.

Safety Switches

The following hand-held powered tools must be equipped with a momentary contact "on-off" control switch: drills, tappers, fastener drivers, horizontal, vertical and angle grinders with wheels larger than 2 inches in diameter, disc and belt sanders, reciprocating saws, saber saws, and other similar tools. These tools also may be equipped with a lock-on control provided that turnoff can be accomplished by a single motion of the same finger or fingers that turn it on.

The following hand-held powered tools may be equipped with only a positive "on-off" control switch: platen sanders, disc sanders with discs 2 inches or less in diameter; grinders with wheels 2 inches or less in diameter; routers, planers, laminate trimmers, nibblers, shears, scroll saws and jigsaws with blade shanks 1/4-inch wide or less.

Other hand-held powered tools such as circular saws having a blade diameter greater than 2 inches, chain saws, and percussion tools without positive accessory holding means must be equipped with a constant pressure switch that will shut off the power when the pressure is released.

Electric Tools

Employees using electric tools must be aware of several dangers; the most serious is the possibility of electrocution.

Among the chief hazards of electric-powered tools are burns and slight shocks which can lead to injuries or even heart failure. Under certain conditions, even a small amount of current can result in fibrillation of the heart and eventual death. A shock also can cause the user to fall off a ladder or other elevated work surface.

To protect the user from shock, tools must either have a three-wire cord with ground and be grounded, be double insulated, or be powered by a low-voltage isolation transformer. Three-wire cords contain two current-carrying conductors and a grounding conductor. One end of the grounding conductor connects to the tool's metal housing. The other end is grounded through a

prong on the plug. Anytime an adapter is used to accommodate a two-hole receptacle, the adapter wire must be attached to a known ground. The third prong should never be removed from the plug.

Double insulation is more convenient. The user and the tools are protected in two ways: by normal insulation on the wires inside, and by a housing that cannot conduct electricity to the operator in the event of a malfunction.

These general practices should be followed when using electric tools:

- Electric tools should be operated within their design limitations.
- Gloves and safety footwear are recommended during use of electric tools.
- When not in use, tools should be stored in a dry place.
- Electric tools should not be used in damp or wet locations.
- Work areas should be well lighted.

Powered Abrasive Wheel Tools

Powered abrasive grinding, cutting, polishing, and wire buffing wheels create special safety problems because they may throw off flying fragments.

Before an abrasive wheel is mounted, it should be inspected closely and sound- or ring-tested to be sure that it is free from cracks or defects. To test, wheels should be tapped gently with a light non-metallic instrument. If they sound cracked or dead, they could fly apart in operation and so must not be used. A sound and undamaged wheel will give a clear metallic tone or "ring."

To prevent the wheel from cracking, the user should be sure it fits freely on the spindle. The spindle nut must be tightened enough to hold the wheel in place, without distorting the flange. Follow the manufacturer's recommendations. Care must be taken to assure that the spindle wheel will not exceed the abrasive wheel specifications.

Due to the possibility of a wheel disintegrating (exploding) during start-up, the employee should never stand directly in front of the wheel as it accelerates to full operating speed.

Portable grinding tools need to be equipped with safety guards to protect workers not only from the moving wheel surface, but also from flying fragments in case of breakage.

In addition, when using a powered grinder:

- Always use eye protection.
- Turn off the power when not in use.
- Never clamp a hand-held grinder in a vise.

Pneumatic Tools

Pneumatic tools are powered by compressed air and include chippers, drills, hammers, and sanders.

There are several dangers encountered in the use of pneumatic tools. The main one is the danger of getting hit by one of the tool's attachments or by some kind of fastener the worker is using with the tool.

Eye protection is required and face protection is recommended for employees working with pneumatic tools.

Noise is another hazard. Working with noisy tools such as jackhammers requires proper, effective use of hearing protection.

When using pneumatic tools, employees must check to see that they are fastened securely to the hose to prevent them from becoming disconnected. A short wire or positive locking device attaching the air hose to the tool will serve as an added safeguard.

A safety clip or retainer must be installed to prevent attachments, such as chisels on a chipping hammer, from being unintentionally shot from the barrel.

Screens must be set up to protect nearby workers from being struck by flying fragments around chippers, riveting guns, staplers, or air drills.

Compressed air guns should never be pointed toward anyone. Users should never "dead-end" it against themselves or anyone else.

Powder-Actuated Tools

Powder-actuated tools operate like a loaded gun and should be treated with the same respect and precautions. In fact, they are so dangerous that they must be operated only by specially trained employees.

Safety precautions to remember include the following:

- These tools should not be used in an explosive or flammable atmosphere.
- Before using the tool, the worker should inspect it to determine that it is clean, that all moving parts operate freely, and that the barrel is free from obstructions.
- The tool should never be pointed at anybody.
- The tool should not be loaded unless it is to be used immediately. A loaded tool should not be left unattended, especially where it would be available to unauthorized persons.

- Hands should be kept clear of the barrel end. To prevent the tool from firing accidentally, two separate motions are required for firing: one to bring the tool into position, and another to pull the trigger. The tools must not be able to operate until they are pressed against the work surface with a force of at least 5 pounds greater than the total weight of the tool.

If a powder-actuated tool misfires, the employee should wait at least 30 seconds, then try firing it again. If it still will not fire, the user should wait another 30 seconds so that the faulty cartridge is less likely to explode, than carefully remove the load. The bad cartridge should be put in water.

Suitable eye and face protection are essential when using a powder-actuated tool.

The muzzle end of the tool must have a protective shield or guard centered perpendicularly on the barrel to confine any flying fragments or particles that might otherwise create a hazard when the tool is fired. The tool must be designed so that it will not fire unless it has this kind of safety device.

All powder-actuated tools must be designed for varying powder charges so that the user can select a powder level necessary to do the work without excessive force.

If the tool develops a defect during use it should be tagged and taken out of service immediately until it is properly repaired.

Fasteners

When using powder-actuated tools to apply fasteners, there are some precautions to consider. Fasteners must not be fired into material that would let them pass through to the other side. The fastener must not be driven into materials like brick or concrete any closer than 3 inches to an edge or corner. In steel, the fastener must not come any closer than one-half inch from a corner or edge. Fasteners must not be driven into very hard or brittle materials which might chip or splatter, or make the fastener ricochet.

An alignment guide must be used when shooting a fastener into an existing hole. A fastener must not be driven into a spalled area caused by an unsatisfactory fastening.

Hydraulic Power Tools

The fluid used in hydraulic power tools must be an approved fire-resistant fluid and must retain its operating characteristics at the most extreme temperatures to which it will be exposed.

The manufacturer's recommended safe operating pressure for hoses, valves, pipes, filters, and other fittings must not be exceeded.

Jacks

All jacks - lever and rachet jacks, screw jacks, and hydraulic jacks – must have a device that stops them from jacking up too high. Also, the manufacturer's load limit must be permanently marked in a prominent place on the jack and should not be exceeded.

A jack should never be used to support a lifted load. Once the load has been lifted, it must immediately be blocked up.

Use wooden blocking under the base if necessary to make the jack level and secure. If the lift surface is metal, place a 1-inch-thick hardwood block or equivalent between it and the metal jack head to reduce the danger of slippage.

To set up a jack, make certain of the following:

- the base rests on a firm level surface
- the jack is correctly centered
- the jack head bears against a level surface
- the lift force is applied evenly

Proper maintenance of jacks is essential for safety. All jacks must be inspected before each use and lubricated regularly. If a jack is subjected to an abnormal load or shock, it should be thoroughly examined to make sure it has not been damaged.

Hydraulic jacks exposed to freezing temperatures must be filled with adequate antifreeze liquid.

General Safety Precautions

Employees who use hand and power tools and who are exposed to the hazards of falling, flying, abrasive and splashing objects, or exposed to harmful dusts, fumes, mists, vapors, or gases must be provided with the particular personal equipment necessary to protect them from the hazard.

All hazards involved in the use of power tools can be prevented by following five basic safety rules:

- Keep all tools in good condition with regular maintenance.
- Use the right tool for the job.
- Examine each tool for damage before use.
- Operate according to the manufacturer's instructions.
- Provide and use the proper protective equipment.

Employees and employers have a responsibility to work together to establish safe working procedures. If a hazardous situation is encountered, it should be brought to the attention of the proper individual immediately.

Safety Hazard Information Bulletin on Bench Grinders from OSHA:

The Directorate of Technical Support issues Hazard Information Bulletins (HIB) as needed to provide relevant information regarding unrecognized or misunderstood safety and health hazards, inadequacies of materials, devices, techniques, and engineering controls. HIB's are initiated based on information provided by the field staff, studies, reports and concerns expressed by safety and health professionals, employers, and the public. Information is compiled based on a comprehensive evaluation of available facts, literature and in coordination with appropriate parties. HIB's do not necessarily reflect OSHA policy.

The Boston Regional Office has bought to our attention a potentially serious hazard existing with an employer's use of a bench grinder equipped with abrasive wheels were rated at 3103 RPM and the grinder motor was rated at 3450 RPM. The BR Tools bench grinder, Model BG-8, was purchased with 8-inch TAI HWA Grinding Wheel Company Ltd. wheels already installed. Both the grinder and the abrasive wheels were manufactured in Taiwan. The employer could not provide information as to where the bench grinder was purchased. While this may be an isolated case of mismatched abrasive wheels and bench grinder, it has not been possible to contact the manufacturer to verify the same. Indeed, this grinder in the same configuration may have been imported by various distributors nationwide.

HAZARD ASSESSMENT FOR PPE (MANDATORY)

- Controlling hazards. PPE devices alone should not be relied on to provide protection against hazards, but should be used in conjunction with guards, engineering controls, and sound manufacturing practices.

- Assessment and selection. It is necessary to consider certain general guidelines for assessing the foot, head, eye and face, and hand hazard situations that exist in an occupational or educational operation or process, and to match the protective devices to the particular hazard. It should be the responsibility of the safety officer to exercise common sense and appropriate expertise to accomplish these tasks.

- Assessment guidelines. In order to assess the need for PPE the following steps should be taken:

- Survey. Conduct a walk-through survey of the areas in question. The purpose of the survey is to identify sources of hazards to workers and co-workers.

- Consideration should be given to the basic hazard categories:

    - Impact

- Penetration
- Compression (roll-over)
- Chemical
- Heat
- Harmful dust
- Light (optical) radiation

- Sources - During the walk-through survey the safety officer should observe:

- Sources of motion; i.e., machinery or processes where any movement of tools, machine elements or particles could exist, or movement of personnel that could result in collision with stationary objects;

- Sources of high temperatures that could result in burns, eye injury or ignition of protective equipment, etc.;

- Types of chemical exposures;

- Sources of harmful dust;

- Sources of light radiation, i.e., welding, brazing, cutting, furnaces, heat treating, high intensity lights, etc.;

- Sources of falling objects or potential for dropping objects;

- Sources of sharp objects which might pierce the feet or cut the hands;

- Sources of rolling or pinching objects which could crush the feet;

- Layout of workplace and location of co-workers; and (j) any electrical hazards. In addition, injury/accident data should be reviewed to help identify problem areas.

- Organize data. Following the walk-through survey, it is necessary to organize the data and information for use in the assessment of hazards. The objective is to prepare for an analysis of the hazards in the environment to enable proper selection of protective equipment.

- Analyze data. Having gathered and organized data on a workplace, an estimate of the potential for injuries should be made. Each of the basic hazards (paragraph 3.a.) should be reviewed and a determination made as to the type, level of risk, and seriousness of potential injury from each of the hazards found in the area. The possibility of exposure to several hazards simultaneously should be considered.

- Selection guidelines. After completion of the procedures in paragraph 3, the general procedure for selection of protective equipment is to:

- Become familiar with the potential hazards and the type of protective equipment that is available, and what it can do; i.e., splash protection, impact protection, etc.;

- Compare the hazards associated with the environment; i.e., impact velocities, masses, projectile shape, radiation intensities, with the capabilities of the available protective equipment;

- Select the protective equipment which ensures a level of protection greater than the minimum required to protect employees from the hazards; and

- Fit the user with the protective device and give instructions on care and use of the PPE. It is very important that end users be made aware of all warning labels for and limitations of their PPE.

- Fitting the device. Careful consideration must be given to comfort and fit. PPE that fits poorly will not afford the necessary protection. Continued wearing of the device is more likely if it fits the wearer comfortably. Protective devices are generally available in a variety of sizes. Care should be taken to ensure that the right size is selected.

- Devices with adjustable features. Adjustments should be made on an individual basis for a comfortable fit that will maintain the protective device in the proper position. Particular care should be taken in fitting devices for eye protection against dust and chemical splash to ensure that the devices are sealed to the face. In addition, proper fitting of helmets is important to ensure that it will not fall off during work operations. In some cases a chin strap may be necessary to keep the helmet on an employee's head. (Chin straps should break at a reasonably low force, however, so as to prevent a strangulation hazard). Where manufacturer's instructions are available, they should be followed carefully.

- Reassessment of hazards. It is the responsibility of the safety officer to reassess the workplace hazard situation as necessary, by identifying and evaluating new equipment and processes, reviewing accident records, and reevaluating the suitability of previously selected PPE.

- Care should be taken to recognize the possibility of multiple and simultaneous exposure to a variety of hazards. Adequate protection against the highest level of each of the hazards should be provided. Protective devices do not provide unlimited protection.

- Operations involving heat may also involve light radiation. As required by the standard, protection from both hazards must be provided.

- Face-shields should only be worn over primary eye protection (spectacles or goggles).

- As required by the standard, filter lenses must meet the requirements for shade designations in 1910.133(a)(5). Tinted and shaded lenses are not filter lenses unless they are marked or identified as such.

- As required by the standard, persons whose vision requires the use of prescription (Rx) lenses must wear either protective devices fitted with prescription (Rx) lenses or protective devices designed to be worn over regular prescription (Rx) eyewear.

- Wearers of contact lenses must also wear appropriate eye and face protection devices in a hazardous environment. It should be recognized that dusty and/or chemical environments may represent an additional hazard to contact lens wearers.

- Caution should be exercised in the use of metal frame protective devices in electrical hazard areas.

- Atmospheric conditions and the restricted ventilation of the protector can cause lenses to fog. Frequent cleansing may be necessary.

- Welding helmets or face-shields should be used only over primary eye protection (spectacles or goggles).

- Non-sideshield spectacles are available for frontal protection only, but are not acceptable eye protection for the sources and operations listed for "impact."

- Ventilation should be adequate, but well protected from splash entry. Eye and face protection should be designed and used so that it provides both adequate ventilation and protects the wearer from splash entry.

- Protection from light radiation is directly related to filter lens density. See note (4). Select the darkest shade that allows task performance.

- Selection guidelines for head protection. All head protection (helmets) is designed to provide protection from impact and penetration hazards caused by falling objects. Head protection is also available which provides protection from electric shock and burn. When selecting head protection, knowledge of potential electrical hazards is important. Class A helmets, in addition to impact and penetration resistance, provide electrical protection from low-voltage conductors (they are proof tested to 2,200 volts). Class B helmets, in addition to impact and penetration resistance, provide electrical protection from high-voltage conductors (they are proof tested to 20,000 volts). Class C helmets provide impact and penetration resistance (they are usually made of aluminum which conducts electricity), and should not be used around electrical hazards.

Where falling object hazards are present, helmets must be worn. Some examples include: working below other workers who are using tools and materials which could fall; working around or under conveyor belts which are carrying parts or materials; working below machinery or processes which might cause material or objects to fall; and working on exposed energized conductors.

- Selection guidelines for foot protection. Safety shoes and boots which meet the ANSI Z41-1991 Standard provide both impact and compression protection. Where necessary, safety shoes can be obtained which provide puncture protection. In some work situations, metatarsal protection should be provided, and in other special situations electrical conductive or insulating safety shoes would be appropriate.

  Safety shoes or boots with impact protection would be required for carrying or handling materials such as packages, objects, parts or heavy tools, which could be dropped; and, for other activities where objects might fall onto the feet. Safety shoes or boots with compression protection would be required for work activities involving skid trucks (manual material handling carts) around bulk rolls (such as paper rolls) and around heavy pipes, all of which could potentially roll over an employee's feet. Safety shoes or boots with puncture protection would be required where sharp objects such as nails, wire, tacks, screws, large staples, scrap metal etc., could be stepped on by employees causing a foot injury.

- Selection guidelines for hand protection. Gloves are often relied upon to prevent cuts, abrasions, burns, and skin contact with chemicals that are capable of causing local or systemic effects following dermal exposure. OSHA is unaware of any gloves that provide protection against all potential hand hazards, and commonly available glove materials provide only limited protection against many chemicals. Therefore, it is important to select the most appropriate glove for a particular application and to determine how long it can be worn, and whether it can be reused.

  It is also important to know the performance characteristics of gloves relative to the specific hazard anticipated; e.g., chemical hazards, cut hazards, flame hazards, etc. These performance characteristics should be assessed by using standard test procedures. Before purchasing gloves, the employer should request documentation from the manufacturer that the gloves meet the appropriate test standard(s) for the hazard(s) anticipated. Other factors to be considered for glove selection in general include:

- As long as the performance characteristics are acceptable, in certain circumstances, it may be more cost effective to regularly change cheaper gloves than to reuse more expensive types; and, (B) The work activities of the employee should be studied to determine the degree of dexterity required, the duration, frequency, and degree of exposure of the hazard, and the physical stresses that will be applied.

With respect to selection of gloves for protection against chemical hazards:

- The toxic properties of the chemical(s) must be determined; in particular, the ability of the chemical to cause local effects on the skin and/or to pass through the skin and cause systemic effects;

- Generally, any "chemical resistant" glove can be used for dry powders;

- For mixtures and formulated products (unless specific test data are available), a glove should be selected on the basis of the chemical component with the shortest breakthrough time, since it is possible for solvents to carry active ingredients through polymeric materials; and,

- Employees must be able to remove the gloves in such a manner as to prevent skin contamination.

- Cleaning and maintenance. It is important that all PPE be kept clean and properly maintained. Cleaning is particularly important for eye and face protection where dirty or fogged lenses could impair vision.

  For the purposes of compliance with 1910.132 (a) and (b), PPE should be inspected, cleaned, and maintained at regular intervals so that the PPE provides the requisite protection. It is also important to ensure that contaminated PPE which cannot be decontaminated is disposed of in a manner that protects employees from exposure to hazards.

- Ways to Prevent Eye Injuries at Work:

  Nearly one million Americans have already lost some degree of sight to an eye injury. With over 365,000 work-related eye injuries still occurring each year, Americans could use a few tips on how to prevent eye injuries in the workplace!

- ASSESS! Conduct a thorough analysis of plant operations. Inspect work areas, access routes and equipment. Examine eye accident and injury reports. Identify operations and areas that present eye hazards.

- TEST! Uncorrected vision problems contribute to accidents. Incorporate vision testing in your pre-placement and routine physical examinations of employees.

- PROTECT! Select protective eyewear designed for a specific operation or hazard. Protective eyewear must meet the current standards referenced by the Occupational Safety and Health Act of 1970 and subsequent revisions.

- PARTICIPATE! For maximum protection against eye injury, establish a 100 percent mandatory program that requires eye protection throughout all operations areas of your plant. Experience shows this kind of program prevents more injuries and is easier to enforce that one limited to certain departments, areas or jobs.

- FIT! Workers cannot be expected to use their protective eyewear unless it fits properly and comfortably. To ensure the eyewear is satisfactory, have it fitted by an eye care professional or someone trained to do this. Provide the means for maintenance and require each worker to be responsible for his or her own eyewear.

- PLAN FOR AN EMERGENCY! Establish first-aid procedures for eye injuries. Make eyewash stations accessible, particularly where chemicals are used. Train employees in basic first aid and identify those with more advanced first-aid training.

- EDUCATE! Conduct ongoing educational programs to establish, maintain and reinforce the need for protective eyewear. Add eye safety to your regular employee education/training programs and include it as a large part of new employee orientation.

- SUPPORT! Management support is a key ingredient in successful eye safety programs. All management personnel should set an example by wearing protective eyewear whenever and wherever required.

- REVIEW! Continually review and, when necessary, revise your accident prevention strategies. Aim for the elimination of all accidents and injuries.

- PUT IT IN WRITING! When all elements of your safety program have been established, put them in writing. Display a copy of the policy in areas frequented by employees, and include a review of the policy in new employee orientation.

* * * * * *

XII. FLAMMABLE AND COMBUSTIBLE LIQUIDS

Introduction

The primary basis of this standard is the National Fire Protection Association's publication NFPA 30, Flammable and Combustible Liquids Code. This standard applies to the handling, storage, and use of flammable and combustible liquids with a flash point below 200oF. There are two primary hazards associated with flammable and combustible liquids:

Explosion and fire. In order to prevent these hazards, this standard addresses the primary concerns of design and construction, ventilation, ignition sources, and storage.

Definitions

There are a number of definitions included in 1910.106. These definitions were derived from consensus standards, and were not uniquely developed for OSHA regulations. Some of the more important definitions are discussed below.

Aerosol shall mean a material which is dispensed from its container as a mist, spray, or foam by a propellant under pressure.

Approved shall mean approved or listed by a nationally recognized testing laboratory.

Boiling point shall mean the boiling point of a liquid at a pressure of 14.7 pounds per square inch absolute (psia). This pressure is equivalent to 760 millimeters of mercury (760 mm Hg).

At temperatures above the boiling point, the pressure of the atmosphere can no longer hold the liquid in the liquid state and bubbles begin to form. The lower the boiling point, the greater the vapor pressure at normal ambient temperatures and consequently the greater the fire risk.

Container shall mean any can, barrel, or drum.

Closed container shall mean a container so sealed by means of a lid or other device that neither liquid nor vapor will escape from it at ordinary temperatures.

Fire area shall mean an area of a building separated from the remainder of the building by construction having a fire resistance of at least 1 hour and having all communicating openings properly protected by an assembly having a fire resistance rating of at least 1 hour.

Flash point means the minimum temperature at which a liquid gives off vapor within a test vessel in sufficient concentration to form an ignitable mixture with air near the surface of the liquid. The flash point is normally an indication of susceptibility to ignition.

The flash point is determined by heating the liquid in test equipment and measuring the temperature at which a flash will be obtained when a small flame is introduced in the vapor zone above the surface of the liquid.

A standard closed container is used to determine the closed-cup flash point and a standard open-surface dish for the open-cup flash point temperature, as specified by the American Society for Testing and Materials (ASTM). These methods are referenced in OSHA's 1910.106 standard.

Combustible liquid means any liquid having a flash point at or above 100oF (37.8oC).

Combustible liquids shall be divided into two classes as follows:

Class II liquids shall include those with flash points at or above 100^{o}F (37.8^{o}C) and below 140^{o}F (60^{o}C), except any mixture having components with flash points of 200oF (93.3^{o}C) or higher, the volume of which make up 99 percent or more of the total volume of the mixture.

Class III liquids shall include those with flash points at or above 140^{o}F (60^{o}C). Class III liquids are subdivided into two subclasses:

Class IIIA liquids shall include those with flash points at or above 140oF (60oC) and below 200oF (93.3^{o}C), except any mixture having components with flash points of 200^{o}F (93.3^{o}C), or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.

Class IIIB liquids shall include those with flash points at or above 200oF (93.3^{o}C). This section does not regulate Class IIIB liquids. Where the term "Class III liquids" is used in this section, it shall mean only Class IIIA liquids.

When a combustible liquid is heated to within 30oF (16.7oC) of its flash point, it shall be handled in accordance with the requirements for the next lower class of liquids.

Flammable liquid means any liquid having a flash point below 100oF (37.8^{o}C) or higher, the total of which make up 99 percent or more of the total volume of the mixture. Flammable liquids shall be known as Class I liquids.

Class I liquids are divided into three classes as follows:

> Class IA shall include liquids having flash points below 73^{o}F (22.8^{o}C) and having a boiling point below 100oF (37.8^{o}C).
>
> Class IB shall include liquids having flash points below 73^{o}F (22.8^{o}C) and having a boiling point at or above 100oF (37.8^{o}C).
>
> Class IC shall include liquids having flash points at or above 73^{o}F (22.8^{o}C) and below 100^{o}F (37.8^{o}C).

It should be mentioned that flash point was selected as the basis for classification of flammable and combustible liquids because it is directly related to a liquid's ability to generate vapor, i.e., its volatility. Since it is the vapor of the liquid, not the liquid itself that burns, vapor generation becomes the primary factor in determining the fire hazard. The expression "low flash - high hazard" applies. Liquids having flash points below ambient storage temperatures generally display a rapid rate of flame spread over the surface of the liquid, since it is not necessary for the heat of the fire to expend its energy in heating the liquid to generate more vapor.

Portable tank shall mean a closed container having a liquid capacity over 60 U.S. gallons and not intended for fixed installation.

A safety can shall mean an approved container, of not more than 5 gallons capacity, having a spring-closing lid and spout cover and so designed that it will safely relieve internal pressure when subjected to fire exposure.

Vapor pressure shall mean the pressure, measured in pounds per square inch (absolute) exerted by a volatile liquid as determined by the Standard Method of Test for Vapor Pressure of Petroleum Products (Reid Method), American Society for Testing and Materials ASTM D323-68.

Vapor pressure is a measure of a liquid's propensity to evaporate. The higher the vapor pressure, the more volatile the liquid and, thus, the more readily the liquid gives off vapors.

Ventilation as specified in this section is for the prevention of fire and explosion. It is considered adequate if it is sufficient to prevent accumulation of significant quantities of vapor-air mixtures in concentration over one-fourth of the lower flammable limit.

Flammable (Explosive) Limits

When vapors of a flammable or combustible liquid are mixed with air in the proper proportions in the presence of a source of ignition, rapid combustion or an explosion can occur. The proper proportion is called the flammable range and is also often referred to as the explosive range. The flammable range includes all concentrations of flammable vapor or gas in air, in which a flash will occur or a flame will travel if the mixture is ignited. There is a minimum concentration of vapor or gas in air below which propagation of flame does not occur on contact with a source of ignition. There is also a maximum proportion of vapor in air above which propagation of flame does not occur. These boundary-line mixtures of vapor with air are known as the lower and upper flammable or explosive limits (LEL or UEL) respectively, and they are usually expressed in terms of percentage by volume of vapor in air.

In popular jargon, a vapor/air mixture below the flammable limit is too "lean" to burn or explode, and a mixture above the upper flammable limit is too "rich" to burn or explode. No attempt is made to differentiate between the terms flammable and explosive as applied to the lower and upper limits of flammability.

Container and Portable Tank Storage

This section applies only to the storage of flammable or combustible liquids in drums or other containers (including flammable aerosols) not exceeding 60 gallons individual capacity and portable tanks of less than 660 gallon individual capacity. A portable tank is a closed container which has a liquid capacity of over 60 gallons and is not intended for fixed installations.

This section does not apply to the following:

- Storage of containers in bulk plants, service stations, refineries, chemical plants, and distilleries;
- Class I or Class II liquids in the fuel tanks of a motor vehicle, aircraft, boat, or portable or stationary engine;
- Flammable or combustible paints, oils, varnishes, and similar mixtures used for painting or maintenance when not kept for a period in excess of 30 days;
- Beverages when packed in individual containers not exceeding 1 gallon in size.

Design, Construction, and Capacity of Containers

Only approved containers and portable tanks may be used to store flammable and combustible liquids. Metal containers and portable tanks meeting the requirements of the Department of Transportation (DOT) (49 CFR 178) are deemed acceptable when containing products authorized by the DOT (49 CFR 173).

The latest version of NFPA 30, Flammable and Combustible Liquids Code indicates that certain petroleum products may be safely stored within plastic containers if the terms and conditions of the following specifications are met:

- ANSI/ASTM D 3435-80, Plastic Containers (Jerry Cans) for Petroleum Products.
- ASTM F 852-86, Standard for Portable Gasoline Containers for Consumer Use.
- ASTM F 976-86, Standard for Portable Kerosene Containers for Consumer Use.
- ANSI/UL 1313-83, Nonmetallic Safety Cans for Petroleum Products.

This standard also requires portable tanks to have provision for emergency venting. Top-mounted emergency vents must be capable of limiting internal pressure under fire exposure conditions to 10 psig or 30 percent of the bursting pressure of the tank, whichever is greater. Portable tanks are also required to have at least one pressure-activated vent with a minimum capacity of 6,000 cubic feet of free air at 14.7 psia and 60^{o}F. These vents must be set to open at not less than 5 psig. If fusible vents are used, they shall be actuated by elements that operate at a temperature not exceeding 300^{o}F.

Maximum allowable sizes of various types of containers and portable tanks are specified based on the class of flammable and combustible liquid they contain.

Design, Construction and Capacity of Storage Cabinets

Not more than 60 gallons of Class I and/or Class II liquids, or not more than 120 gallons of Class III liquids may be stored in an individual cabinet.

This standard permits both metal and wooden storage cabinets. Storage cabinets shall be designed and constructed to limit the internal temperature to not more than 325oF when subjected to a standardized 10-minute fire test. All joints and seams shall remain tight and the door shall remain securely closed during the fire test. Storage cabinets shall be conspicuously labeled, "Flammable - Keep Fire Away."

The bottom, top, door, and sides of metal cabinets shall be at least No. 18 gage sheet metal and double walled with 11/2-inch air space. The door shall be provided with a three-point lock, and the door sill shall be raised at least 2 inches above the bottom of the cabinet.

Storage Inside Buildings

Egress

Flammable or combustible liquids, including stock for sale, shall not be stored so as to limit use of exits, stairways, or areas normally used for the safe egress of people.

Office Occupancies

Storage shall be prohibited except that which is required for maintenance and operation of equipment. Such storage shall be kept in closed metal containers stored in a storage cabinet or in safety cans or in an inside storage room not having a door that opens into that portion of the building used by the public.

General Purpose Public Warehouses

There are tables in the standard summarizing the storage requirements applicable to "General Purpose Public Warehouses." These tables refer to indoor storage of flammable and combustible liquids which are confined in containers and portable tanks. Storage of incompatible materials that create a fire exposure (e.g., oxidizers, water-reactive chemicals, certain acids and other chemicals) is not permitted.

Warehouses or Storage Buildings

The last type of inside storage covered by this paragraph addresses storage in "warehouses or storage buildings." These structures are sometimes referred to as outside storage rooms. Practically any quantity of flammable and combustible liquid can be stored in these buildings provided that they are stored in a configuration consistent with the tables in this paragraph.

Containers in piles shall be separated by pallets or dunnage where necessary to provide stability and to prevent excessive stress on container walls.

Stored material shall not be piled within 3 feet of beams or girders and shall be at least 3 feet below sprinkler deflectors or discharge orifices of water spray, or other fire protection equipment.

Aisles of at least 3 feet in width shall be maintained to access doors, windows or standpipe connections.

Storage Outside Buildings

Requirements covering "storage outside buildings" are summarized in tables in this paragraph. Associated requirements are given for storage adjacent to buildings. Also included are requirements involving controls for diversion of spills away from buildings and security measures for protection against trespassing and tampering. Certain housekeeping requirements are given which relate to control of weeds, debris and accumulation of unnecessary combustibles.

Fire Control

Suitable fire control devices, such as small hose or portable fire extinguishers, shall be available at locations where flammable or combustible liquids are stored.

At least one portable fire extinguisher having a rating of not less than 12-B units shall be located:

- outside of, but not more than 10 feet from, the door opening into any room used for storage; and

- not less than 10 feet, nor more than 25 feet, from any Class I or Class II liquid storage area located outside of a storage room but inside a building.

The reason for requiring that portable fire extinguishers be located a distance away from the storage room is that fires involving Class I and Class II flammable liquids are likely to escalate rapidly. If the fire is too close to the storage area, it may be impossible to get to it once the fire has started.

Open flames and smoking shall not be permitted in flammable or combustible liquid storage areas.

Materials which react with water shall not be stored in the same room with flammable or combustible liquids. Many flammable and combustible liquid storage areas are protected by automatic sprinkler or water spray systems and hose lines. Consequently, any storage of water-reactive material in the storage area creates an unreasonable risk.

Definitions:

Flash Point -- the lowest temperature at which a flammable liquid will give off enough vapors to form an ignitable mixture with the air above the surface of the liquid or within its container.

Lower Flammable Limit - the percentage of vapor in the air below which a fire can't occur because there isn't enough fuel: the mixture is said to be too lean.

Upper Flammable Limit - the percentage of vapor in the air above which there isn't enough air for a fire: the mixture is said to be too rich.

Vapor Density - the weight of a flammable vapor compared to air. (Air =1). Vapors with a high density are more dangerous and require better ventilation because they tend to flow along the floor and collect in low spots.
PEL- the Permissible Exposure Limit of the vapor according to OSHA standards, expressed in parts of vapor per million parts of contaminated air. The PEL is listed because many of these substances present inhalation as well as fire hazards.

HAZARDOUS MATERIALS

Waste Defined Hazardous

EPA has defined hazardous waste. A waste may be hazardous because of its general characteristics, or it may be specifically listed by technical name. HPO also collects wastes that may not be defined by EPA as hazardous, but present a significant enough hazard to warrant handling as a hazardous waste.

General Characteristics

Wastes exhibiting any of these characteristics are hazardous.

- Ignitability (EPA code D001)
    - Liquids that have a flash point less than 140° F (60° C.), e.g., xylene, acetonitrile, ethanol, toluene.
    - Solids capable of causing fire by friction, absorption of moisture, or spontaneous chemical change and when ignited burn vigorously and persistently to create a hazard, e.g., picric acid, sodium dithionite.
    - Flammable compressed gases, e.g., hydrogen, ethylene, methane.
    - Oxidizers; substances which yield oxygen readily to stimulate combustion, e.g., potassium permanganate, sodium chlorate, sodium nitrate.

- Corrosivity (EPA code D002)
    - Aqueous solutions with pH equal to or less than 2 or greater than 12.5.
    - Liquids capable of corroding steel at a specified rate and temperature.

- Reactivity (EPA code D003)
    - Substances that react with water violently, or produce toxic gases or explosive mixtures with water, e.g., potassium, sodium, sodium hydride.
    - Substances that are normally unstable or explosive, e.g., phosphorous.
    - Chemicals containing cyanide or sulfide that generate toxic gases when exposed to pH between 2 and 12.5, e.g., potassium cyanide, sodium sulfide.

- Toxicity (EPA code D series)
    - Materials that have certain heavy metals or organic constituents above regulated levels, e.g., silver, cadmium, chloroform, etc.

Analysis of Household Chemicals:

Hazard	Kitchen & Bathroom	Home Workshop	Garden & Garage
Corrosive	Bleach Drain cleansers Floor wax Strippers Glass cleaners Laundry stain Removers Lye Muriatic acid Oven cleansers Powdered Cleansers	Dry cell Batteries Muriatic acid TSP Wet cell batteries	Brake fluid Glass cleansers Pool chemicals Tire cleansers

Hazard	Kitchen & Bathroom	Home Workshop	Garden & Garage
Flammable	Aerosol spray Butane refills Furniture Cleansers Hair sprays Home perm Solutions Nail acrylics Nail polishes Removers Propane gas Rubbing alcohol Spot removers Rubbing Alcohol	Acetone Aerosol paints Contact cement Oil-based Woodstains Oil-based Paints Paint thinners Petroleum-based Solvents and Cleansers Turpentine Degreasers	Aerosol sprays Aerosol insect Repellants All fuels Antifreeze Barbeque Starters Brake fluid Car waxes Gas barbeques Kerosene Petroleum-based Transmission Fluid Oil

Hazard	Kitchen & Bathroom	Home Workshop	Garden & Garage
Reactive	Aerosol sprays Bleach and ammonia	Acetone Aerosol sprays Petroleum-based Solvents	Aerosol sprays All fuels Fuels for Garden tools
	Bleach when mixed with any degreasers Petroleum degreasers mixed with any degreaser acid or base Petroleum-based cylinder solvents		Propane
Toxic	Air fresheners Ammonia-based cleansers Bleach Carbon Disinfectants Drain cleansers Floor & furniture polishes removers Hair colorings Liquid cleansers Moth repellants Nail acrylics Oven cleansers Photographic chemicals Rubbing alcohol Rug & upholstery cleansers Silver & brass polishes Spot removers	Acetone Contact cement Paint brush cleansers Paint thinners Paint strippers Paints & wood stains Solvents Varnish Wood preservatives fluid	Aerosol sprays All fuels Antifreeze Brake fluid Car polishes & Tetrachloride Waxes Fertilizers Fungicides Insect repellants Insecticides Pool chemicals Transmission Used oil Weed killers

Alternatives

- Household use baking soda as a non-abrasive scouring powder. Use a vinegar and water mixture to clean windows and other smooth surfaces. For safe furniture polish, mix 1 tablespoon melted carnauba wax or 1 teaspoon lemon oil with 2 cups mineral oil. Rubbing toothpowder on wood will remove water stains. Rug and upholstery stains should be treated immediately with cold water or soda water. Drains can be kept clear by rinsing them with boiling water twice a week. Open clogged drains with a plunger or metal snake.

- Home Improvements Use latex or water-based paints wherever possible. Thin them with water. Re-use solvents. Give oil-based paints and wood stains to neighbors or recyclers.

- Garden Use peat moss, manure, or fish meal instead of chemical fertilizers. Use organic gardening techniques for weed control; pull weeds in the summer and cover the garden in the fall with organic mulch to discourage weed growth. Start a compost heap.

- Pest Control Prevent pest problems by growing healthy plants. Choose disease resistant plant varieties. Wash aphids off of plants with a strong stream of water. Use cardboard collars around transplants to protect them from cutworms. Place sticky bands on tree trunks in the fall to trap winter moths. Spray BTK for leaf eating caterpillars. Cover carrots with fine screening to keep away rust fly. Attract the beneficial insects that control pests by growing flowers rich in pollen and nectar.

Safe Disposal

- Don't dump hazardous wastes in water, soil, drains or your household garbage.

- Reduce hazardous wastes by buying environmentally safe products wherever possible. If you must buy hazardous products, buy only as much as you need. Use them up or give them to others who will use them.

- Re-use hazardous products whenever possible. Examples: Use old paint as a primer coat. Re-use turpentine after paint particles have settled to the bottom.

- Recycle everything you can. Used paint, motor oil, antifreeze, solvents and batteries are some of the products being recycled.

- Safe disposal options may be available through community programs or industry stewardship collection depots.

Responding to Oil Spills (refers to large spills, may not be applicable for small shops)

Oil Spill Response

The large, environmentally devastating oil spills of recent years such as the 1989 on Valdez incident have underscored the need for prompt, effective government and private sector response. Oil spills kill and injure plants and wildlife, and can often upset delicate ecological balances.

This environmental damage can threaten public health and welfare by endangering drinking water supplies and ruining commercial fishing industries. With oversight by the On-Scene Coordinator (OSC), the party responsible for the spill may spend millions of dollars to clean up the spill, restore damaged natural resources, and pay penalties. As many people know from news coverage of spills such as the Exxon Valdez, the U.S. Coast Guard is in charge of response to coastal spills. What many people do not realize, however, is that EPA responds to oil spills to inland waters (e.g., rivers, lakes) and adjoining shorelines. These inland spills can be as catastrophic as the more publicized coastal incidents. The 1988 collapse of an aboveground oil storage tank in Pennsylvania released almost one million gallons of diesel fuel into the Monongahela and Ohio Rivers, disrupting

water supplies, forcing the closing of schools and businesses, and inflicting serious ecological damage.

Laws and Regulations

EPA carries out its oil spill response activities as part of its responsibilities under section 311 of the Clean Water Act. Specifically, section 311 provides for oil spill reporting, response, enforcement, and funding and for measures to prevent oil spills from happening in the first place. These Clean Water Act provisions were expanded upon and strengthened by the Oil Pollution Act of 1990 (OPA). The oil spill regulations that EPA has issued to fulfill its Clean Water Act duties have two basic purposes: preventing spills from occurring, and ensuring a quick, effective cleanup of spills that do occur.

Laws for Oil Spill Responses: The Clean Water Act

Section 311 of the Clean Water Act was amended by the Oil Pollution Act of 1990 to require that EPA and the Coast Guard direct responses to oil spills that pose a substantial threat to public health and welfare. The Oil Pollution Act also added a requirement that vessels and fixed facilities prepare plans to prevent oil spills and to respond to spills that do occur.

Other provisions of section 311 of the Clean Water Act authorize EPA and the Coast Guard to:

- Establish criteria for notifying the Federal government of discharges of oil into U.S. waters;
- Direct and conduct responses to oil spills;
- Assess civil and criminal penalties for violation of oil spill laws; and
- Administer a Federal oil spill response fund.

Prevention: The Best Response

The easiest and simplest way to avoid the environmental and economic costs of oil spills is to keep them from happening in the first place. The Agency's Spill Prevention, Control and Countermeasures (SPCC) regulation requires certain non-transportation-related facilities (e.g., storage facilities, refineries) that store oil to prepare plans for the prevention and containment of oil spills. The U.S. Department of Transportation regulates transportation-related facilities (e.g., pipelines, shoreline loading facilities for vessels). Under the Agency's SPCC program, EPA OSCs, States and Technical Assistance Teams inspect hundreds of facilities each year. Inspectors examine the layout, organization, and structure of the facility and review the facility's SPCC plan to ensure compliance with the regulation.

Planning for an Oil Spill

Despite prevention efforts, oil spills do occur. Therefore, it is most important to be ready with a plan for minimizing the size of the spill and the amount of damage it causes. The National

Contingency Plan requires that Federal, State and Local officials as well as responsible parties plan for and work together to clean up spills quickly and effectively. Under the Clean Water Act, as amended by the OPA, facility owners and operators must have specific plans for response to a worst-case spill from their facilities. Periodically, EPA also inspects facilities' spill removal equipment. The OPA requires EPA and other Federal, State and Local officials to develop spill response plans for every inland area of the U.S. These Area Contingency Plans facilitate the coordination of response efforts when spills do occur. The OPA planning and inspection requirements assure that both government and responsible parties are prepared to respond effectively to dangerous spills.

When an Oil Spill Occurs

The Discharge of Oil Regulation (also known as the "sheen" rule under the Clean Water Act) states that whenever an oil spill occurs in U.S. waters that causes a discoloration or sheen on the surface of a body of water, the person in charge of the facility or vessel responsible for the spill must notify the National Response Center immediately at (800) 4248802. If the spill is in inland waters, the National Response Center will relay the information by telephone to an EPA OSC in the appropriate EPA Regional office so that the Agency can assess whether and how it should respond. EPA directs any responses to inland spills that pose a substantial threat to the public health or welfare, and has the authority to respond to any other discharges. Even where other State or Federal agencies assume control of the response, EPA provides advice and monitors response efforts. OSCs consider and apply a full range of resources and methods for responding to spills.

Mechanical methods - booms, skimmers, and containers may be used to recover the spilled oil and to store the oil until it can be disposed of or reused. Mechanical containment or recovery is the most common type of response action.

Chemical treatments may be employed to coagulate the oil for easier collection, or to direct the oil to a less sensitive location by dispersing it into tiny droplets. Biological techniques such as the introduction of microbes or microbe nutrients may be used to promote the natural microbial consumption and decomposition of oil.

The Agency maintains a list of chemical and biological products the National Contingency Plan Product Schedule that may be approved and used on particular spills. The list provides data available on the products, thus ensuring that responders have certain baseline information to use in their decision making.

EPA and the Coast Guard seek to recover spill response costs and damages from responsible parties whenever possible. When the party responsible for a spill cannot be determined or does not have the funds to cover response costs, the costs may be paid from the Oil Spill Liability.

Trust Fund. Fund monies are supplied by a five-cent-per-barrel fee on domestic and imported oil. The Fund provides up to $1 billion per incident for cleanup costs and other damages. An example of a Federal response to an inland oil spill is provided next.

Public Participation and Outreach

Getting Involved

EPA plays a vital role in protecting our environment, but this cannot be accomplished without assistance and cooperation from the public. Some important responsibilities of local communities are to notify the National Response Center ((800) 4248802) of any emergency incidents, be prepared for releases that do occur, assist with the response, and generally stay informed.
The Agency works with the public by informing local communities of emergency incidents and resulting response actions.

Informing the Community

The Agency responds to the public's need for information by answering questions directly, making presentations, and preparing and distributing publications. The National Contingency Plan describes specific requirements for community relations and public participation in emergency responses to releases of oil and hazardous substances. In the case of removal actions at hazardous waste sites, for example, EPA appoints a spokesperson who notifies the community of specific response actions, answers any questions, and updates the residents on progress at the site. An administrative record, or a repository of information on the site, must be established within 60 days. If the removal action is expected to continue for more than 120 days, the spokesperson will interview community groups to identify their concerns and prepare a community relations plan to address these concerns:

Taking Responsibility in Cleanup

In cleaning up oil spills or hazardous substance releases, EPA notifies the parties potentially responsible for the release to involve them as appropriate in the process. Local governments also are encouraged to participate in the response. Under the Superfund Amendments and Reauthorization Act of 1986, the Agency established a reimbursement program to help local governments cope with expenses that significantly exceed funds available for temporary emergency response measures.

Workshops and Publications

The Agency conducts workshops and seminars to keep Federal, State, and local regulators, the regulated community, trade groups, and the general public informed about EPA regulations and programs. EPA uses lectures, handout materials, question and answer sessions, hypothetical release scenarios, and computer demonstrations to convey important information.

EPA also prepares and distributes informational materials on releases of oil and hazardous substances, cleanup efforts, and related issues to a wide variety of audiences. Some examples include journal articles and question and answer booklets for the regulated community. EPA

headquarters and field personnel are kept up-to-date through bulletins on statutory requirements, response activities, and new regulations and policies. If you would like more information on how EPA's emergency response program works, please contact your EPA Regional office.

For answers to any technical or regulatory questions concerning emergency response to oil and hazardous substance releases, please contact the toll-free RCRA/Superfund Hotline at (800) 424-9346, or (703) 920-9810 in the Washington, D.C. metropolitan area. The Emergency Planning and Community Right-To-Know (EPCRA) Information Hotline will answer your questions concerning SARA Title III and chemical accident prevention issues; call toll-free at (800) 535-0202, or (703) 920-9877 in the Washington, D.C. metropolitan area. Specific questions on ERNS, the SPCC regulation, as well as requests for the National Contingency Plan Product Schedule, may be directed to the Emergency Response Division's Information Line at (202) 260-2342.

For printed information on CERCLA and SARA Title III, such as copies of rulemakings, as well as records supporting rulemakings, call the Agency's Superfund Docket at (202) 260-3046. The Public Information Center at the Agency answers inquiries from the public about EPA, its programs, and activities. For a variety of general, nontechnical information call (202) 260-7751.

Welding Operations in a Maintenance Department Environment

Conditions that directly affect safety & health in welding operations:

- Since welding and cutting are "hot" processes, the danger of fires and explosions are ever present concerns.
- Fire prevention is a major priority.

There are four acceptable options for preventing fires and explosions caused by welding & cutting processes:

- Move the combustibles away from the welding
- Move the welding away from the combustibles
- Protect the combustibles from exposure
- DON'T WELD OR CUT!

Separate the Combustibles from the Welding/Cutting Operation:

- Welding and cutting operations must be separated from combustibles by at least 35 feet.
- This distance should be multiplied by at least 2.5 when the welding/cutting operation is suspended over combustibles.

Protect the Combustibles From Welding/Cutting Operations:

- This option should only be chosen when the welding/cutting operation and the combustibles cannot be adequately separated.
- Protective barriers may include fire blankets, steel partitions, or other types of covers.

- A FIRE WATCHER should also be present.

Duties and Specifications for the Fire Watcher:

- The Fire Watcher must be adequately trained to operate firefighting equipment.
- The Fire Watcher must be properly instructed on what to do if a fire occurs.
- The Fire Watcher must remain at the task for at least 1/2 hour after the welding/cutting has been completed.

Special Notes for Preventing Fire & Explosions due to Welding or Cutting:

- Find out what's on the other side of the wall.
- Watch out for closed containers.
- Don't expose electric lines or hydraulic lines to heat.

Unsafe Equipment Promotes Occupational Accidents & Illnesses:

- Check the equipment thoroughly and often, especially after it has been moved.
- Check hoses, regulators, valves, power conductors, leads, transformers, and restraining devices.
- Keep the equipment clean and free of rust, moisture, and petroleum products.

Safety Means Communicating:

- Coordination of efforts promotes safety.
- Workers who are assigned tasks near welding/cutting processes must know how to avoid the associated risks.
- Welders must communicate with one another on safety matters such as ground connections, material stresses, etc.

Occupational Illnesses:

- Illnesses may be either acute or chronic
- Illnesses suffered by welders/cutters are generally caused by the hot process or a result of working in confined spaces
- You must know and understand the hazards associated with the materials to which the welder/cutter is exposed.

Compile ALL the MSDS:

- An MSDS must be available AT THE JOB SITE for every material and substance found on the work site.

- Each welder must be informed on the hazards associated with the materials and substances found on the job
- Each welder must be adequately protected from injury that may result from exposure to the job hazards Some MSDS Include:
    - Welding rods, fluxes, gases, and resins.
    - Base metals which are fabricated by the welding processes.
    - Coatings found on the base metal or close to the welding processes.
    - Watch out for chlorinated solvents, lead, nickel, chromium, cadmium, fluorine, tin, brass/bronze, copper, zinc, aluminum, vanadium, selenium, and silver.

Inherent Hazards Associated With Welding and Cutting:

- UV and IR light sources (lens shade)
- Thermal burns (gloves, shoes, hood)
- Heat stress (water, breaks, scheduling)
- Cuts (materials handling gloves)
- Trip/Fall injuries (housekeeping)
- "Struck by" injuries (shoes, hard hats)
- Those to which any other worker may be exposed

You **must** be familiar with and expect variations in the workplace:

- The nature and degree of exposure to hazards changes from day to day
- This is especially true in the construction industry
- The only way you can keep up with new developments is to get out of the office and into the work area
- *Remember*: no two jobs are the same.

* * * * * *

XIII. FIRE EXTINGUISHER TRAINING AND USE

Fire extinguishers and extinguishing material has been around for a long time. You've seen them everywhere, they're very useful and have saved many lives. But not everyone understands them or knows how to use them. If you were experiencing a flammable liquid fire, what type of extinguisher would be necessary to extinguish the fire? Water? Would you use an ABC type extinguisher or an ABCD type extinguisher?

Always remember that life safety is much more important than property. If you can't extinguish a fire safely, call the fire department and let them handle the situation. In the event of a small fire, call the fire department anyway, because small fires can quickly get out of hand and seconds count in the fire fighting business. Fire extinguishers are not designed to fight a large or spreading fire and even against small fires, extinguishers are useful only under the right conditions. We know that everyone takes fire extinguishers for granted because they aren't used on a frequent basis. You don't pay much attention to them because you know they'll be there in case of an emergency.

First of all, extinguishers must be inspected at least monthly. Be sure to retain these inspection records in your files. Inspect extinguishers to make sure they're clean and in serviceable condition, the pin is sealed on the handle to indicate it hasn't been used and of course, to check the correct pressure, if your extinguisher has a pressure gauge. Remember that once an extinguisher has been used, if only for a second - it must be completely serviced and recharged.

Extinguishers get damaged and may not work when the need arises, so check for visible damage to the container and the handle. You're also checking to make sure the extinguisher is located in its proper place. In the event an extinguisher is used or found to be defective, most organizations have extra extinguishers, to replace the damaged or defective extinguisher while it’s being repaired or serviced. Inspect all extinguishers at least monthly. Once a year, fire extinguishers must be inspected and service by an authorized service company. After the extinguishers have been inspected and serviced, the servicing company will issue a service tag. This tag is good for one year. During your monthly inspections, check these service tags, to make sure this tag is on the extinguisher and its current. If the tag is over a year old, it needs to be re-serviced.

Fire extinguishers come in all shapes and sizes, but you're probably most familiar with the red extinguishers. Many years ago, fire extinguishers looked like this. Actually, it was a bottle of water that was thrown at the fire. The bottle broke and hopefully cooled the fire. Later, evolved a water and acid solution extinguisher. This type of extinguisher was activated by turning the extinguisher upside down and the acid reacted with the water to build pressure and expel the extinguishing agent. We don't use these anymore because they're old and when activated, they have a tendency to explode when pressurized. If you have any of these types of extinguishers, don’t use them, as they could be very dangerous when used.

Today, we have a variety of extinguishers, each designed to fight different types of fires. Most are pressurized, with an inert gas that expels the extinguishing agent, such as dry chemical, carbon dioxide, foam, water mists or other agents. We use the word PASS to help you remember how to use an extinguisher. Pull the pin, Aim the nozzle, Squeeze the handle and Sweep from side to side. Pass. Remember we said these extinguishers were pressurized. This means you need to hold the extinguisher firmly, as the force of the expelled gas can be fairly strong, so hang onto the extinguisher if you're going to pull the pin and squeeze the handle. Also, if you've never used an extinguisher, the noise of the expelling gas can startle you, so be prepared.

Combustion is created by interaction of three basic elements. Heat or ignition, oxygen and fuel. We call it the fire triangle. To extinguish a fire, you have to interrupt one or more elements. Therefore, to kill a fire, one or more of these elements must be denied. You can exclude oxygen from the fire, remove the fuel on which the fire is feeding or lower the temperature. We have different types of extinguishers for each type or classes of fire. You probably know the different classes of fires, but as a review, let's look at them again.

First, there's CLASS A FIRES. Generally they have glowing embers as a by-product. A persons' house on fire could be classified as a class 'A' fire. Wood, clothing, curtains, paper or similar materials are considered Class A Fires. Water is the extinguishing agent on class 'a' fires, which cools the temperature of the fire until it's extinguished.

CLASS B FIRES include flammable liquids and gases, such as gasoline, oil, paints, grease, acetylene and thinners. To extinguish a class B fire, the objective is to remove the oxygen from the fire. Carbon dioxide, or CO2 extinguishing agents displace the oxygen of the fire. Here is a CO2 extinguisher in action. It puts the fire out very quickly. These extinguishers are filled with CO2 which is a non-flammable carbon dioxide gas under extreme pressure. You can recognize a CO2 extinguisher by it hard plastic or metal horn and lack of pressure gauge. The pressure in the cylinder is so great that when you use it, bits of dry ice may shoot out the horn. CO2 extinguishes the fire by displacing oxygen or taking away the oxygen element of the fire triangle. It is a clean extinguishing agent and generally will not leave a residue on sensitive electronic or other equipment. It is also non-conductive, which means it can be used for electrical fires. CO2 may be ineffective on Class A fires, as it may not displace enough oxygen to successfully put out the fire.

Class 'C' is for fires involving electricity. Motors, compressors, pumps, electrical tools, fuse boxes, appliances and anything energized with electricity. You wouldn't want to use water on electrical fires as the electrical shock hazard could be as damaging as the fire itself.

Class 'D' fires are those fires involving exotic metals, such as beryllium, sodium, titanium, magnesium and other metals that can burn. Class 'D' extinguishers smother the fire with a dry chemical to extinguish burning metals.

In most cases now, his most familiar type of extinguisher is the ABC type. Why is it called ABC? Primarily because this extinguisher uses a dry chemical powder that extinguishes CLASS 'A', CLASS 'B' and CLASS 'C' FIRES.

There's another extinguishing agent called Halon, which is a clean, chemical extinguisher that was designed for computers, electronic equipment and other sensitive equipment. Halon is no longer being used, and has been banned in the United States and other countries, due to the potential damage to the environment by depleting the ozone. There are new extinguishers and systems that will replace Halon, such as a “water-mist” type extinguishing agent. Water mist is non-toxic and has no ozone depletion potential. Water mist is electrically non-conductive and enhances the cooling and soaking characteristics of the agent. It is designed to replace Halon in health care facilities, electronic equipment manufacturing and similar environments.
Good housekeeping is one of the most important parts of fire prevention. Clean, neat and organized. Don't forget to keep closets, janitorial rooms and other equipment areas clean, neat and organized. Store flammable liquids in approved containers and don't leave paint cans, thinners or solvents around your work area. Flammables and combustibles should be kept in safety containers and properly stored when not in use. Check your equipment, especially your electrical cords, tools, plugs and receptacles, to make sure they're in serviceable condition. If you work with flammable liquids, pay attention to spark producing tools, electrical motors and other items that can ignite flammable vapors.

Do you know what makes a safety container for flammable liquids? An approved flammable liquid container has a spring loaded lid, to prevent spills, but will allow the liquid in the container to expand by slightly releasing the lid enough for small amounts of vapors to escape. It allows excess pressure to escape, but won't spill the liquid. Gasoline cans without spring loaded lids, cannot breath, therefore expansion of the liquid can cause the can to burst. Perhaps the most important part of a safety container is the flame arrestor. It's a mesh screen inside the container that looks like a filter. It's designed to prevent flames from returning inside the container causing an explosion. This type of container, that is sold in almost any hardware or gas station today does not have a flame arrestor. If you're pouring a flammable liquid out of this type of container and a spark or other ignition source causes a fire, the flame can be sucked back into the can causing a violent explosion. Now you know the difference in a safety container and a potential bomb. We didn't even mention bonding and grounding of flammable liquid containers to reduce the potential of explosion due to static electricity. That information comes in another program.

How about those shop rags, oily clothing and other fire hazards? Be sure to put soiled rags into safety waste cans. Metal cans with metal lids. You can create spontaneous combustion by leaving greasy rags sitting in a corner or stored in a container other than a metal container that has a metal lid. We could continue with fire prevention, such as not blocking exits with materials, smoking only in authorized areas, emptying trash daily, knowing where exits are located and keeping your equipment clean to prevent residue buildup and fire potential, but we don't have time to cover these subjects in this program. They're common sense items and the importance of preventing fires, rather than extinguishing them is well known.

Life safety is paramount - your life and the lives of others. Don't take chances. If you're not sure if you can extinguish a fire safely, leave the area and close the door behind you, to keep the fire from spreading. Next, fully understand that smoke from any type of fire kills more people than the actual fire. Never try to extinguish a fire if smoke presents any hazard. The fumes and gases of smoke are very toxic and can kill you. When fighting a fire with an extinguisher, always keep your back toward an available escape route. Next, remember the word PASS. This word is a reminder to: Pull the pin, Aim the nozzle, Squeeze the handle and Sweep from side to side.

Remove the extinguisher from its mount and take it to the fire. Pull the pin, then aim the extinguisher nozzle towards the base of the fire, standing approximately 6 to 10 feet from the fire. Then squeeze the handle. If you stand too close to the fire and squeeze the handle, the force of the pressurized gas and extinguishing material could actually spread the flames. Stand away, aim the nozzle towards the base of the flame, squeeze the handle, sweeping from side to side then move closer. After the fire is out, check to make sure it's really out. Don't leave the area until you have verified that a fire will not re-ignite. Many times, fires start up again after you think they're out. That's another reason for calling the fire department. If you are successful in extinguishing the fire, the fire department professionals can double check to make sure it's fully extinguished and they're happier if you already have the fire extinguished. They get real upset if you don't call them until the fire gets out of hand. It's also a good idea to communicate and train with your local fire department. This gives them better training and familiarity at your facilities, in the event of an emergency. Fire extinguisher service vendors often provide hands on training with the extinguishers, as well.

Don't be afraid to let your supervisor know you never have used an extinguisher. Most people haven't used an extinguisher and extinguishing a fire with an extinguisher does require a little training and practice.

It's important to remember the classes of fire and why certain extinguishing agents work better on certain types of fires. Remember we stated that some extinguishing agents, such as water, cools the temperature of the fire until it's extinguished. Some agents, such as carbon dioxide removes oxygen from the fire. This is important because if you're in an area where large amounts of carbon dioxide are used to extinguish a fire, there will be insufficient oxygen for you to breathe. There are other fire suppression systems, such as a foam extinguishing system. You can see here, a gasoline loading dock's foam system was activated and it acts like a sprinkler system, covering the entire area with foam. There are dry chemical and CO2 systems, commonly used in kitchens, to automatically suppress a fire. You should be familiar with any automatic systems in your area and know how they work and what type of extinguishing agent is used. Knowing and understanding classes of fires, types of extinguishing agents and how to use fire extinguishers is extremely important. This knowledge can save your life in case of emergency. Remember that life safety is paramount. Never try to extinguish a fire where your life or the lives of others are in jeopardy. Get out and leave the fire fighting to the professionals. When evacuating a building, don't use elevators and of course, don't panic. Keep calm and put your emergency plan in action.

XIV. ACCIDENT INVESTIGATION

Thousands of accidents occur throughout the United States every day. The failure of people, equipment, supplies, or surroundings to behave or react as expected causes most of the accidents. Accident investigations determine how and why these failures occur. By using the information gained through an investigation, a similar or perhaps more disastrous accident may be prevented. Conduct accident investigations with accident prevention in mind. Investigations are NOT to place blame.

An accident is any unplanned event that results in personal injury or in property damage. When the personal injury requires little or no treatment, it is minor. If it results in a fatality or in a permanent total, permanent partial, or temporary total (lost-time) disability, it is serious. Similarly, property damage may be minor or serious. Investigate all accidents regardless of the extent of injury or damage.

Accidents are part of a broad group of events that adversely affect the completion of a task. These events are incidents. For simplicity, the procedures discussed in later sections refer only to accidents. They are, however, also applicable to incidents.

This discussion introduces the reader to basic accident investigation procedures and describes accident analysis techniques.

Accident Prevention

Accidents are usually complex. An accident may have 10 or more events that can be causes. A detailed analysis of an accident will normally reveal three cause levels: basic, indirect, and direct. At the lowest level, an accident results only when a person or object receives an amount of energy or hazardous material that cannot be absorbed safely. This energy or hazardous material is the *direct cause* of the accident. The direct cause is usually the result of one or more unsafe acts or unsafe conditions, or both. Unsafe acts and conditions are the indirect cause or symptoms. In turn, indirect causes are usually traceable to poor management policies and decisions, or to personal or environmental factors. These are the basic causes.

In spite of their complexity, most accidents are preventable by eliminating one or more causes. Accident investigations determine not only what happened, but also how and why. The information gained from these investigations can prevent recurrence of similar or perhaps more disastrous accidents. Accident investigators are interested in each event as well as in the sequence of events that led to an accident. The accident type is also important to the investigator. The recurrence of accidents of a particular type or those with common causes shows areas needing special accident prevention emphasis.

Investigative Procedures

The actual procedures used in a particular investigation depend on the nature and results of the accident. The agency having jurisdiction over the location determines the administrative

procedures. In general, responsible officials will appoint an individual to be in charge of the investigation. The investigator uses most of the following steps:
Define the scope of the investigation:

- Select the investigators. Assign specific tasks to each (preferably in writing).
- Present a preliminary briefing to the investigating team, including:
    - Description of the accident, with damage estimates.
    - Normal operating procedures.
    - Maps (local and general).
    - Location of the accident site.
    - List of witnesses.
    - Events that preceded the accident.
- Visit the accident site to get updated information.
    - Inspect the accident site.
    - Secure the area. Do not disturb the scene unless a hazard exists.
    - Prepare the necessary sketches and photographs. Label each carefully and keep accurate records.
- Interview each victim and witness. Also interview those who were present before the accident and those who arrived at the site shortly after the accident. Keep accurate records of each interview. Use a tape recorder if desired and if approved.
- Determine:
    - What was not normal before the accident.
    - Where the abnormality occurred.
    - When it was first noted.
    - How it occurred.
- Analyze the data obtained. Repeat any of the prior steps, if necessary.
- Determine:
    - Why the accident occurred.
    - A likely sequence of events and probable causes (direct, indirect, basic).
- Alternative sequences.
- Check each sequence against the data.
- Determine the most likely sequence of events and the most probable causes.
- Conduct a post-investigation briefing.

- Prepare a summary report, including the recommended actions to prevent a recurrence. Distribute the report according to applicable instructions.

- An investigation is not complete until all data are analyzed and a final report is completed. In practice, the investigative work, data analysis, and report preparation proceed simultaneously over much of the time spent on the investigation.

Fact-Finding

Gather evidence from many sources during an investigation. Get information from witnesses and reports as well as by observation. Interview witnesses as soon as possible after an accident. Inspect the accident site before any changes occur. Take photographs and make sketches of the accident scene. Record all pertinent data on maps. Get copies of all reports. Documents containing normal operating procedures, flow diagrams, maintenance charts, or reports of difficulties or abnormalities are particularly useful. Keep complete and accurate notes in a bound notebook. Record pre-accident conditions, the accident sequence, and post-accident conditions. In addition, document the location of victims, witnesses, machinery, energy sources, and hazardous materials.

In some investigations, a particular physical or chemical law, principle, or property may explain a sequence of events. Include laws in the notes taken during the investigation or in the later analysis of data. In addition, gather data during the investigation that may lend itself to analysis by these laws, principles, or properties. An appendix in the final report can include an extended discussion.

Interviews

In general, experienced personnel should conduct interviews. If possible, the team assigned to this task should include an individual with a legal background. In conducting interviews, the team should:

- Appoint a speaker for the group.
- Get preliminary statements as soon as possible from all witnesses.
- Locate the position of each witness on a master chart (including the direction of view).
- Arrange for a convenient time and place to talk to each witness.
- Explain the purpose of the investigation (accident prevention) and put each witness at ease.
- Listen, let each witness speak freely, and be courteous and considerate.
- Take notes without distracting the witness. Use a tape recorder only with consent of the witness.
- Use sketches and diagrams to help the witness.
- Emphasize areas of direct observation. Label hearsay accordingly.
- Be sincere and do not argue with the witness.

- Record the exact words used by the witness to describe each observation. Do not "put words into a witness' mouth."
- Word each question carefully and be sure the witness understands.
- Identify the qualifications of each witness (name, address, occupation, years of experience, etc.).
- Supply each witness with a copy of his or her statements. Signed statements are desirable.

After interviewing all witnesses, the team should analyze each witness' statement. They may wish to re-interview one or more witnesses to confirm or clarify key points. While there may be inconsistencies in witness' statements, investigators should assemble the available testimony into a logical order. Analyze this information along with data from the accident site.

Not all people react in the same manner to a particular stimulus. For example, a witness within close proximity to the accident may have an entirely different story from one who saw it at a distance. Some witnesses may also change their stories after they have discussed it with others. The reason for the change may be additional clues.

A witness who has had a traumatic experience may not be able to recall the details of the accident. A witness who has a vested interest in the results of the investigation may offer biased testimony. Finally, eyesight, hearing, reaction time, and the general condition of each witness may affect his or her powers of observation. A witness may omit entire sequences because of a failure to observe them or because their importance was not realized.

Problem Solving Techniques

Accidents represent problems that must be solved through investigations. Several formal procedures solve problems of any degree of complexity. This section discusses two of the most common procedures: Change Analysis and Job Safety Analysis.

Change Analysis

As its name implies, this technique emphasizes change. To solve a problem, an investigator must look for deviations from the norm. Consider all problems to result from some unanticipated change. Make an analysis of the change to determine its causes. Use the following steps in this method:

- Define the problem (What happened?).
- Establish the norm (What should have happened?).
- Identify, locate, and describe the change (What, where, when, to what extent).
- Specify what was and what was not affected.
- Identify the distinctive features of the change.

- List the possible causes.
- Select the most likely causes.

Job Safety Analysis

Job safety analysis (JSA) is part of many existing accident prevention programs. In general, JSA breaks a job into basic steps, and identifies the hazards associated with each step. The JSA also prescribes controls for each hazard. A JSA is a chart listing these steps, hazards, and controls. Review the JSA during the investigation if a JSA has been conducted for the job involved in an accident. Perform a JSA if one is not available. Perform a JSA as a part of the investigation to determine the events and conditions that led to the accident.

Report of Investigation

As noted earlier, an accident investigation is not complete until a report is prepared and submitted to proper authorities. Special report forms are available in many cases. Other instances may require a more extended report. Such reports are often very elaborate and may include a cover page, a title page, an abstract, a table of contents, a commentary or narrative portion, a discussion of probable causes, and a section on conclusions and recommendations.

The following outline has been found especially useful in developing the information to be included in the formal report:

- Background Information:
    - Where and when the accident occurred
    - Who and what were involved
    - Operating personnel and other witnesses
- Account of the Accident (What happened?)
    - Sequence of events
    - Extent of damage
    - Accident type
    - Agency or source (of energy or hazardous material)
- Discussion (Analysis of the Accident – HOW; WHY)
    - Direct causes (energy sources; hazardous materials)
    - Indirect causes (unsafe acts and conditions)
    - Basic causes (management policies; personal or environmental factors)

- Recommendations (to prevent a recurrence) for immediate and long-range action to remedy:
    - Basic causes
    - Indirect causes
    - Direct causes (such as reduced quantities or protective equipment or structures)

Summary

Thousands of accidents occur daily throughout the United States. These result from a failure of people, equipment, supplies, or surroundings to behave as expected. A successful accident investigation determines not only what happened, but also finds how and why the accident occurred. Investigations are an effort to prevent a similar or perhaps more disastrous sequence of events.

Most accident investigations follow formal procedures. This discussion covered two of the most common procedures: Change Analysis and Job Safety Analysis. An investigation is not complete however, until completion of a final report. Responsible officials can then use the resulting information and recommendations to prevent future accidents.

* * * * * * * *

XV. SELF-INSPECTION CHECKLIST

Note: This checklist covers a majority of industries, therefore, may be too extensive for a small organization. It is included herein primarily for training purposes.

Safety and Health Program

- Do you have an active safety and health program in operation that deals with general safety and health program elements as well as management of hazards specific to your worksite?

- Is one person clearly responsible for the overall activities of the safety and health program?

- Do you have a safety committee or group made up of management and labor representatives that meet regularly and reports in writing on its activities?

- Do you have a working procedure for handling in-house employee complaints regarding safety and health?

- Are you keeping your employees advised of the successful effort and accomplishments you and/or your safety committee have made in assuring they will have a workplace that is safe and healthful?

- Have you considered incentives for employees or workgroups who have excelled in reducing workplace injuries/illnesses?

Personal Protective Equipment

- Are employers assessing the workplace to determine if hazards that require the use of personal protective equipment (for example, head, eye, face, hand, or foot protection) are present or are likely to be present?

- If hazards or the likelihood of hazards are found, are employers selecting and having affected employees use properly fitted personal protective equipment suitable for protection from these hazards?

- Has the employer been trained on PPE procedures; that is, what PPE is necessary for a job task, when they need it, and how to properly adjust it?

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

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

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

- Are protective gloves, aprons, shields, or other means provided and required where employees could be cut or where there is reasonably anticipated exposure to corrosive liquids, chemicals, blood, or other potentially infectious materials? See 29 CFR 1910.1030(b) for the definition of "other potentially infectious materials."

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

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

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

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

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

- Do you have eye wash facilities and a quick drench shower within the work area where employees are exposed to injurious corrosive materials? Where special equipment is needed for electrical workers, is it available?

- Where food or beverages are consumed on the premises, are they consumed in areas where there is no exposure to toxic material, blood, or other potentially infectious materials?

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

- Are adequate work procedures, protective clothing and equipment provided and used when cleaning up spilled toxic or otherwise hazardous materials or liquids?

- Are there appropriate procedures in place for disposing of or decontaminating personal protective equipment contaminated with, or reasonably anticipated to be contaminated with, blood or other potentially infectious materials?

Flammable and Combustible Materials

- Are combustible scrap, debris, and waste materials (oily rags, etc.) stored in covered metal receptacles and removed from the worksite promptly?

- Is proper storage practiced to minimize the risk of fire including spontaneous combustion?

- Are approved containers and tanks used for the storage and handling of flammable and combustible liquids?

- Are all connections on drums and combustible liquid piping, vapor and liquid tight?
- Are all flammable liquids kept in closed containers when not in use (for example, parts cleaning tanks, pans, etc.)?
- Are bulk drums of flammable liquids grounded and bonded to containers during dispensing?
- Do storage rooms for flammable and combustible liquids have explosion-proof lights?
- Do storage rooms for flammable and combustible liquids have mechanical or gravity ventilation?
- Is liquefied petroleum gas stored, handled, and used in accordance with safe practices and standards?
- Are "NO SMOKING" signs posted on liquefied petroleum gas tanks?
- Are liquefied petroleum storage tanks guarded to prevent damage from vehicles?
- Are all solvent wastes and flammable liquids kept in fire-resistant, covered containers until they are removed from the worksite?
- Is vacuuming used whenever possible rather than blowing or sweeping combustible dust? Are firm separators placed between containers of combustibles or flammables, when stacked one upon another, to assure their support and stability?
- Are fuel gas cylinders and oxygen cylinders separated by distance, and fire-resistant barriers, while in storage?
- Are fire extinguishers selected and provided for the types of materials in areas where they are to be used?
    - Class A Ordinary combustible material fires.
    - Class B Flammable liquid, gas or grease fires.
    - Class C Energized-electrical equipment fires.
- Are appropriate fire extinguishers mounted within 75 feet of outside areas containing flammable liquids, and within 10 feet of any inside storage area for such materials?
- Are extinguishers free from obstructions or blockage?
- Are all extinguishers serviced, maintained and tagged at intervals not to exceed 1 year?
- Are all extinguishers fully charged and in their designated places?

- Where sprinkler systems are permanently installed, are the nozzle heads so directed or arranged that water will not be sprayed into operating electrical switch boards and equipment?

- Are "NO SMOKING" signs posted where appropriate in areas where flammable or combustible materials are used or stored?

- Are safety cans used for dispensing flammable or combustible liquids at a point of use?

- Are all spills of flammable or combustible liquids cleaned up promptly?

- Are storage tanks adequately vented to prevent the development of excessive vacuum or pressure as a result of filling, emptying, or atmosphere temperature changes?

- Are storage tanks equipped with emergency venting that will relieve excessive internal pressure caused by fire exposure?

- Are "NO SMOKING" rules enforced in areas involving storage and use of hazardous materials?

Hand and Portable Powered Tools

Hand Tools and Equipment

- Are all tools and equipment (both company and employee owned) used by employees at their workplace in good condition?

- Are hand tools such as chisels and punches, which develop mushroomed heads during use, reconditioned or replaced as necessary?

- Are broken or fractured handles on hammers, axes and similar equipment replaced promptly?

- Are worn or bent wrenches replaced regularly?

- Are appropriate handles used on files and similar tools?

- Are employees made aware of the hazards caused by faulty or improperly used hand tools?

- Are appropriate safety glasses, face shields, etc. used while using hand tools or equipment which might produce flying materials or be subject to breakage?

- Are jacks checked periodically to ensure they are in good operating condition?

- Are tool handles wedged tightly in the head of all tools?
- Are tool cutting edges kept sharp so the tool will move smoothly without binding or skipping?
- Are tools stored in dry, secure locations where they won't be tampered with?
- Is eye and face protection used when driving hardened or tempered spuds or nails?

Portable (Power Operated) Tools and Equipment

- Are grinders, saws and similar equipment provided with appropriate safety guards?
- Are power tools used with the correct shield, guard, or attachment, recommended by the manufacturer?
- Are portable circular saws equipped with guards above and below the base shoe? Are circular saw guards checked to assure they are not wedged up, thus leaving the lower portion of the blade unguarded?
- Are rotating or moving parts of equipment guarded to prevent physical contact?
- Are all cord-connected, electrically operated tools and equipment effectively grounded or of the approved double insulated type?
- Are effective guards in place over belts, pulleys, chains, sprockets, on equipment such as concrete mixers, and air compressors?
- Are portable fans provided with full guards or screens having openings ½ inch or less?
- Is hoisting equipment available and used for lifting heavy objects, and are hoist ratings and characteristics appropriate for the task?
- Are ground-fault circuit interrupters provided on all temporary electrical 15 and 20 ampere circuits, used during periods of construction?
- Are pneumatic and hydraulic hoses on power operated tools checked regularly for deterioration or damage?

Powder-Actuated Tools

- Are employees who operate powder-actuated tools trained in their use and carry a valid operator's card?
- Is each powder-actuated tool stored in its own locked container when not being used?

- Is a sign at least 7 inches by 10 inches with bold face type reading "POWDER-ACTUATED TOOL IN USE" conspicuously posted when the tool is being used?

- Are powder-actuated tools left unloaded until they are actually ready to be used?

- Are powder-actuated tools inspected for obstructions or defects each day before use?

- Do powder-actuated tool operators have and use appropriate personal protective equipment such as hard hats, safety goggles, safety shoes and ear protectors?

Lockout/Tagout Procedures

- Is all machinery or equipment capable of movement, required to be de-energized or disengaged and locked-out during cleaning, servicing, adjusting or setting up operations, whenever required?

- Where the power disconnecting means for equipment does not also disconnect the electrical control circuit:

- Are the appropriate electrical enclosures identified?

- Is means provided to assure the control circuit can also be disconnected and locked-out?

- Is the locking-out of control circuits in lieu of locking-out main power disconnects prohibited?

- Are all equipment control valve handles provided with a means for locking-out?

- Does the lock-out procedure require that stored energy (mechanical, hydraulic, air, etc.) be released or blocked before equipment is locked-out for repairs?

- Are appropriate employees provided with individually keyed personal safety locks?

- Are employees required to keep personal control of their key(s) while they have safety locks in use?

- Is it required that only the employee exposed to the hazard, place or remove the safety lock?

- Is it required that employees check the safety of the lock-out by attempting a startup after making sure no one is exposed?

- Are employees instructed to always push the control circuit stop button immediately after checking the safety of the lock-out?

- Is there a means provided to identify any or all employees who are working on locked-out equipment by their locks or accompanying tags?

- Are a sufficient number of accident preventive signs or tags and safety padlocks provided for any reasonably foreseeable repair emergency?

- When machine operations, configuration or size requires the operator to leave his or her control station to install tools or perform other operations, and that part of the machine could move if accidentally activated, is such element required to be separately locked or blocked out?

- In the event that equipment or lines cannot be shut down, locked-out and tagged, is a safe job procedure established and rigidly followed?

Confined Spaces

- Are confined spaces thoroughly emptied of any corrosive or hazardous substances, such as acids or caustics, before entry?

- Are all lines to a confined space, containing inert, toxic, flammable, or corrosive materials valved off and blanked or disconnected and separated before entry?

- Are all impellers, agitators, or other moving parts and equipment inside confined spaces locked-out if they present a hazard?

- Is either natural or mechanical ventilation provided prior to confined space entry?

- Are appropriate atmospheric tests performed to check for oxygen deficiency, toxic substances and explosive concentrations in the confined space before entry?

- Is adequate illumination provided for the work to be performed in the confined space?

- Is the atmosphere inside the confined space frequently tested or continuously monitored during conduct of work? Is there an assigned safety standby employee outside of the confined space. When required, whose sole responsibility is to watch the work in progress, sound an alarm if necessary, and render assistance?

- Is the standby employee appropriately trained and equipped to handle an emergency?

- Is the standby employee or other employees prohibited from entering the confined space without lifelines and respiratory equipment if there is any question as to the cause of an emergency?

- Is approved respiratory equipment required if the atmosphere inside the confined space cannot be made acceptable?

- Is all portable electrical equipment used inside confined spaces either grounded and insulated, or equipped with ground fault protection?

- Before gas welding or burning is started in a confined space, are hoses checked for leaks, compressed gas bottles forbidden inside of the confined space, torches lighted only outside of the confined area and the confined area tested for an explosive atmosphere each time before a lighted torch is to be taken into the confined space?

- If employees will be using oxygen-consuming equipment-such as salamanders, torches, and furnaces, in a confined space-is sufficient air provided to assure combustion without reducing the oxygen concentration of the atmosphere below 19.5 percent by volume?

- Whenever combustion-type equipment is used in a confined space, are provisions made to ensure the exhaust gases are vented outside of the enclosure?

- Is each confined space checked for decaying vegetation or animal matter which may produce methane?

- Is the confined space checked for possible industrial waste which could contain toxic properties?

- If the confined space is below the ground and near areas where motor vehicles will be operating, is it possible for vehicle exhaust or carbon monoxide to enter the space?

Electrical

- Do you specify compliance with OSHA for all contract electrical work?

- Are all employees required to report as soon as practicable any obvious hazard to life or property observed in connection with electrical equipment or lines?

- Are employees instructed to make preliminary inspections and/or appropriate tests to determine what conditions exist before starting work on electrical equipment or lines?

- When electrical equipment or lines are to be serviced, maintained or adjusted, are necessary switches opened, locked-out and tagged whenever possible?

- Are portable electrical tools and equipment grounded or of the double insulated type?

- Are electrical appliances such as vacuum cleaners, polishers, and vending machines grounded?

- Do extension cords being used have a grounding conductor?

- Are multiple plug adaptors prohibited?

- Are ground-fault circuit interrupters installed on each temporary 15 or 20 ampere, 120 volt AC circuit at locations where construction, demolition, modifications, alterations or excavations are being performed?

- Are all temporary circuits protected by suitable disconnecting switches or plug connectors at the junction with permanent wiring?

- Do you have electrical installations in hazardous dust or vapor areas? If so, do they meet the National Electrical Code (NEC) for hazardous locations?

- Is exposed wiring and cords with frayed or deteriorated insulation repaired or replaced promptly?

- Are flexible cords and cables free of splices or taps?

- Are clamps or other securing means provided on flexible cords or cables at plugs, receptacles, tools, equipment, etc., and is the cord jacket securely held in place? Are all cord, cable and raceway connections intact and secure?

- In wet or damp locations, are electrical tools and equipment appropriate for the use or location or otherwise protected?

- Is the location of electrical power lines and cables (overhead, underground, under floor, other side of walls) determined before digging, drilling or similar work is begun?

- Are metal measuring tapes, ropes, hand lines or similar devices with metallic thread woven into the fabric prohibited where they could come in contact with energized parts of equipment or circuit conductors?

- Is the use of metal ladders prohibited in areas where the ladder or the person using the ladder could come in contact with energized parts of equipment, fixtures or circuit conductors?

- Are all disconnecting switches and circuit breakers labeled to indicate their use or equipment served?

- Are disconnecting means always opened before fuses are replaced?

- Do all interior wiring systems include provisions for grounding metal parts of electrical raceways, equipment and enclosures?

- Are all electrical raceways and enclosures securely fastened in place?

- Are all energized parts of electrical circuits and equipment guarded against accidental contact by approved cabinets or enclosures?

- Is sufficient access and working space provided and maintained about all electrical equipment to permit ready and safe operations and maintenance?

- Are all unused openings (including conduit knockouts) in electrical enclosures and fittings closed with appropriate covers, plugs or plates?

- Are electrical enclosures such as switches, receptacles, and junction boxes, provided with tight fitting covers or plates?

- Are disconnecting switches for electrical motors in excess of two horsepower, capable of opening the circuit when the motor is in a stalled condition, without exploding? (Switches must be horsepower rated equal to or in excess of the motor hp rating.) Is low voltage protection provided in the control device of motors driving machines or equipment which could cause probable injury from inadvertent starting?

- Is each motor disconnecting switch or circuit breaker located within sight of the motor control device?

- Is each motor located within sight of its controller or the controller disconnecting means capable of being locked in the open position or is a separate disconnecting means installed in the circuit within sight of the motor?

- Is the controller for each motor in excess of two horsepower, rated in horsepower equal to or in excess of the rating of the motor it serves?

- Are employees who regularly work on or around energized electrical equipment or lines instructed in the cardiopulmonary resuscitation (CPR) methods?

- Are employees prohibited from working alone on energized lines or equipment over 600 volts?

Walking-Working Surfaces

General Work Environment

- Is a documented, functioning housekeeping program in place?
- Are all worksites clean, sanitary, and orderly?
- Are work surfaces kept dry or is appropriate means taken to assure the surfaces are slip-resistant?
- Are all spilled hazardous materials or liquids, including blood and other potentially infectious materials, cleaned up immediately and according to proper procedures?
- Is combustible scrap, debris and waste stored safely and removed from the worksite properly?
- Is all regulated waste, as defined in the OSHA bloodborne pathogens standard (1910.1030), discarded according to federal, state, and local regulations?
- Are accumulations of combustible dust routinely removed from elevated surfaces including the overhead structure of buildings, etc.?
- Is combustible dust cleaned up with a vacuum system to prevent the dust from going into suspension?
- Is metallic or conductive dust prevented from entering or accumulating on or around electrical enclosures or equipment?
- Are covered metal waste cans used for oily and paint-soaked waste?

Walkways

- Are aisles and passageways kept clear?
- Are aisles and walkways marked as appropriate?
- Are wet surfaces covered with non-slip materials?
- Are holes in the floor, sidewalk or other walking surface repaired properly, covered or otherwise made safe?
- Is there safe clearance for walking in aisles where motorized or mechanical handling equipment is operating?

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

- Are spilled materials cleaned up immediately?

- Are changes of direction or elevation readily identifiable?

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

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

- Are standard guardrails provided wherever aisle or walkway surfaces are elevated more than 30 inches above any adjacent floor or the ground?

- Are bridges provided over conveyors and similar hazards?

Floor and Wall Openings

- Are floor openings guarded by a cover, a guardrail, or equivalent on all sides (except at entrance to stairways or ladders)?

- Are toe-boards installed around the edges of permanent floor openings (where persons may pass below the opening)?

- Are skylight screens of such construction and mounting that they will withstand a load of at least 200 pounds?

- Is the glass in the windows, doors, glass walls, etc., which are subject to human impact, of sufficient thickness and type for the condition of use?

- Are grates or similar type covers over floor openings such as floor drains of such design that foot traffic or rolling equipment will not be affected by the grate spacing?

- Are unused portions of service pits and pits not actually in use either covered or protected by guardrails or equivalent?

- Are manhole covers, trench covers and similar covers, plus their supports designed to carry a truck rear axle load of at least 20,000 pounds when located in roadways and subject to vehicle traffic?

- Are floor or wall openings in fire resistive construction provided with doors or covers compatible with the fire rating of the structure and provided with a self-closing feature when appropriate?

Stairs and Stairways

- Are standard stair rails or handrails on all stairways having four or more risers?
- Are all stairways at least 22 inches wide?
- Do stairs have landing platforms not less than 30 inches in the direction of travel and extend 22 inches in width at every 12 feet or less of vertical rise?
- Do stairs angle no more than 50 and no less than 30 degrees?
- Are step risers on stairs uniform from top to bottom?
- Are steps on stairs and stairways designed or provided with a surface that renders them slip resistant?
- Are stairway handrails located between 30 and 34 inches above the leading edge of stair treads?
- Do stairway handrails have at least 3 inches of clearance between the handrails and the wall or surface they are mounted on?
- Where doors or gates open directly on a stairway, is there a platform provided so the swing of the door does not reduce the width of the platform to less than 21 inches?
- Where stairs or stairways exit directly into any area where vehicles may be operated, are adequate barriers and warnings provided to prevent employees stepping into the path of traffic?
- Do stairway landings have a dimension measured in the direction of travel, at least equal to the width of the stairway?

Elevated Surfaces

- Are signs posted, when appropriate, showing the elevated surface load capacity?
- Are surfaces elevated more than 30 inches above the floor or ground provided with standard guardrails?
- Are all elevated surfaces (beneath which people or machinery could be exposed to falling objects) provided with standard 4-inch toe-boards?

- Is a permanent means of access and egress provided to elevated storage and work surfaces?

- Is required headroom provided where necessary?

- Is material on elevated surfaces piled, stacked or racked in a manner to prevent it from tipping, falling, collapsing, rolling or spreading?

- Are dock boards or bridge plates used when transferring materials between docks and trucks or rail cars?

Hazard Communication

- Is there a list of hazardous substances used in your workplace?

- Is there a written hazard communication program dealing with Material Safety Data Sheets (MSDS), labeling, and employee training?

- Is each container for a hazardous substance (i.e., vats, bottles, storage tanks, etc.) labeled with product identity and a hazard warning (communication of the specific health hazards and physical hazards)?

- Is there a Material Safety Data Sheet readily available for each hazardous substance used?

- Is there an employee training program for hazardous substances?

- Does this program include:

    - An explanation of what an MSDS is and how to use and obtain one?
    - MSDS contents for each hazardous substance or class of substances?
    - Explanation of "Right to Know?"

- Identification of where an employee can see the employer's written hazard communication program and where hazardous substances are present in their work areas?

- The physical and health hazards of substances in the work area, and specific protective measures to be used?

- Details of the hazard communication program, including how to use the labeling system and MSDS's?

- Are employees trained in the following:
    - How to recognize tasks that might result in occupational exposure?
    - How to use work practice and engineering controls and personal protective equipment and to know their limitations?
    - How to obtain information on the type selection, proper use, location, removal handling, decontamination, and disposal of personal protective equipment?
- Who to contact and what to do in an emergency?

* * * * * * *